Indigenous Peoples' food systems & well-being

interventions & policies for healthy communities

Edited by HARRIET V. KUHNLEIN BILL ERASMUS DINA SPIGELSKI BARBARA BURLINGAME

CINE

FAO FIAT PANIS

In Memoriam

Dr Lois Englberger was the academic partner in the Pohnpei case study presented in this volume, until her untimely death in 2011. As a "citizen of the world" Lois travelled and worked in India, Colombia, Yemen, the Kingdom of Tonga and several other Pacific island nations. Her work with local collaborators in the Federated States of Micronesia developed the Island Food Community of Pohnpei, which has been praised and supported by a breadth of government ministries in the country, the Pacific region, and internationally. This volume is dedicated to this remarkable woman, who was an essential inspirational member of our team.

Our book is dedicated to all children in communities of Indigenous People who will continue to face challenges to protect their traditional knowledge and use of their local foods for physical, social and environmental health.
We know our work gives you power and strength.

Photo cover: Alvaro Mutumbajoy's grandson eating fish soup with vegetables (Inga Research Team)

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CASE STUDIES

Preface

Indigenous Peoples have historically faced the denial of their rights, been victims of ancestral knowledge theft and experienced the destruction of their livelihoods. Nevertheless, they still possess rich and diverse cultural knowledge, language, values, traditions, customs, symbolism, spirituality, forms of organization, standards of living, world views and conceptions of development. These components form the basis of their cultural heritage, and allow them to interact with and have a positive influence on the economic, social and political dynamics of any region or country.

Traditional knowledge has been stored in the collective memory of Indigenous Peoples for centuries, and is seen through the day-to-day activities of men and women. This knowledge is expressed through stories, songs, folklore, proverbs, dances, myths, cultural values, beliefs, rituals, community laws, local language, agricultural practices, tools, materials, plant species and animal breeds. In essence, the natural environment is what makes the knowledge of each people unique and different from that of any other.

Indigenous Peoples' greatest and most laborious achievement so far is the United Nations Declaration on the Rights of Indigenous Peoples. This was adopted by the General Assembly of the United Nations in the belief that Indigenous Peoples' control over the events that affect their lands, territories and resources will maintain and strengthen their institutions, cultures and traditions and promote the development of individuals according to their aspirations and demands.

However, there is still need for targeted strategies and policies that facilitate and foster Indigenous Peoples' use, processing and management of their natural resources for food security and health through self-determination and autonomy. These policies should be effective at the local, state, national, international and regional levels if they are to be successful; they should stress the importance of using cultural knowledge to develop health promotion activities and improve overall health (mental, emotional, spiritual, physical) and well-being.

I find it important to mention some of the cultural indicators for food security, food sovereignty and sustainable development according to Indigenous Peoples, in order to understand the importance of linkages between traditional knowledge and traditional foods:

1. access to, security for, and integrity of lands, territories, natural resources, sacred sites and ceremonial areas used for traditional food production;
2. abundance, scarcity and/or threats regarding traditional seeds, plant foods and medicines, food animals, and the cultural practices associated with their protection and survival;
3. use and transmission of methods, knowledge, language, ceremonies, dances, prayers, oral histories, stories and songs related to traditional foods and subsistence practices, and the continued use of traditional foods in daily diets;
4. Indigenous Peoples' capacity for adaptability, resilience and/or restoration regarding traditional food use and production in response to changing conditions;
5. Indigenous Peoples' ability to exercise and implement their rights to promote their food sovereignty.

Indigenous Peoples' right to food is inseparable from their rights to land, territories, resources, culture and self-determination. An integral human rights-based approach will open constructive dialogue on what policies, regulations and activities are needed to ensure food security for all, regardless of adaptation. Encouraging meaningful participation by all parties may be the key to building trust and resolving ongoing resource conflicts. Needless to say, the United Nations Permanent Forum on Indigenous Issues will address this issue in upcoming sessions.

In brief, the importance of this book arises from its detailed documentation, using a participatory methodology for ten years in different agro-ecological contexts; it provides evidence on the nutrient composition of traditional diets, which supports the Indigenous Peoples' approach.

We hope the book motivates different actors to continue supporting traditional knowledge, to deal jointly with the crisis we face. Ultimately, we hope this book provides the first step in a detailed analysis of Indigenous Peoples' activities and influence in today's world.

Myrna Cunningham
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Nicaragua, 2013

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Foreword

I live in the community of Ndilo and am a member of the Yellowknives Dene First Nation. Our territory is adjacent to Yellowknife, the capital of the Northwest Territories, Canada. As National Chief of the Dene Nation and Regional Chief of the Northwest Territories for the Assembly of First Nations my association with the Indigenous Peoples' Food Systems for Health Program has been a privilege and a responsibility, to ensure that the indigenous voice brings the credibility and relevance of this work to Indigenous Peoples everywhere. Having served for many years as Chair of the Governing Board of the Centre for Indigenous Peoples' Nutrition and Environment (CINE) at McGill University I know well the quality of the participatory processes and scientific work of CINE.

The Indigenous Peoples' Food Systems for Health Program is built on networks of partnerships at several levels. Each of the case studies we work with involves a network of partners, and the overall programme is built on these networks, which have met together at least once a year over the last ten years to share experiences and strategies on how to promote and use traditional food systems to enhance health. Each of the chapters in this book reflects understanding and commitment from collaboration among community and academic partners. Together we have worked to define processes and activities and how they are evaluated to improve food systems and health in the communities.

Working with Indigenous Peoples from 12 global regions has given important insights. Similarities in the circumstances faced by Indigenous Peoples are striking and have no boundaries. Indigenous Peoples have been colonized and are dealing with the forces of assimilation. Their land and resources have been assaulted and access to their own food has been threatened. Vastly different ecosystems and cultures of Indigenous Peoples have followed similar paths through time and development, witnessing similar changes in access to land and food. These include changes in and losses of animals and plants in the ecosystems where Indigenous Peoples live, and changes in health, which are manifested by both undernutrition and overnutrition (obesity) and the accompanying chronic diseases. There has been loss of cultural knowledge with the passing of elders in the circle of life and the imposed imperative to move from expressing the benefits of sharing and assisting others to embracing competition and the wage economy. Throughout this "modernization", Indigenous Peoples have been marginalized, vulnerable, living in extreme poverty and losing their sense of identity and self-determination.

The good news is that the programme described in this book has brought people together to work to improve these patterns. Indigenous Peoples are now expressing their human rights to self-determination and health, and are less isolated and demoralized. Instead, they are becoming increasingly aware that their original diets and local foods are very healthy. Indigenous Peoples have a great deal to share among themselves, and with all humankind. The wisdom inherent to their cultures and ways of knowing and doing demonstrate the all-encompassing connectedness of the land and food to their physical and mental health and spirituality.

Recognizing, understanding and dealing with the benefits and threats to Indigenous Peoples' ecosystems, and the biodiversity provided in their food helps them to know "who they are" and to "feel good about themselves", a confidence that is important to everyone. The way forward is to take things in hand, and work together at the community level with our partners in academia, government and non-governmental organizations, with valuable support from the United Nations.

In this book you will find an inspiring array of methods, processes and activities that can mobilize leaders and their communities. The book will assist them in understanding their ecosystems and, whenever and however possible, using their local food to experience the benefits it gives to cultural expression, food security and health. The book is a natural sequel and partner to the preceding book in this series, *Indigenous Peoples' food systems: the many dimensions of culture, diversity and environment for nutrition and health* (FAO & CINE, 2009).

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2013

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Acknowledgements

Writing this section is very difficult for us. There are so many people and agencies to acknowledge that the task is indeed daunting. Each chapter in this book has its own section recognizing contributors in their various roles. So here we note important contributions to the overall effort and to this volume.

Our work is grounded in understanding Indigenous Peoples' food systems for their scientific and social qualities, beginning with the very basics of scientific identification, nutrient composition and cultural value of the many foods contained in the rural ecosystems where Indigenous Peoples live. We have been fortunate to have the engagement of many interdisciplinary scholars within our team who have worked with us to focus on specific unique communities of indigenous people. This breadth in disciplines makes the research and its conclusions meaningful for recognizing and promoting Indigenous Peoples' food systems from many perspectives. Our results lead us to challenge the international community at all levels to give these food systems and the people who depend on them the respect and credibility they deserve for providing nutrition and good health. Therefore, we gratefully thank all of our partners for bringing this effort to fruition, and we also sincerely appreciate those who have responded to our work.

We thank McGill University and staff of the Centre for Indigenous Peoples' Nutrition and Environment (CINE) who have given immeasurably of their resources and time to undertake the work of the programme, including by providing the necessary management and office facilities. Several chapters have been developed with those who are or have been part of McGill/CINE as professors, affiliated members, graduate students and staff, or who are in leadership roles through the Governing Board of CINE. Kp-studios.com of Anacortes, Washington, United States of America provided most of the excellent photographs from the case study areas.

We thank the members of the International Union of Nutritional Sciences (IUNS) Task Force on Indigenous Peoples' Food Systems and Nutrition, recently renamed the Task Force on Traditional, Indigenous, and Cultural Food and Nutrition, who helped with the conceptual planning of the programme that has been implemented over the last ten years. Several lead authors of chapters in this volume were members of the task force and contributors to the meetings and satellite meetings of the International Congresses of Nutrition, sponsored by IUNS in Vienna, Durban and Bangkok in 2001, 2005 and 2009, respectively. IUNS and its executives have given exceptional support to the concepts of the task force and this programme, which evolved within it.

The Food and Agriculture Organization of the United Nations (FAO) has been a pillar of support for our work. In providing leadership for the publication process of our series of three books dedicated to the programme, FAO has given editorial and typesetting services as well as outstanding advice on aesthetic qualities in crafting the publication. FAO has provided Internet versions of the books and distributed hard copies free of charge through the United Nations publications distribution system, including FAO's regional offices, and university libraries. In addition,

FAO provided initial funding to kick-start several of the case studies described here. Case study leaders have presented their data and results in several venues sponsored by FAO. Without doubt, the world's attention to issues surrounding Indigenous Peoples' food systems, and our work in this realm have been fostered and promoted by FAO.

The Rockefeller Foundation's Bellagio Center on the shores of beautiful Lake Como in Italy provided grants to bring our team members together on three occasions, for meetings to stimulate our thinking about ways to make progress during the programme. This was essential for our within-programme communications and provided stimulation that was most welcome. We all extend a warm "thank you" to The Rockefeller Foundation for these opportunities in 2004, 2007 and 2008, and to the staff at the Bellagio Center for their unforgettably beautiful setting, hospitality, facilities and efficient service.

Primary funding for the research grants based from CINE was given by the Canadian Institutes of Health Research through the Institute of Aboriginal Peoples' Health, the Institute of Population and Public Health and the Institute of Nutrition, Metabolism and Diabetes. Funding for research and conference grants was given by the Canadian International Development Agency and the International Development Research Centre. Each of the case study intervention and evaluation efforts in this book gained additional funding from other agencies in the country concerned; these agencies are acknowledged in each chapter. We thank the Ernst Göhner Stiftung for assistance in the final months of preparing the publication, and for funds to prepare the videographic documentation of case studies at www.indigenousnutrition.org.

It is the people in the communities participating in the research described here to whom we are greatly indebted. Their wisdom, encouragement and enthusiasm emboldened the academic partners and led all of us to make the chapters reflect their thinking, their perspectives and their work. Thousands of Indigenous Peoples of all ages in seven countries are represented in this book. They built the knowledge base represented in all of the publications from the programme. Hundreds of community associates, many of whom were volunteers, contributed and continue to contribute to the ongoing activities in each of the case studies.

The collective intention of chapter authors is to dedicate this book to children in communities of Indigenous Peoples, who will continue to face challenges to protecting their traditional knowledge and use of their local foods for physical, social and environmental health. We know that our books will give them power and strength.

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Overviews

Chapter 1

Why do Indigenous Peoples' food and nutrition interventions for health promotion and policy need special consideration?

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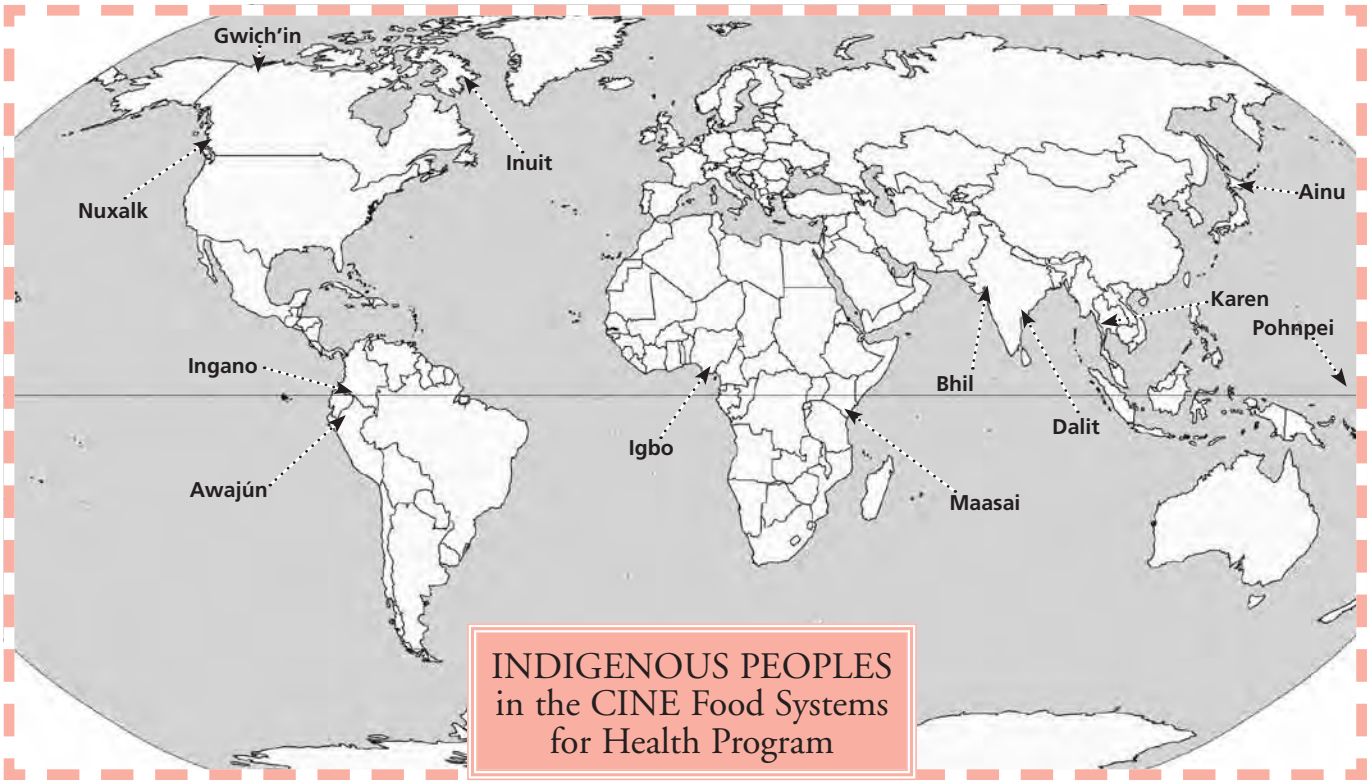

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Key words > Indigenous Peoples, food systems, food-based interventions, nutrition interventions, food policy, health promotion

"Traditional food system work is a reality check; it helps to not forget where you come from and who you are. It makes sense to us."

Earl Nowgesic, indigenous health leader, Canada

Abstract

This book is about Indigenous Peoples' food systems and how important local knowledge about foods and the ecosystems that provide them can be used to improve health and well-being. The authors describe processes and activities in nine cultures of Indigenous Peoples, where interventions were developed and implemented with local knowledge, and explain how this information can benefit Indigenous Peoples everywhere, and all of humankind.

Food and nutrition insecurity and the burden of high incidence of non-communicable diseases reach all corners of the globe. This "nutrition transition" is driven by changing lifestyles, loss of livelihoods for all those engaged in food production, increasing poverty and urbanization, and sedentary lifestyles with changing dietary patterns. The result is increasing global obesity and non-communicable diseases, including malnutrition in all its forms. The situation is especially critical for Indigenous Peoples, who often experience the most severe financial poverty and health disparities in both developing and developed countries, particularly where they depend on ecosystems under stress to support their needs for food and well-being.

The programme of work that concludes with preparation of this book was developed from the view that Indigenous Peoples with cultural homelands in the most rural areas of developing regions experience common challenges in relation to their traditional food systems, food security and health. The authors' view is that Indigenous Peoples' existing resources and knowledge about their cultures and ecosystems can be used to develop and implement effective health promotion activities.

The programme process and progression

The chapters in this book describe the adventures and findings of more than 40 interdisciplinary collaborators who have researched Indigenous Peoples' food systems and health promotion interventions. It is the third publication from the Indigenous Peoples' Food Systems for Health Program originating from the Centre for Indigenous Peoples' Nutrition and Environment (CINE) and the Task Force on Indigenous Peoples' Food Systems and Nutrition of the International Union of Nutritional Sciences (IUNS). This excellent team of scholars and community leaders has conducted research with communities of Indigenous Peoples for about ten years, creating methodologies, food systems documentation, and unique interventions to improve health by using aspects of local food systems.

In this book, the findings are considered from several interdisciplinary roots by experts in nutrition, epidemiology, anthropology, human rights, nursing and ethnobotany, in partnership with leaders of indigenous communities. Nine unique food system interventions conducted in widely diverse cultures and ecosystems are presented, with overview chapters on the circumstances and challenges rural-dwelling Indigenous Peoples face in health, environment, child nutrition and human rights, and how intervention practices and policies can be developed. The book is

written for readers from a variety of backgrounds, to share this diversity of perspectives from the unique case studies. As much as possible, the writing style and community perspective on intervention activities have been maintained, to enrich the chapters.

Work on traditional food systems is important for Indigenous Peoples. It provides a reality check and assurance that outsiders with diverse expertise value local foods and practices in the social contexts where Indigenous Peoples experience them. It helps people to realize the importance of maintaining their connections with nature and their own cultures, and between heart and mind, to reaffirm identity. Where people identify themselves with their culture and natural environment, knowledge and use of traditional food systems to improve health builds community support and engagement for holistic health and well-being. This affects the many aspects of physical, emotional, mental and spiritual health – for adults, children and elders, individually and in community and cultural collectives – in recognizing continuity from the past, into the present and towards the future.

The stories of the nine interventions presented here show how much the indigenous world has to offer through insights into the mysteries of successful food and nutrition promotion programmes everywhere. They demonstrate how special consideration to building cultural pride, cross-sectoral planning, enthusiastic and energetic advocates, and community goodwill can challenge the obstacles and barriers to knowledge transmission for action, through healthy behaviours for individuals and the community. Special focus has been on children and youth, and on finding ways to make local traditions relevant and useful to them. In fact, all the indigenous communities and leaders represented here recognized the programme's importance for the health of their children today and into the future – hence, the selection of a photo of an indigenous child and his traditional meal for the book's cover.

The journey began in Salaya, Thailand, to create the methodology for documenting the food systems of indigenous cultures. This methodology is now electronically available.[1] After identifying community and academic partners for the case studies, the authors proceeded to the documentation of 12 international case studies (Map on p. 4). This resource is available through the United Nations bookstore, and also online.[2] An extensive network of collaborators developed and exchanged information in annual meetings over several years to build the knowledge base resulting in this book.

All the participants remember the beautiful rainbow they saw over Lake Como, Italy during their first meeting in the conference room of The Rockefeller Foundation Bellagio Center. At that meeting, they recognized the commitment and strength of their collaboration, and how their aspirations, if realized, would benefit Indigenous Peoples everywhere. Participants remember Dr Suttilak Smitasiri's words that their "pot of gold" is the grounding of their nutrition work in the unique cultures in which they work. Several years and much hard work have passed, and the results of that labour are reported in this book, Book 3 in the series. Readers are invited to refer to the acknowledgements section, where the authors thank their teams of collaborators and many supporters.

Context of the interventions

Ways of identifying Indigenous Peoples have been described at length by United Nations agencies[3] and in earlier publications.[4] Throughout the world, there are more than 370 million Indigenous Peoples, speaking more than 4 000 languages and located in more than 90 countries. Those living in their rural homelands depend on traditional food systems rooted in historical continuity in their regions, where food is harvested with traditional knowledge from the natural environment, and prepared and served in local cultural settings. Foods purchased from markets, often through globalized industrial outlets, are also part of Indigenous Peoples' food systems today, and are among the considerations required for interventions to promote healthy diets in communities.

1 www.mcgill.ca/cine/research/global/
2 www.fao.org/docrep/012/i0370e/i0370e00.htm
3 www.un.org/esa/socdev/unpfii/documents/sowip_web.pdf
4 www.fao.org/docrep/012/i0370e/i0370e00.htm

Recognition of the vast food biodiversity in indigenous knowledge, and research to identify the composition of nutrients and other properties of this food are at the centre of the knowledge needed to build good nutrition promotion programmes for community members of all ages. This combination of traditional indigenous knowledge with "Western" scientific documentation was welcomed in the case study interventions. Information exchange is at the heart of this work. The reader will find many examples of successful knowledge sharing within communities, which stimulated good dietary patterns and provided the impetus for important evaluations based on food use and dietary quality.

All the programme's research throughout the last ten years has been greatly enhanced by state-of-the-art participatory processes, with indigenous community and academic colleagues collaborating equally in the decision-making for project activities. Each of the intervention chapters demonstrates how health promotion has been conducted successfully. The chapters present nine very different stories regarding types of intervention, local resources used and evaluation methods. Attention was always given to the right social settings, and to using social capital combined with capacity building. Logistical constraints and the limited availability of funds necessitated work with small population groups, where meaningful control groups do not exist. Intervention effectiveness was usually evaluated through before-and-after measurements and qualitative techniques, and involved active community participation and support. The interventions directed at improving food provisioning were most successfully evaluated through food and dietary measurements, often with qualitative techniques. The reader is directed to the interventions described in Chapters 5 to 13, and to the overview of interventions in Chapter 14.

The aim of this programme has been to build the scientific credibility of local food systems, to use this information to improve the health of the people directly involved, and to share success stories to influence policies at the local, national and international levels. Chapter 16 discusses how policies can be influenced to benefit Indigenous Peoples' use of their food systems, particularly by increasing access to the range of biodiversity available. Several of the interventions increased their scope and dimension by scaling up activities to additional communities within the region and – in some cases – more broadly. For example, Chapter 12 notes the requests for and activities of the Pohnpei Go Local! project throughout the Pacific region. Such scaling up is surely the gold standard of a successful health promotion programme.

Common themes in interventions

The nine interventions capture themes that address the challenges Indigenous Peoples face in nutrition and health, access to their ecosystem food resources, and the social contexts in which food is prepared and consumed. The activities and local-level policy implications described are impressively case-specific and diverse. These interventions stress the necessity of working from the bottom up, using the indigenous community's perspective of what works and how to proceed, with evaluations that are meaningful to the people directly involved. Successful and less successful engagements with government are also described, calling attention to the benefits that government interaction can provide.

Interventions to improve the health circumstances of Indigenous Peoples in rural, often remote, settings can be very different from those for a country's general population. Activities must be in harmony with the local cultural and social settings, local personnel and local sources of food. There is financial poverty in the rural settings where these interventions were conducted, but communities prefer not to define their success in terms of money. Instead, they measure success through the benefits brought to local social, cultural and ecosystem contexts. For the Karen people in Thailand, for example, "food is a part of happiness" that cannot be measured with money. It is difficult to create behavioural changes to improve people's obesity or stunting status, but being "short/small" or "big" is not as important as changing the conditions that cause these conditions, with full self-determination for the communities directly involved.

Throughout the book, the text shifts between past and present tenses. This is because most of the interventions are still ongoing, and evaluations were completed at a designated point after their initiation. Although this style is awkward, it also reflects how the state of the case studies changes with time. In the Nuxalk project (Chapter 11), for example, the intervention and initial evaluation were conducted several years ago, while the current chapter refers to a recent revisiting of the project.

Implications for policy

Indigenous Peoples attach profound importance and commitment to protecting their land and access to food resources and promoting the benefits of local food to enhance food and nutrition security. Policies protecting Indigenous Peoples' right to food are centred on access to traditional food system resources and giving Indigenous Peoples priority in their use. Chapters 15 and 16 elaborate on these principles.

Much can be learned from studying the food systems of Indigenous Peoples. To start with, nations must be encouraged to disaggregate population data by culture and geographic location, to explore the circumstances faced by Indigenous Peoples in their home areas. The Pan-American Health Organization (PAHO) has identified the disparities faced by Indigenous Peoples in the Americas,[5] but other regions are not as diligent in uncovering such disparities for segments of their populations. Only when the extent of the problem is known can reasonable and meaningful action be taken to promote equality in food and nutrition security and well-being.

Nutrition improvements and health promotion interventions with Indigenous Peoples can be successful when they give full attention to the social context, social support, social capital and local food resources and provisioning. The book offers the perspective that understanding how to use local foods to improve Indigenous Peoples' health benefits them directly, and also gives new insights for nutritional health promotion initiatives in general.

The authors hope that the evidence supplied from this programme and its publications will stimulate others to promote traditional food systems for Indigenous Peoples in their regions, and to contribute to mainstreaming food-based approaches with local resources. In addition to the three major publications from the programme, there are hundreds of peer-reviewed articles from team members, documentary videos[6] and presentations given at local, national and international meetings. This issues a clear call for nutritionists and their colleagues in leadership roles in indigenous communities to experience the wide variety of unique foods and the social settings in which they are used, and to promote these important elements of local culture and ecosystems for their health benefits and their promise to provide sustainable solutions to food and nutrition security

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[5] www.unscn.org/layout/modules/resources/files/scnnews37.pdf

[6] www.indigenousnutrition.org

Chapter 2

Health disparities: promoting Indigenous Peoples' health through traditional food systems and self-determination

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Key words > Indigenous Peoples, determinants of health, thrifty gene, undernutrition, overnutrition, type 2 diabetes, food security

"We have a pot of gold when we have a meeting of the minds on medical sciences that is highly qualified in culture."

Suttilak Smitasiri, Salaya, Thailand 2009

Abstract

Although there is considerable global diversity in indigenous cultures and ecosystems, one shared commonality is that Indigenous Peoples experience disparities across all dimensions of health. This chapter discusses the disparities in unhealthy body weights from under- to overnutrition, the emergence of type 2 diabetes mellitus, food security and micronutrient deficiencies, and longevity.

Indigenous Peoples living in arid or semi-arid areas that experience drought or seasonal fluctuations in food availability continue to suffer from underweight and malnourishment, while those living in remote, biodiverse areas and engaged in traditional activities with little reliance on market economies tend to be of normal weight. In sharp contrast, Indigenous Peoples living in developed countries have a risk of obesity that is generally 1.5 times greater than that observed for non-Indigenous Peoples residing in the same country or affiliated state. The thrifty gene, the thrifty phenotype and, more recently, the environmental programming hypotheses need to be researched within a context that does not ignore the profound contributions of other underlying causes of health disparities. Assaults on "indigeneity" and self-determination contribute to the health effects of disparities in poverty, education, nutrition, food security, household crowding, and poor access to and utilization of health care.

Multiple strategies are needed to help narrow the gap in nutrition-related chronic diseases. Successful programmes are likely to be those that improve health through the promotion of cultural strengths and self-determination, including traditional food systems. Although this is a challenge, improving the health and longevity of Indigenous Peoples is not an impossible task.

Introduction

For Indigenous Peoples, determinants of health take on the additional dimensions of collective assaults on "indigeneity", where the end results are profound and far-reaching and contribute to the wide gaps in indigenous health and well-being.

There are an estimated 370 million indigenous people worldwide, with considerable cultural diversity. However, one commonality is that Indigenous Peoples experience disparities across all dimensions of health indicators (Anderson *et al.*, 2006; Cunningham, 2009; Montenegro and Stephens, 2006; Ohenjo *et al.*, 2006). The key to understanding the underlying causes of these disparities lies in the current relationship of Indigenous Peoples to the larger society. While the social determinants of population health are now widely appreciated (Glouberman and Millar, 2003), for Indigenous Peoples determinants of health take on the additional dimensions of assaults on "indigeneity", including colonization and disassociation from their land, cultural and linguistic heritage and even families – when there has been forced residential schooling. In these situations, self-esteem and individual and group identity and self-determination have been eroded. The end result of these collective assaults on "indigeneity" are profound and far-reaching, and contribute to the wide gaps in indigenous health and well-being (Cunningham, 2009; King, Smith and Gracey, 2009; Ohenjo *et al.*, 2006; Stephens *et al.*, 2006).

The dimensions of health and well-being cover a broad range of health outcomes, but this chapter is limited to disparities in unhealthy body weights, emerging type 2 diabetes mellitus (DM), micronutrient deficiencies, longevity and food security. The chapter ends with indigenous perspectives on health determinants, as a guide for identifying health promotions and interventions that will make a difference by improving health through the promotion of cultural strengths and self-determination, including traditional food systems.

Micronutrient deficiencies

Micronutrient deficiencies among Indigenous Peoples tend to mirror those that are prevalent in the larger society, but Indigenous Peoples face increased vulnerability, particularly to the extent that they suffer disproportionately from poverty. Micronutrient deficiencies rank among the top 20 risk factors for morbidity and impaired quality of life, with particular burdens falling on populations in poorer countries, women of reproductive age and young children. However, they are sufficiently prevalent (among more than 2 billion people globally) to affect almost all population segments to some degree (Lopez *et al.*, 2006). Amelioration of these deficiencies constitutes one of the most cost-effective public health interventions in terms of improving overall health, the outcomes of common infectious diseases and the quality of life (Jamison *et al.*, 1993; Tulchinsky, 2010; Harrison, 2010). A list of specific micronutrient deficiency conditions and qualitative estimates of their global prevalence is provided in Annex 2.1.

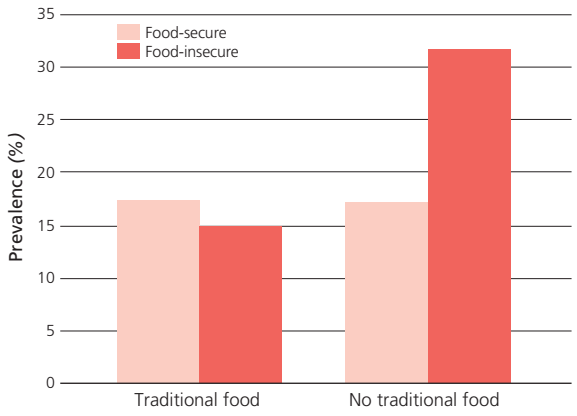
Although deficiencies of particular vitamins and minerals can be conceptualized singularly, it is important to remember that they usually occur in combination. Diets limited in variety and in foods of animal origin are most frequently deficient in micronutrients. On the public health agenda, deficiencies of vitamin A, iodine, iron, folic acid and to some extent zinc have had the most attention because of the evidence base for the efficacy of correcting these deficiencies and the feasibility of effective interventions. However, there is abundant evidence that the problems of micronutrient deficiencies are far from being solved globally.

Existing case studies provide evidence that Indigenous Peoples suffer from micronutrient deficiencies at least as severely as the larger populations from which they are drawn, and probably even more so, given their disparities in poverty (Carino, 2009). Micronutrient deficiencies are not inconsistent with high levels of overweight and obesity, as shown by vitamin A deficiency documented in almost one-third of children aged two to ten years in Mand, Federated States of Micronesia, where adult obesity is very high (Englberger *et al.*, 2009). There is also evidence that as problems of food insecurity increase – through constraints in access to traditional food sources, lands and waterways – traditional practices that protect against micronutrient deficiencies may increase (see section on food insecurity on pp. 17 to 20). For example, the prevalence of total anaemia among Inuit preschoolers illustrates the potential for traditional foods to ameliorate food insecurity. Children who had consumed no traditional food the previous day and were food-insecure, based on the United States Department of Agriculture (USDA) assessment tool for food insecurity, had the highest prevalence of anaemia, while iron-deficiency anaemia prevalence was low among children who had consumed traditional food the previous day, regardless of food insecurity status (Egeland *et al.*, 2013) (Figures 2.1 and 2.2).

From under- to overnutrition

Currently, the risks of underweight and obesity vary considerably among Indigenous Peoples living in diverse settings. In general, Indigenous Peoples who live in remote areas with considerable biodiversity and who are engaged in traditional activities with little reliance on market economies tend to be of normal weight: among Awajún women of Peru, 92 percent had a body mass index (BMI) in what is considered the normal range of 18.5 to 24.9 kg/m^2 (Creed-Kanashiro *et al.*, 2009); among the Ingano of Colombia, 89 percent of women and 96.6 percent of men had normal healthy BMIs (Correal *et al.*, 2009); and for

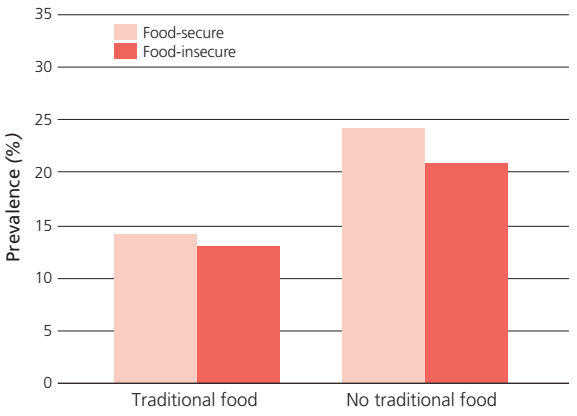
Figure 2.1 Percentage anaemic, by previous-day traditional food (TF) consumption (yes or no) and past-year child food security status



Anaemia defined as venous or capillary haemoglobin < 110 g/litre for three-to-four-year-olds and < 115 g/litre for five-year-olds.
$p < 0.10$ for the interaction term TF by food security in logistic regression model adjusting for age, sex and sampling method (capillary versus venous).

Sources: Data from Egeland *et al.*, 2011; Nunavut Inuit Child Health Survey 2007–2008.

Figure 2.2 Percentage iron-deficient, by previous-day traditional food (TF) consumption (yes or no) and past-year food security status



Iron deficiency defined as plasma ferritin < 12 µg/litre; those with hsCRP > 8 mg/litre were excluded.
$p < 0.06$, indicating a borderline significantly lower percentage of iron deficiency among Inuit preschoolers who consumed TF the previous day compared with non-TF consumers in logistic regression analyses, adjusting for age and sex.

Sources: Data from Egeland *et al.*, 2011; Nunavut Inuit Child Health Survey 2007–2008.

the Karen of Thailand, overweight was rare among children aged 0 to 12 years (Chotiboriboon *et al.*, 2009). In arid or semi-arid areas with less biodiversity and drought or seasonal fluctuations in food availability, underweight and malnutrition are prevalent: among the Maasai experiencing drought, between 25.1 and 35.7 percent of children were underweight and 46.1 to 60.3 percent were stunted (World Vision Kenya, 2004; Oiye *et al.*, 2009); in India, among landless Dalit working as farm labourers, chronic energy deficiency affected 42 percent of women (Salomeyesudas and Satheesh, 2009); malnutrition is also the primary concern for Bhil and other tribal populations in India (Bhattacharjee *et al.*, 2009; National Institute of Nutrition, 2000; Hamill *et al.*, 1977); and among the Igbo of Nigeria, 42 percent of children were stunted, 25 percent were underweight and 9 percent were wasted (Okeke *et al.*, 2009).

In sharp contrast, Indigenous Peoples living in developed countries have a risk of obesity that is generally at least 1.5 times greater than that observed for non-indigenous peoples residing in the same country or affiliated state. Obesity-related chronic diseases have increased from being rare to what is now considered an epidemic, particularly in type 2 DM.

In Pohnpei, Federated States of Micronesia, the prevalence of overweight and obesity has increased from almost zero immediately after the Second World War to its current levels, with a third of women being overweight (Pohnpei STEPS, 2002) and the population suffering unprecedented rates of obesity, hypertension and diabetes (Durand, 2007).

In Australia, where undernutrition was of paramount concern for Indigenous Peoples 30 years ago (Gracey, 1976), an epidemic in overweight and obesity has led to disabling and often fatal chronic diseases (Gracey, 2007). A survey found that aboriginal and Torres Strait Islanders were 1.3 times more likely to be obese than non-indigenous Australians (Australian Bureau of Statistics and Australian Institute of Health and Welfare, 2005). In New Zealand, 41.7 percent of Maori were obese in the 2006/2007 health survey: a rate 1.5 times the 26.5 percent observed among New Zealanders of European descent (New Zealand Ministry of Health, 2008). In 1996, the lifetime risks of developing type 2 DM for Maori were 26 percent for

men and 32 percent for women, compared with 10 and 8 percent for men and women of European descent (New Zealand Ministry of Health, 2002).

In the United States of America, overweight and obesity are a notable health problem among American Indians and Alaska Natives. In a study of five-year-old children, 47 percent of boys and 41 percent of girls were overweight; 24 percent of the children attending 55 schools on 12 reservations were obese; and the risk of overweight and obesity increased with successive age groups evaluated (Zephier *et al.*, 2006). Indigenous Peoples in the United States were also twice as likely to suffer type 2 DM than non-Hispanic whites (Steele *et al.*, 2008), apart from in Alaska, where rates for type 2 DM were similar for indigenous and non-Hispanic whites (6 percent). There is evidence that type 2 DM is increasing among Alaska Natives and Greenlanders (Inuit), who have historically been spared from the epidemic observed among other Indigenous Peoples (Ebbesson *et al.*, 1998; Jørgensen *et al.*, 2002). The Pima Indians of Arizona suffer from an excessively high rate of type 2 DM, at five times that observed among the Pima Indians of remote mountainous northwestern Mexico, where a traditional lifestyle and diet and greater physical activity have been reported as accounting for reduced obesity and type 2 DM risk (Schulz *et al.*, 2006; Ravussin *et al.*, 1994).

In Canada, overweight and obesity rates are highly prevalent among Indigenous Peoples regardless of geographic location or ethnicity (Young and Sevenhuysen, 1989; Tjepkema, 2002; McIntyre and Shah, 1986; Kuhnlein *et al.*, 2004; Galloway, Young and Egeland, 2010). The prevalences of diabetes for First Nations Canadian men and women were respectively 3.6 and 5.3 times higher than those of the general Canadian population (Young *et al.*, 2000).

In addition to the high risk of overweight and obesity among Indigenous Peoples living in developed countries, there is evidence that overweight and obesity are emerging among Indigenous Peoples in low-income countries who are undergoing acculturation in the context of poverty. In these situations, indicators of overnutrition in adults coexist with indicators of undernutrition, particularly in children, indicating rapid nutrition transitions. Among the Suruí of the Amazon, 60.5 percent of 20 to 49.9-year-olds were either overweight or obese (Lourenço *et al.*, 2008), and among the Ribeirinhos of Brazil (Piperata, 2007) and Andean populations of Argentina (Romaguera *et al.*, 2008) overweight and obesity are prevalent and coexist with indicators of poor growth such as stunting.

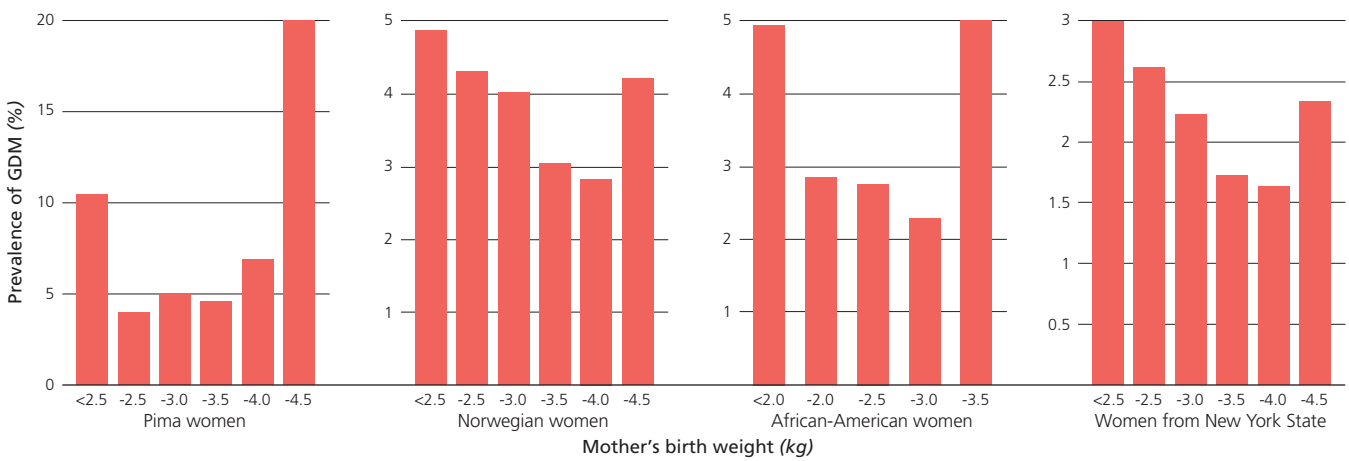
The thrifty gene hypothesis and environmental programming in context

> The "thrifty gene" hypothesis might have seemed like a good idea many years ago in the absence of experimental-based knowledge in the pre-genomic era. But, current research suggests that in most cases a single mutation in a single gene is unlikely to predispose an entire group of people to a complex outcome like type 2 diabetes.
>
> *Dr Robert Hegele*

A commonly cited underlying cause for the high rates of obesity and type 2 DM in Indigenous Peoples is the "thrifty gene" hypothesis, which postulates that there is inherited susceptibility for a biological incapacity to adapt to a modern sedentary lifestyle with a consistent supply of energy. However the thrifty gene hypothesis has been criticized as too simplistic (Paradies, Montoya and Fullerton, 2007; Fee, 2006), given that human beings are remarkably genetically similar, sharing 99.9 percent of their genomes, and have a relatively common and recent evolutionary history of hunting and gathering in periods of feast and famine, which essentially places all humans in a similar thrifty gene risk paradigm (Paradies, Montoya and Fullerton, 2007).

Although there has been progress in genetic research, the aetiology of type 2 DM is complex and multifactoral, and current research suggests that " in most cases a single mutation in a single gene is unlikely to predispose an entire group of people to a complex outcome like type 2 diabetes" (R. Hegele, personal communication, 2009). One exception occurs among the Oji-Cree of northern Ontario, in whom hepatic nuclear factor-1alpha (HNF1A) G319S has been found to be associated with a distinct form of type 2 DM with an earlier age of onset, a lower BMI and a higher

Figure 2.3 Women's own birth weight and later prevalence of gestational diabetes (GDM)



Source: Adapted from Pettitt and Jovanovic, 2007.

post-challenge plasma glucose level than usually observed (Hegele, 2001). However, the genetic variant HNF1A G319S is highly specific to the Oji-Cree and has not been found among other Indigenous Peoples or even among other Canadian Cree with high rates of diabetes.

In recent years, the "thrifty genotype" hypothesis has been supplemented by recognition that what may be happening proximally as populations undergo rapid changes in environment and lifestyle is intergenerational transmission of a "thrifty phenotype". This concept was introduced by Hales *et al.* (1991) and proposes that environmental factors acting in early (intra-uterine) life, particularly undernutrition, may influence later risk of type 2 DM and other chronic diseases of adulthood. The hypothesis is based largely on consistent observations of the inverse relationship between birth weight and risk of future ischaemic heart disease in adulthood (Huxley *et al.*, 2007). However, a growing body of evidence suggests there is a U-shaped data curve between birth weight and chronic diseases (with more chronic disease at the lower and higher ends of birth weight), especially for diabetes. Among Pima Indians, for example, a U-shaped curve was identified between women's own birth weight and later risk of gestational diabetes (Pettitt and Knowler, 1998). These findings have also been observed in other study populations (Egeland, Skjaerven and Irgens, 2000; Williams *et al.*, 1999; Innes *et al.*, 2002; Pettitt and Jovanovic, 2007) (Figure 2.3). The data suggest that maternal obesity and diabetes may create susceptibility to later chronic disease in the offspring, through hyperglycaemic and epigenetic mechanisms (Smith *et al.*, 2009; Egeland and Meltzer, 2010; Dabelea, 2007; Pettitt *et al.*, 1998; Silverman *et al.*, 1998).

Emerging data suggest possible epigenetic effects (changes in gene expression transmissible intergenerationally but not involving alteration of DNA base sequences); the concept has been termed "environmental programming" (Lucas, 1991; Lindsay and Bennett, 2001).

However, as health disparities between Indigenous Peoples and their non-indigenous counterparts are observed across a broad range of health outcomes – including intentional and unintentional injuries, psychological distress and mental illness, birth defects, cancers, perinatal and post-neonatal mortality (Stephens *et al.*, 2006) – scientific research into the thrifty gene, the thrifty phenotype and the environmental programming hypotheses must take into account the profound contributions of other underlying causes of health disparities. The literature on Indigenous Peoples' health identifies poverty, low education, marginalization and racism, disassociation from land, culture and family, inadequate health care access and utilization, and

disparities in many other determinants of disease, such as food insecurity, as underlying causes for health inequities (Carino, 2009; Cunningham, 2009; Stephens *et al.*, 2006; King, Smith and Gracey, 2009; Ring and Brown, 2003).

Mortality disparities

Indigenous Peoples experience greater rates of health disparities and decreased longevity compared with non-Indigenous Peoples, regardless of the geographic area in which they live (Zinn, 1995; Stephens *et al.*, 2005; Ring and Brown, 2003; Ohenjo *et al.*, 2006; Montenegro and Stephens, 2006). However, incomplete data on indigenous status and health indicators make it difficult to estimate consistently the extent of disparities between indigenous and non-indigenous people by country (Stephens *et al.*, 2006). Indigenous Peoples in remote areas are usually underrepresented in the literature, and many countries do not identify ethnicity in their health statistics. In Latin America, studies indicate excessive infant mortality rates among Indigenous Peoples, which are three to four times as high as national averages of up to 30 per 1 000 live births with, for example, 99 to 100 per 1 000 live births for the Campa-Ashaninka and Machiguenga of the Peruvian Amazon, and 67 and 83 per 1 000 live births respectively for the Cumbas and Colimbuela of Ecuador (Montenegro and Stephens, 2006; Cardoso, Santos and Coimbra, 2005; Garnelo, Brandão and Levino, 2005). In Africa, excessive infant and under-five mortality have been noted among forest-dwelling Aka in the Central African Republic, the Twa in Uganda, and the Mbendjele in northern Congo, with a high death rate associated with infectious diseases (Ohenjo *et al.*, 2006).

Excess mortality and disease-specific mortality for Indigenous Peoples have been noted in developed countries with generally good health surveillance systems (Bramley *et al.*, 2004). Although indigenous status is underreported in death records in Australia, the existing data indicate a fourfold excess age-adjusted death rate among indigenous compared with non-indigenous Australians from 2000 to 2004 (Australian Bureau of Statistics, 2002; 2003; 2004; 2005). In addition, while infant mortality has been decreasing over time, disparities in infant mortality between indigenous and non-indigenous Australians have increased, owing to greater reductions in mortality among non-indigenous infants (from 8.4 to 3.7 per 1 000 live births between 1980 to 1984 and 1998 to 2001) than among indigenous Australians (from 25 to 16.1 per 1 000 live births over the same period) (Freemantle *et al.*, 2006). The most recent data suggest that indigenous children are twice as likely to die than non-indigenous children (McCredie, 2008) and that infant mortality rates were three times higher for indigenous boys and 2.5 times higher for indigenous girls than for non-indigenous children between 2004 and 2006 (Australian Bureau of Statistics, 2007). At birth, Indigenous Peoples in Australia also face a 15- to 20-year reduction in life expectancy, with the leading cause of mortality now being cardiovascular diseases (Trewin and Madden, 2005). In New Zealand, the gap in life expectancy was eight years between Maori and non-Maori people in 1999, and although decreases in mortality have been noted over time, disparities persist (New Zealand Ministry of Social Development, 2004).

In the United States of America, American Indians and Alaska Natives born in 1999 to 2001 had a life expectancy that was 2.4 years less (at 74.5 versus 76.9 years) than that of the overall United States population (Indian Health Service, 2006). Infant mortality is approximately 20 percent higher among American Indians and Alaska Natives (at 8.3 per 1 000 live births in 2002 to 2004) than for the total United States population (at 6.9 per 1 000 live births in 2003) (Indian Health Service, 2009). In the Federated States of Micronesia, which is now independent but freely associated with the United States of America, improvements in infant mortality have been noted, but the rate remains excessively high at 33 deaths per 1 000 live births in 2007 (ESCAP, 2009).

In Canada most health indicators identify large disparities in morbidity and longevity between Indigenous Peoples and the general population, with gaps in life expectancy of 5.5 years for females and 8.1 years for males in 2000 (Health Canada, 2005). For

Inuit, the estimated average life expectancy is 15 years less than that of the general Canadian population. Infant mortality rates among Inuit, although decreasing over time, remain four times higher than those among the general population (Wilkins *et al.*, 2008).

Avoidable deaths and morbidity

A greater proportion of the mortality among Indigenous Peoples is avoidable than is among non-indigenous people (Ring and Brown, 2003). In New Zealand, the Ministry of Health estimates that the avoidable death rates among Maori are almost double those among New Zealanders of European or other descent (New Zealand Ministry of Health, 1999). In Australia, the risk of preventable infant deaths was 8.5 times higher among indigenous than non-indigenous Australians, with higher infant mortality rates attributable to infection and birth defects, particularly in remote areas (Freemantle *et al.*, 2006).

To reduce the gap in avoidable mortality, more emphasis should be placed on primary health care services for prevention and early diagnosis and treatment (Ring and Brown, 2003). In a global review of type 2 DM complication rates, Indigenous Peoples, regardless of their geographic location, experienced a disproportionate rate of complications relative to their non-indigenous counterparts (Naqshbandi *et al.*, 2008).

In addition to improving the availability of health care services and diagnostic screenings, there is also need for education to improve indigenous communities' awareness that services are available and accessible and that they can make a difference in promoting health (Reading, 2009).

Food insecurity

Food security is fundamental to population health and is a common theme of the case studies described in this volume. Populations are considered food-insecure when there is limited availability of, or ability to acquire, culturally acceptable, nutritionally adequate and safe foods on a sustained basis (FAO, 1996). Gradients of food security range from fully secure, to mild anxiety about not having enough food, to outright hunger. Even in developed countries, food-insecure people suffer from various degrees of poverty and have poorer perceived health and lower nutrient intakes or nutrition status than the food-secure (McIntyre *et al.*, 2003; Ledrou and Gervais, 2005; Kirkpatrick and Tarasuk, 2008; Vozoris and Tarasuk, 2003; Rose and Oliveira, 1997; Skalicky *et al.*, 2006; Zalilah and Tham, 2002). Among the Orang Asli (Timian) of Malaysia, a study of 64 children identified that 82 percent of homes with children reported food insecurity, which coexisted with high prevalence of underweight, stunting and wasting (at 45.3, 51.6 and 7.8 percent, respectively) and dietary intakes noted at less than two-thirds the recommended dietary allowance (RDA) levels for energy, calcium and iron, but remarkably good intakes of many other nutrients (Zalilah and Tham, 2002).

For Indigenous Peoples, the current definitions of food security are inadequate as they rely entirely on the assessment of monetary access to market food (Nord, Andrews and Carson, 2006), whereas Indigenous Peoples also consume traditional foods. Given the role of traditional food systems and food sharing networks in contributing to food security, nutrient intakes and cultural identity, the definition of food security for Indigenous Peoples should include assessment of traditional food intake and the stability of access to traditional foods (Egeland *et al.*, 2010; Power, 2008; Lambden, Receveur and Kuhnlein, 2007). The contribution of traditional food to nutrition status can be substantial, and assessments of the impact of food insecurity can be hindered when assessment tools consider only monetary access to market foods.

Food insecurity, with resulting outright hunger and undernourishment, remains a global public health challenge. In the case studies included in the CINE series, the Maasai of Kenya, the Dalit and Bhil of India and, to a lesser extent, the Igbo of Nigeria showed evidence of severe food insecurity resulting in high prevalence of undernutrition.

Paradoxically, however, food insecurity has not been consistently related to undernourishment (Renzaho, 2004; Zalilah and Tham, 2002), and studies now report either a greater risk of obesity or no

differences in adiposity by food security status (Casey *et al.*, 2006; Jiménez-Cruz, Bacardí-Gascón and Spindler, 2003; Gundersen *et al.*, 2008; Townsend *et al.*, 2001; Dinour, Bergen and Yeh, 2007; CDC, 2003; Rose and Bodor, 2006; Whitaker and Orzol, 2006). Variable gradients in the severity of food insecurity and differences in the local cultural and economic context of the amounts and types of food obtained and the extent of physical activity are likely to contribute to the conflicting findings between food insecurity and adiposity in the literature.

Food security for Indigenous Peoples is affected by changing environments, including environmental contamination and degradation, climate change, urban growth, modern farming and ranching and other infringements on traditional lands. Global market forces and colonization also play an omnipresent role in influencing dietary and lifestyle habits, as they generally increase dependence on highly processed food of poor nutrient quality, usually in the form of refined grains, and food with added sugar and fat, which increase the energy density of food consumed. All of these factors can work in tandem to reduce the viability of traditional food systems, and are serious threats to sustaining food security, especially for marginalized Indigenous Peoples (Thrupp, 2000). The dietary changes associated with globalization and colonization were cited as contributing to the recent epidemic of obesity and obesity-related chronic diseases in the Pacific Island countries and East Africa (Hughes and Lawrence, 2005; Raschke and Cheema, 2008).

An inverse relationship between the energy density of food and energy costs has been reported, and energy-dense and nutrient-poor food provides kilocalories at affordable cost; the high palatability of added sugar, sodium and fat in highly processed food can also lead to overconsumption of energy, and has been suggested as a mechanism by which poverty and food insecurity can lead to obesity and type 2 DM, both of which follow a socio-economic gradient in risk (Drewnowski and Specter, 2004; Drewnowski, 2009). In Guam, 49 percent of Chamorros were obese and Chamorros had a high dietary energy density, with 1.9 kcal per gram of food consumed compared with 1.6 kcal/g among Filipinos, of whom only 20 percent were obese (Guerrero *et al.*, 2008). The high energy density of the diet in the Federated States of Micronesia is coupled with low physical activity, with 64.0 to 77.2 percent of youth not meeting recommended levels of physical activity in a recent survey (Lippe *et al.*, 2008). A shift in energy balance occurs when energy-dense processed market food is adopted, while physical activity is reduced as traditional activities are abandoned, both leading to weight gain.

From the biodiverse tropical areas to the far reaches of the Arctic, Indigenous Peoples' food security situation is highly variable, reflecting not only changes or degradation in ecosystems, but also geopolitical factors such as civil unrest, global economic forces, and urbanization and development. Environmental degradation can lead to loss of biodiversity, thereby threatening food security. In the highlands of Papua New Guinea, for example, the degradation of soil and vegetation has led to an overdependence on sweet potato on the high-altitude plateau and the dry grasslands, with women and children being more vulnerable to reduced dietary diversity (Bayliss-Smith, 2009). For the Maasai of Kenya, access to land for grazing their cattle (a cornerstone of their traditional diet) is increasingly limited as the growth of Nairobi and other large cities consumes more land, imposing barriers to free movement for Maasai and their cattle. In the biodiverse western Amazon area, Indigenous Peoples such as the Sacha Runa of Ecuador, the Ingano of Colombia and the Awajún of Peru actively cultivate biodiversity, and utilize both wild forests and cultivated fields for sustaining resilience in their ecosystem, to support their food security, medicinal care and cultural heritage (Garí, 2001; Creed-Kanashiro *et al.*, 2009; Correal *et al.*, 2009).

As proposed development projects involving oil, mineral and timber extraction and agrodevelopment encroach on to the lands of Indigenous Peoples in the Amazon, food security is threatened unless an alternative paradigm of development is promoted in which indigenous agro-ecology and biodiversity can continue to thrive. The Ingano made historic progress by being the principal actors in the development and management

of a protected area fully recognized by the State, the Indiwasi National Park. Conserved land areas represent a means by which Indigenous Peoples can conserve biodiversity and cultural integrity, promote food security and reach the Millennium Development Goals (Pathak, Kothari and Roe, 2005). In addition, climate change is threatening small island states (Barnett, Dessai and Jones, 2007) and the Inuit traditional food system (Chapter 9 – Egeland *et al.*, 2013), and is projected to have sweeping effects globally on food security, especially for Indigenous Peoples, who often live in vulnerable and extreme environments (FAO, 2008a).

Many indigenous communities, including those in Australia, Canada, the United States of America, Japan, New Zealand, India (the Bhil) and the Federated States of Micronesia, depend largely on market economies for access to basic foodstuffs, and supplement their market food diets to varying degrees with hunted, caught and cultivated traditional foods. In the context of cash-poor economies and a volatile global market of fluctuating food prices, the maintenance of cultural knowledge and traditions regarding food is a matter not only of cultural identity and transmission, but also of maintaining food security and nutritional health. Global market forces, including the utilization of grain for supplying biofuels, resulted in exorbitant price increases for basic food grain staples in 2007/2008, with direct effects on increasing hunger among the disadvantaged (FAO, 2008b). While grain supply costs declined somewhat in 2009, following a peak in mid-2008, the global economic crisis continues to undermine food security (Harrison, Tirado and Galal, 2010). Given the high rates of poverty among Indigenous Peoples, the current global economic crisis will undoubtedly put a disproportionate burden on the food security of Indigenous Peoples. The prices of food purchased are also heavily influenced by the costs of transportation, with effects on food security for remote communities.

Food insecurity is reported among Indigenous Peoples in developed countries. In New Zealand, women, Pacific Islanders and Maori were at greater risk of food insecurity than the overall population (Parnell *et al.*, 2001). In Canada, poverty rates are twice as high among aboriginal peoples than non-aboriginal Canadians (Canadian Council on Social Development, 2003), and 33 percent of aboriginal people were food-insecure compared with 9 percent among non-aboriginal Canadian households (Willows *et al.*, 2009). Inuit, who reside in remote communities, face even greater challenges to food security than other Indigenous Peoples in Canada. For Inuit, climate change threatens traditional food species reproduction and survival and limits the human navigation that is essential for hunting (Chapter 9 – Egeland *et al.*, 2013). This in turn would limit access to traditional food and threaten food security and nutrition status (Egeland *et al.*, 2009; Johnson-Down and Egeland, 2010; Kuhnlein and Receveur, 2007). In focus groups in six Inuit communities, participants stated that "a lot of people are living near poverty" and having difficulty obtaining enough food to eat (Chan *et al.*, 2006). Despite large Canadian subsidies for a food mail programme (of CAD 46 million in 2006/2007) for northern communities, food costs in most remote communities are at least double those in southern Canadian cities or towns closer to food distribution routes (Indian and Northern Affairs Canada, 2007). The combination of inability to afford market food, lack of access to hunting and fishing and/or lack of a hunter in the family contribute to food insecurity in Canadian Arctic communities, particularly among households headed by women (Duhaime, Chabot and Gaudreault, 2002; Lambden *et al.*, 2006).

Among the case studies in this volume, the one in which traditional food systems were closest to being entirely lost is that of the Ainu of Japan. Strong assimilation policies by the Japanese Government over a fairly long period have stopped food insecurity (in the usual definition of inadequate access to enough food) from being a problem, but have also resulted in loss of identification of traditional foods and dishes. A recent effort aims to reidentify traditional Ainu foods and culture before the relevant knowledge is lost. The Government of Japan has now officially recognized the Ainu as an Indigenous People and has publicly recognized the hardships and poverty they have endured (Ito, 2008), which represents progress for the Ainu.

Food security is complex, relying on local food culture and ecosystems, fluctuations in precipitation and climate, soil quality, and socio-economic aspects of trade and food purchasing behaviour. Where soils are poor and weather extreme, food diversity and adequacy are compromised, and macro- and micronutrient deficiencies may be evident, depending on the predominant dietary practices. For example, in areas with low consumption of animal food, low vitamin D, calcium, n-3 fatty acids and B_{12} would be expected, whereas in areas with low fruit and vegetable consumption, carotenoids and phytonutrients may be compromised (Wahlqvist and Lee, 2007). An additional consideration is the growing body of evidence indicating that micronutrient deficiencies are more common among obese than normal-weight people in a wide variety of populations and age groups (Garcia, Long and Rosado, 2009). This evidence is fairly robust and includes antioxidant nutrients, vitamins A, D, C, B_{12} and folate, iron and zinc. There are several plausible biological mechanisms to explain this, and it is not yet clear in which direction any causal pathways may be operating. However, it is clear that the presence of overweight and obesity is consistent with, and may even be associated with, higher risk for impaired micronutrient status.

Where do we go from here?

Indigenous Peoples' knowledge and food systems are fast disappearing but are of utmost importance, not only for sustaining Indigenous Peoples but also for providing alternative paradigms for coping with diverse ecosystems in a changing global environment.

The challenge is to retain traditional food knowledge and food systems, including market food, through sound governance for food security. Indigenous Peoples have been remarkably resilient, and collectively provide a vast tapestry of culturally diverse examples of human ingenuity in food systems that are adaptive to different and often harsh ecosystems. However, Indigenous Peoples' knowledge and food systems are poorly documented and fast disappearing, even though they are of utmost importance not only for sustaining Indigenous Peoples but also for providing alternative paradigms for coping with diverse ecosystems in a changing global environment.

While the social determinants of health are now widely accepted, Indigenous Peoples suffer from additional assaults on "indigeneity" and self-determination, which contribute to disparities in poverty, education, nutrition and food security, household crowding, poor access to and utilization of health care, and preventable diseases. Thus, Indigenous Peoples' health problems "cannot be resolved solely through health interventions"; policies with a stronger emphasis on indigenous rights are needed (Stephens *et al.*, 2006; Gracey and King, 2009; UNPFII, 2009). In addition, governments need to collect health information on needs and conditions, and should allocate adequate resources to addressing the socio-economic inequities between indigenous and non-indigenous people, to narrow the disparities in health and disease (Gracey and King, 2009). Specific programmes that target mothers and children, nutritional deficiencies, improvements in sanitation and household crowding as a means of reducing infectious diseases, improving living conditions and opportunities for urban residents, and addressing diseases of acculturation are among the top priorities (Gracey and King, 2009). Opportunities for reducing micronutrient deficiency disease through food fortification (Harrison, 2010) should be examined carefully, with a view to identifying the potential effects on the diets of indigenous populations.

To identify the next steps in reducing the enormous health disparities that exist, Indigenous Peoples' conceptualization of health and the determinants of their health framework also needs to be understood (Mowbray and WHO Commission on Social Determinants of Health, 2007). Indigenous Peoples' view of health is not limited to individual health and the absence of disease, but also encompasses the health of the entire community and of the ecosystem on which it relies; this includes the concept of well-being, which is more than the absence of disease (King, Smith and Gracey, 2009). The traditional holistic view of health covers spiritual, mental, physical and emotional well-

being. Where colonization is part of the history of indigenous groups, it features as a prominent determinant of poor health because it relates to the disruption of ties to the land and traditional food systems that had an omnipresent role in defining traditional social arrangements, self-identity with defined roles for community members, and systems of knowledge. The weakening or destruction of cultural practices and language, disconnectedness from cultural identity and ongoing marginalization in which Indigenous Peoples are not recognized or understood by society's institutions all contribute to health disparities. The disruptions associated with colonization, which lead to lack of autonomy and self-esteem, are linked closely to poor health status (Durie, Milroy and Hunter, 2009).

Reversing the effects of colonization therefore depends on efforts to encourage self-determination in all facets of life. This will promote collective and individual identity, self-esteem and a greater locus of control, which can improve a broad range of health outcomes for Indigenous Peoples. In addition, international collaboration among Indigenous Peoples can foster innovative health research and help identify solutions to commonly shared problems (Reading, 2009).

Traditional food systems provide a strong foundation for cultural identity, a basis for social support networks and medicinal remedies, and nutritional health. The promotion of traditional food and food systems assists Indigenous Peoples in gaining greater autonomy and self-determination and promotes health. Policies need to encourage sound environmental husbandry by all sectors of society, and provide opportunities for Indigenous Peoples to continue or enhance their utilization of traditional food systems. Nutrition and health education and making healthy market foods affordable provide a highly worthwhile complementary approach, which is needed to reduce the disparities in nutrition-related chronic diseases.

Improved primary health care and models of health care delivery in cross-cultural settings are also needed. Community-led or -partnered programmes will enhance acceptability among community members and are likely to improve the performance indicators of programmes' successes (Ring and Brown, 2003; Gracey and King, 2009). Indigenous Peoples are taking leadership in the development of community-based programmes that emphasize nutrition and physical activity, such as the Unity of First People of Australia innovative health promotion programme in Kimberley Region, where positive changes in knowledge about food, nutrition and exercise are having an impact on diabetes risk factors (Gracey *et al.*, 2006). Another success has been the community-led Kahawá:ke Diabetes Prevention Project, in which a decline in the incidence of type 2 DM between 1986/1988 and 1992/1994 coincided with the Mohawk community's mobilization of prevention efforts (Horn *et al.*, 2007).

The many initiatives described in the CINE case study series indicate how the collaborative ties that Indigenous Peoples have can make a difference in the health of their communities. There is no single successful strategy; multiple strategies are needed to help narrow the gap in nutrition-related chronic diseases. However, successful programmes will likely be those that include Indigenous Peoples' initiatives and perspectives and local food resources; partnerships among and within communities; community partnerships with nutritionists, health care providers and health care specialists; the involvement of government and non-governmental agencies; and locally operated points for health care screening and feedback tied to health education. Improving Indigenous Peoples' health is a "critical but complex challenge" (Stephens *et al.*, 2005), but not an impossible task

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Annex 2.1 Micronutrient deficiency conditions and their worldwide prevalence

Micronutrient	*Deficiency prevalence*	*Major deficiency disorders*
Iodine	2 billion at risk	Goitre, hypothyroidism, iodine deficiency disorders, increased risk of stillbirth, birth defects, infant mortality, cognitive impairment
Iron	2 billion	Iron deficiency, anaemia, reduced learning and work capacity, increased maternal and infant mortality, low birth weight
Zinc	Estimated as high in developing countries	Poor pregnancy outcomes, impaired growth (stunting), genetic disorders, decreased resistance to infectious diseases
Vitamin A	254 million preschool children	Night blindness, xerophthalmia, increased risk of mortality in children and pregnant women
Folate (vitamin B_6)	Insufficient data	Megaloblastic anaemia, neural tube and other birth defects, heart disease, stroke, impaired cognitive function, depression
Cobalamine (vitamin B_{12})	Insufficient data	Megaloblastic anaemia (associated with *Helicobacter pylori*-induced gastric atrophy)
Thiamine (vitamin B_1)	Insufficient data, estimated as common in developing countries and in famines, displaced persons	Beriberi (cardiac and neurologic), Wernicke and Korsakov syndromes (alcoholic confusion and paralysis)
Riboflavin (vitamin B_2)	Insufficient data, estimated as common in developing countries	Non-specific – fatigue, eye changes, dermatitis, brain dysfunction, impaired iron absorption
Niacin (vitamin B_3)	Insufficient data, estimated as common in developing countries and in famines, displaced persons	Pellagra (dermatitis, diarrhoea, dementia, death)
Vitamin B_6	Insufficient data, estimated as common in developing countries and in famines, displaced persons	Dermatitis, neurological disorders, convulsions, anaemia, elevated plasma homocysteine
Vitamin C	Common in famines, displaced persons	Scurvy (fatigue, haemorrhages, low resistance to infection, anaemia)
Vitamin D	Widespread in all age groups, low exposure to ultraviolet rays of sun	Rickets, osteomalacia, osteoporosis, colorectal cancer
Calcium	Insufficient data, estimated as widespread	Decreased bone mineralization, rickets, osteoporosis
Selenium	Insufficient data, common in Asia, Scandinavia, Siberia	Cardiomyopathy, increased cancer and cardiovascular risk
Fluoride	Widespread	Increased dental decay, affects bone health

Source: Tulchinsky, 2010, adapted from Allen *et al.*, 2006: Table 1.2, pp. 6–10.

Chapter 3

Global environmental challenges to the integrity of Indigenous Peoples' food systems

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> “In less than 100 years since the colonization of Hokkaido, our land was changed to farmland and resort land, the mountains are ruined, rivers are covered with concrete and their flows were changed by dams.”
>
> Koichi Kaizawa, Ainu community leader

Abstract

The integrity of Indigenous Peoples' food systems is intimately connected to the overall health of the environment. Recent declines in many aspects of environmental quality, from loss of biodiversity to environmental contamination, have combined with social, economic, political and cultural factors to threaten the health and well-being of Indigenous Peoples, and ultimately of people everywhere. This has affected the quality of indigenous food, restricted its availability or curtailed access to it.

All of the global case studies of Indigenous Peoples in the Indigenous Peoples' Food Systems for Health Program indicate concerns over environmental degradation as a major aspect of Indigenous Peoples' declining use of their indigenous food. Interconnected concerns include biodiversity loss of wild species and of cultivated species and varieties; hydroelectric dams and their impacts on fish and other foods; contamination of water and food from a host of chemical, radioactive and biological pollutants; and climate change, with its accompanying uncertainties and instabilities regarding food systems.

Reconnecting Indigenous Peoples with their traditional territories, and reversing some of the restrictive regulations against Indigenous Peoples' historical hunting and plant harvesting practices may help to restore and maintain traditional resources. More cooperative arrangements for co-management of habitats and resources should be instated. Collaborative research is recommended, such as that reflected in this volume in which environmental and other relationships among Indigenous Peoples' cultures, lands and resource stewardship are complemented with supporting work by academic partners. Ultimately, this will help to maintain and strengthen the resilience of ecosystems and cultural systems, including diverse and healthy food systems.

Introduction

Humans are completely dependent on healthy environments for their health and well-being. Global human food systems have been created and supported by a combination of the earth's multitudes of life forms and ecosystems and by human ingenuity, developed and shared over many thousands of years. Today, however, both the cultural diversity and the global biodiversity that gave rise to human food systems are threatened in many places, and Indigenous Peoples' food systems are particularly vulnerable (Davis, 2001; Carlson and Maffi, 2004; Wilson, 1992). To maintain the integrity of human food systems around the world, the environmental problems affecting biodiversity and biological productivity must be addressed, as the survival of the life forms that provide food, directly and indirectly, is fundamental to the well-being of human cultures and populations.

Almost daily, reports of environmental problems with impacts on human nutrition dominate the media. All of these influence human nutrition through:

- overexploitation of major fish stocks (Jackson *et al.*, 2001; Myers and Worm, 2003; Pauly *et al.*, 2000; Roach, 2006; Schindler *et al.*, 2002), forests (FAO and IPGRI, 2002) and terrestrial wildlife (Bennett and Robinson, 2000);

Table 3.1 Environmental impacts identified as affecting indigenous food systems of case study communities

Source/type of environmental impact	*Examples/food system impact*	*References*
Erosion of biodiversity (wild species)	Threats to caribou calving grounds from natural gas pipeline and oil drilling in Arctic regions; widespread loss of tropical forests; decreased yield and availability of certain foods (e.g., ooligan for Nuxalk; wild fish and shellfish species, and wild game in many places)	Egeland *et al.*, 2009 (Inuit, Nunavut); Kuhnlein *et al.*, 2009 (Gwich'in, northern Canada); Chapter 8 in this volume (Ingano, Colombia); Turner *et al.*, 2009; Chapter 11 in this volume (Nuxalk, western Canada)
Erosion of biodiversity (cultivated species)	Decreased use and loss of cultivated varieties (cultivars or landraces) (e.g., traditional cereals, banana varieties, taro, breadfruit); threats from large-scale monocultures and genetically modified food crops	Brookfield and Padoch, 1994; Chotiboriboon *et al.*, 2009; Chapter 10 in this volume (Karen, Thailand); Creed-Kanashiro *et al.*, 2009; Chapter 5 in this volume (Awajún, Peru); Englberger *et al.*, 2009; Chapter 12 in this volume (Pohnpei, Federated States of Micronesia); Salomeyesudas and Satheesh, 2009; Chapter 6 in this volume (Dalit, India); Turner *et al.*, 2009; Chapter 11 in this volume (Nuxalk, western Canada)
Deforestation and overexploitation of forest resources	Destruction of forests through logging and illicit crop cultivation; overharvesting of rubber; deforestation through charcoal making and fuelwood harvesting	Chotiboriboon *et al.*, 2009; Chapter 10 in this volume (Karen, Thailand); Correal *et al.*, 2009 (Ingano, Colombia); Creed-Kanashiro *et al.*, 2009; Chapter 5 in this volume (Awajún, Peru); Oiye *et al.*, 2009 (Maasai, Kenya)
Water shortages	Drought, desertification; acute shortages of water for livestock and household use	Correal *et al.*, 2009 (Ingano, Colombia); Oiye *et al.*, 2009 (Maasai, Kenya); Salomeyesudas and Satheesh, 2009 (Dalit, India)
Hydroelectric dam construction	Loss of salmon and other indigenous food; changes in environment; loss of access to indigenous food; loss of water quality	Iwasaki-Goodman, Ishii and Kaizawa, 2009 (Ainu, Japan)
Water pollution from domestic and livestock waste	Solid waste disposal problems; inadequate sanitation; faecal contamination of water and bacterial disease from poor waste disposal	Correal *et al.*, 2009 (Ingano, Colombia); Creed-Kanashiro *et al.*, 2009; Chapter 5 in this volume (Awajún, Peru); Englberger *et al.*, 2009; Chapter 12 in this volume (Pohnpei, Federated States of Micronesia); Oiye *et al.*, 2009 (Maasai, Kenya)
Contamination of food web, and threat of contamination, from industrial development, mining, herbicide spraying, nuclear power facilities	Pollution and chemical contamination from mining, oil drilling and petrochemical development; toxic residues in food	Correal *et al.*, 2009 (Ingano, Colombia); Creed-Kanashiro *et al.*, 2009; Chapter 5 in this volume (Awajún, Peru); Egeland *et al.*, 2009 (Inuit, Nunavut); Kuhnlein *et al.*, 2009 (Gwich'in, northern Canada)
Soil erosion and deterioration	Decline in soil fertility; soil loss; overgrazing and reduced carrying capacity for livestock; deterioration of pastures	Correal *et al.*, 2009 (Ingano, Colombia); Oiye *et al.*, 2009 (Maasai, Kenya); Okeke *et al.*, 2009 (Igbo, Nigeria)
Global climate change	Melting glacial ice and sea ice (in the north); changes in rainfall patterns; weather extremes, floods; raised sea levels	Correal *et al.*, 2009 (Ingano, Colombia); Creed-Kanashiro *et al.*, 2009; Chapter 5 in this volume (Awajún, Peru); Egeland *et al.*, 2009 (Inuit, Nunavut); Englberger *et al.*, 2009; Chapter 12 in this volume (Pohnpei, Federated States of Micronesia); Kuhnlein *et al.*, 2009 (Gwich'in, northern Canada); Oiye *et al.*, 2009 (Maasai, Kenya)

Chapters in this volume:
5 – Creed-Kanashiro *et al.*, 2013;
6 – Salomeyesudas *et al.*, 2013;
8 – Caidedo and Chaparro, 2013;
10 – Sirisai *et al.*, 2013;
11 – Turner *et al.*, 2013;
12 – Englberger *et al.*, 2013.

- habitat loss from urbanization and the industrialization of landscapes (Millennium Ecosystem Assessment, 2005; CBD, 1992);
- invasive species (Crosby, 1986; Wilson, 1992);
- pollution and degradation of lands, waterways and the foods they produce (WWF, 2004; Ross and Birnbaum, 2003; Kuhnlein and Chan, 2000);
- global climate change (Ashford and Castleden, 2001; IPCC, 2007; Salick and Ross, 2009; Thomas *et al.*, 2004).

Invariably, environmental impacts on food systems are cumulative and interconnected, and they interact at multiple scales of time and space. To understand and mitigate these impacts more effectively, it is necessary to recognize their pervasiveness, examine the origins of the problems and the processes involved, and address these at multiple levels. Looking at individual case studies of indigenous communities and their direct connections to local environments and food sources provides a solid and tangible starting point.

Widespread environmental deterioration leading to the erosion of biodiversity is not a recent phenomenon. However, because the world's population is increasingly urban and distant from the natural rural environment, the signs and signals that sources of food and clean water are imperilled have received little attention until recently (Ommer and Coasts Under Stress Research Project Team, 2007; Pollen, 2006). For example, most of the medicinal plants traditionally employed in East Africa come from forests that have been nearly eliminated throughout most of their original range (Cunningham, 1997). People living close to their food sources – who include many if not most of the world's Indigenous Peoples living relatively traditional lifestyles – have been firsthand witnesses to much of this environmental loss. For example, the Kogi Indians of the Sierra Nevada de Santa Marta in Colombia have been noting accelerated glacier melting and other associated climatic changes for decades (J. Mayr, personal communication to M. Plotkin, 2006). Far to the north, Canadian Indigenous Peoples of the polar regions, including Inuit, Gwich'in and Dene, have also been observing environmental deterioration: melting of sea ice, thawing of permafrost and siltation of rivers, with a host of effects and impacts on wildlife and Indigenous Peoples' food systems (Berkes *et al.*, 2005; Krupnik and Jolly, 2002; Salick and Ross, 2009). In many cases, it is the observations, experiences, practices and cultural institutions of local Indigenous Peoples that help to determine the rates and causes of environmental loss, and Indigenous Peoples can often have some of the best ideas of possible ways to protect habitats, repair some of the damage and adapt to changing conditions (Turner and Clifton, 2009). This chapter focuses on the environmental aspects of Indigenous Peoples' food security, and discusses how the damage that threatens local and global food resources can be mitigated or possibly reversed.

Indigenous Peoples' food systems and environments

Investigations of the food systems of indigenous communities participating in the CINE Indigenous Peoples' Food Systems for Health Program (Kuhnlein *et al.*, 2006) sought to improve understanding of the environmental context of Indigenous Peoples' foodways. The state of each region's ecosystems and their capacity to support Indigenous Peoples' food systems is of fundamental importance. Indigenous communities participating in the programme identified several major environmental problems that negatively affect their overall food security and food systems (Table 3.1). These include specific concerns, such as declining populations of resource species: caribou in northern Canada, ooligans and salmon on the west coast of Canada, and crop diversity for bananas and other species in Pohnpei, Dalit and Karen communities in the Federated States of Micronesia, India and Thailand, respectively. They also incorporate some impacts that are more indirect but just as significant, such as deforestation, water deterioration, soil erosion and climate change. Each of these conditions and situations affects not only the case study indigenous communities, but also many other Indigenous Peoples and, eventually, all humanity and other species on the globe. As many Indigenous Peoples hold a "kincentric" worldview, in which all species are respected as close relatives, the

notion of harm to species such as polar bears, salmon or orca whales is as alarming and upsetting as direct impacts on human communities themselves (Salmón, 2000; Senos *et al.*, 2006).

In the following sections, four of the overriding environmental problems that affect Indigenous Peoples' food systems are described in more detail to demonstrate the complex web of issues that are involved with each: biodiversity loss, especially of food species; hydroelectric dams and their effects; contamination of water and food; and global climate change.

Biodiversity loss

On every continent, Indigenous Peoples, other local peoples and biologists have noted alarming declines in the populations of many of the world's species (Wilson, 1992; Millennium Ecosystem Assessment, 2005). In recent times, many species have become extinct, for diverse reasons, most of which are directly or indirectly attributable to human activity. There are compelling examples of past human-caused extinctions or severe depletions of important food species, including the passenger pigeon in the Americas and the American bison (Davis, 1998). Today, with burgeoning human populations, globalization and increasing commodification of wild resources that were, and still are, major components of Indigenous Peoples' food systems, erosion of biodiversity is an ever-growing concern, and needs increased attention. For both wild species and crop varieties important to Indigenous Peoples, the largely negative role of large-scale commercialization and globalization of the marketplace cannot be ignored.

Many Indigenous Peoples have traditionally had strong protocols and culturally mediated prohibitions against overharvesting and towards the sustainable use and enhancement of food resources (Anderson *et al.*, 2005; Berkes, 2008; Deur and Turner, 2005; Johannes, 2002; Turner and Berkes, 2006). Today, however, species that were once carefully stewarded by local people – such as sea urchins, herring eggs and abalone for British Columbia coastal peoples in Canada – have become commodified, with global demands for immense quantities. Without proper and careful constraints on the use of these species, this situation characteristically leads to overexploitation, to the ultimate detriment of the local peoples who rely on them (Berkes *et al.*, 2006). Similarly, the health and livelihoods of local and Indigenous Peoples in many countries are threatened by escalating unsustainable use of wild meat or "bushmeat" (Bennett and Robinson, 2000; Anderson *et al.*, 2005), and by industrial and government-sanctioned deforestation to meet a great world demand for timber and dominant agricultural crops (Mackenzie, 1993; Balée, 1994; Turner and Turner, 2006; 2008; Graham, 2008). Habitat loss, the impacts of introduced species and the loss of pollinators are a few of the many threats to Indigenous Peoples' food systems, beyond direct overharvesting (Porcupine Caribou Management Board, 2007; Kuhnlein, 1992; Nabhan, 1986). The story is repeated again and again, from flying foxes and tropical forests in Samoa to Pacific salmon and coastal temperate rain forests on the northwest coast of North America (Cox, 1997; Nabhan, 2006).

Salmon farming or marine net-pen aquaculture can cause many direct and indirect negative impacts on marine environments. Depletion of fish stocks used as fish feed, destruction of coastal ecosystems such as eelgrass beds that are important nursery grounds for marine species, potential invasion of introduced Atlantic salmon, eutrophication caused by nutrients from fish and excess food and faeces, use of antibiotics, and sea lice infestations are some of the challenges facing Indigenous Peoples on the northwest coast of North America, who rely on the annual runs of wild Pacific salmon for their nutrition and cultural integrity (Volpe, 2007). Globally, all marine systems are now showing deleterious effects of human-caused change (Pauly *et al.*, 2000).

Alongside the decline and extinction of native or wild species around the globe, crop varieties and special landraces (adaptations of domesticated species) of plants and animals have also been declining dramatically (Fowler and Mooney, 1990; Nabhan and Rood, 2004). Again, the reasons are complex, but political and industrial agendas are clearly implicated (Shiva, 2000), along with valid efforts to provide sufficient food for a burgeoning world population through a

movement known as the green revolution. Increasing use of fertilizers, pesticides and herbicides, high fossil fuel inputs for ploughing, seeding and harvesting, and monoculture crop production are outcomes of the green revolution. The escalating production of genetically engineered crops has caused growing concern for Indigenous Peoples wishing to retain control over their own landraces and food systems (La Duke and Carlson, 2003; Pasternak, Mazgul and Turner, 2009; Kurunganti, 2006). Plantations of sugar cane, coffee, maize and other megacrops for export markets often give employment to Indigenous Peoples, but have widely replaced their diverse subsistence crops. Large-scale production of cattle and other livestock, with the accompanying pollution and degradation of pasturelands and deforestation, has also had severe negative consequences for Indigenous Peoples. Drought and desertification – often resulting from poor management practices, overcrowding and overgrazing – are also widely recognized as threats to Indigenous Peoples' food security.

One of the growing threats to subsistence food production is the biofuel industry. Biofuels are becoming a popular alternative and supplementary fuel for motor vehicles and heating. Although they tend to burn cleaner than fossil fuels and are theoretically a renewable resource, the market forces at play often result in the sequestering of lands formerly used for food production, to generate biofuels – often at the expense of Indigenous Peoples' well-being. Food security may decrease with cash cropping (Dewey, 1979; 1981): in Brazil, sugar cane, soybeans, castor beans and maize are being grown in increasing quantities to produce ethanol, reducing the nutrition opportunities for smallholder farmers (Conservation International, 2007; FIAN International, 2008; Graham, 2008).

Hydroelectric dams

Industrial-scale hydro projects provide power, but have proven destructive to Indigenous Peoples' ways of life and food systems; however, more dams are being planned and constructed. For example, the James Bay project of Hydro-Quebec in Canada put thousands of square kilometres of traditional Cree territory under water in 1983, not only cutting off access to Cree food resources, but also placing the Cree's health at risk from mercury contamination of the fish they consumed. The decomposing trees and other plants covered by the dam floodwaters produced methane, which converted natural mercury in the soil into a toxic form that entered the food chain, poisoning both the fish and those who eat them (Richardson, 1991; Kuhnlein and Chan, 2000). Another example is dam construction in Mato Grosso State of Brazil, which will severely restrict aquatic protein for 14 tribes whose main source of protein is fish (M. Plotkin, personal observation, 2009).

Iwasaki-Goodman, Ishii and Kaizawa (2009) have documented a wide range of impacts resulting from the construction of an immense hydroelectric dam on the Saru River, site of the Ainu homeland for at least 1 000 years. The Ainu resided along the riverbanks and obtained much of their sustenance from the river by fishing, while farming and hunting on the adjacent lands. Traditionally, the river also provided high-quality drinking-water. More than 100 years ago, non-Ainu Japanese began colonizing the area, and the Hokkaido Government started establishing regulations aimed at assimilating the Ainu and restricting their cultural traditions, including hunting and fishing. In 1997, the Nibutani Dam was completed in the heart of Ainu territory, against the wishes of the Ainu. A court challenge of the legality of this dam by two Ainu landowners eventually resulted in a judgment that the government had failed to assess the effect that the dam's construction would have on the local Ainu culture, thereby ignoring values that required serious consideration. This led to increased recognition of the importance of cultural impact assessments in any future developments, establishing an important precedent. In the same year that the dam was completed, the Law Concerning Promotion of Ainu Culture and Dissemination and Enlightenment of Knowledge about Ainu Traditions was enacted. This law has reinforced an ongoing movement to revitalize Ainu culture, and interviews about the impacts of the Nibutani dam have been part of the impact assessment programme required before any subsequent dams are constructed.

Respondents in these interviews identified many changes resulting from the dam construction:

- cooler weather and more fog and mist;
- increased siltation and significant shallowing of the river;
- undesirable flooding of the rice fields following a typhoon in 2003;
- loss of access to the other side of the river for food gathering;
- restrictions on children's play areas, fishing places and picnicking areas;
- loss of shallow ponds and riverbanks that were sources of fish and other cultural resources;
- loss of spawning areas for smelts (fish);
- disappearance of kelp, shellfish, flounders and octopus;
- muddying of the river and loss of clear drinking-water.

In short, the Nibutani Dam "killed the natural environment" for the Ainu (Iwasaki-Goodman, Ishii and Kaizawa, 2009).

Contamination of water and food

Consumption of and exposure to contaminated water is an ongoing and growing concern, especially for people living in rural areas. Worldwide, many indigenous communities have been adversely affected by contaminated water. For example, the Wayanas of southern Suriname have up to 17 times the recommended level of mercury in their hair samples, resulting from mercury pollution (C. Healy, personal communication to M. Plotkin, 2006; Nuttall, 2006).

Sewage pollution is another ongoing and related issue. Many small communities – and some large cities – discharge large amounts of raw or minimally treated sewage into rivers, lakes and coastal waters, which affects the foods in these systems. The city of Victoria, Canada, which used to have some of the best clam digging beaches on the coast, now has chronically contaminated beaches; for many decades, the local Straits Salish First Nations have not been able to harvest their seafood near the populated areas of the Saanich Peninsula and Victoria coastline.

Among the case study communities, the Awajún of Peru and their neighbouring communities face major problems relating to water quality and pollution from human waste: all homes in the region have precarious access to basic water and sewage services, most have no running water, and rubbish is thrown into the river. Human faeces are commonly seen in public areas, and a system of latrines installed by a government organization in the early 1990s – when there were concerns about cholera in the region – is generally considered a failure because of poor design, bad location and lack of training in maintenance. Many people, both children and adults, suffer from diarrhoea, parasites and other illnesses related to contamination, and there is concern about typhoid fever (I. Tuesta, M. Carrasco and H. Creed-Kanashiro, personal communication, 2008).

Environmental contaminants that biomagnify and concentrate in food webs are also a threat, and have been well studied in some places (Kuhnlein *et al.*, 1982; 2005; Kuhnlein and Chan, 2000; Chan *et al.*, 1996; Chan, Kuhnlein and Receveur, 2001; Thompson, 2005; Ross, 2000; 2006; Ross and Birnbaum, 2003; Ross *et al.*, 2004). As already mentioned, mercury contamination has been particularly insidious, causing health concerns such as nervous system disorders from eating local fish from affected rivers (Lebel *et al.*, 1997; Shkilnyk, 1985; Khaniki *et al.*, 2005), in addition to the more widely publicized phenomenon of mercury contamination of coastal ecosystems and large oceanic species such as tuna.

As well as mercury and other metals, a range of organic industrial compounds, classed generally as persistent organic pollutants (POPs), are also of concern. These are semi-volatile fat-soluble toxic compounds, including polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioins (PCDDs, also known as dioxins), polychlorinated dibenzofurans (PCDFs, also known as furans), polybrominated diphenyl ethers (PBDEs) polybrominated biphenyls (PBBs) and polychlorinated naphthalenes (PCNs) (Iwasaki-Goodman, Ishii and Kaizawa, 2009; Rayne *et al.*, 2004; Ross, 2006; Ross and Birnbaum, 2003; Ross *et al.*, 2004). The origins of these compounds are mainly industrial, and range from local sites such as pulp mills

and discarded machinery, to diffuse, distant sources from which the contaminants are transported through the atmosphere, ocean currents, soil and waterways, including by migratory species such as whales and salmon that have been contaminated (Johannessen and Ross, 2002; Krümmel *et al.*, 2003; Lichota, McAdie and Ross, 2004). Arctic regions are particularly vulnerable to contamination from POPs whose sources are known to be very distant; many of the contaminants in northern Canadian, for example, come from industrial centres in northern Asia and Europe (Knotsch and Lamouche, 2010).

Because predator species such as tuna, salmon and seals are at the upper trophic levels of food webs, these "sentinel" species are particularly vulnerable to contaminants, which accumulate in their fatty tissues (Ross, 2000). Humans who use these species as food in any quantity are placed at risk: ingesting contaminated food is the principal means by which humans are exposed to these highly toxic environmental pollutants (Parrish *et al.*, 2007). This situation is of particular concern in the food systems of Indigenous Peoples who consume large amounts of seal, salmon or other predator species (Johannessen and Ross, 2002; Mos *et al.*, 2004; Ross and Birnbaum, 2003). For example, POPs can interfere with the immune function of animals and – potentially – humans, making them more vulnerable to infectious diseases (Ross, 2002; Ross, Vos and Osterhaus, 2003). They can also disrupt endocrine function, reproduction and vitamin A production in the human body (Ross, 2000; Simms *et al.*, 2000). Recently, researchers have been observing possible associations between diabetes and levels of POPs (Jones, Maguire and Griffin, 2008; Rignell-Hydbom, Rylander and Hagmar, 2007).

Many indigenous communities have expressed concerns about contamination of their food (and their medicines and basketry materials) from agricultural chemicals and pesticides and from the herbicides used in industrial forestry, factory farming and powerline rights-of-way (Wong, 2003; Pollen, 2006). Mining and its associated smelters and refineries also present contamination concerns. Centres of industrial activity, such as at Kitimat in British Columbia, Canada have affected the habitats and food systems of indigenous and other local people. In Kitimat, pollutants from an aluminium smelter and other industrial plants have contaminated many Haisla foods, such as oulachens (ooligans, a favourite fish of the north coast) (Chan *et al.*, 1996; Turner *et al.*, 2009; Chapter 11 in this volume – Turner *et al.*, 2013), shrimp, clams and other species in the vicinity of the smelter. The Haisla elders used to refer to this area along the Kitimat River as their "grocery store", because it was such an important source of food, but they can no longer harvest their indigenous foods there (G. Amos, personal communication, 2007).

Gold, uranium, diamond and other mines are common in regions such as northern Canada, where many of the miners and local residents are Indigenous Peoples (e.g., Deline Mine in Canada's Northwest Territories). These people are directly affected by contaminants from the mines, while the caribou, fish and other animals on which they depend for food are affected by mining pollution and the impacts of the roads, settlements and infrastructure built to support prospecting and mining (B. Erasmus, personal communication, 2008). Mining in Amazonia is notoriously destructive to Indigenous Peoples and their food systems (Roulet *et al.*, 1999). The Awajún in Peru are concerned about possible mercury pollution of their rivers from gold mines upriver in the mountains and from mines in neighbouring Ecuador, but tests have not yet been carried out to determine the extent of the threat (I. Tuesta, M. Carrasco and H. Creed-Kanashiro, personal communication, 2008).

Oil and gas exploration and extraction, together with the construction of pipelines and their corridors, present a range of environmental problems and concerns regarding Indigenous Peoples' food systems and health (Wernham, 2007). In northern Alberta, Canada, the tar sands development, in which oil and gas are extracted from heavy crude oil that is mined from the surface and treated with large quantities of heated water, has resulted in environmental devastation and large deforested areas, described as "a moonscape" (Griffiths, Taylor and Woynillowicz, 2006). Impacts on wildlife are of great concern, with reports of entire flocks of ducks being destroyed in the expansive oil sands tailing

ponds contaminated with bitumen residues (Torys LLP, 2010; B. Erasmus, personal communication, 2008). Not only is such destruction harmful to people's food resources, but it is also emotionally and culturally devastating to witness. In the Amazon region of Peru, the Awajún are concerned about the development of large-scale hydrocarbon extraction south of their lands; such development can cause deforestation and environmental devastation, as the Awajún are already observing in neighbouring Brazil.

Airborne radioactive contamination of food is a concern for Indigenous Peoples in the Arctic, where lichens absorb airborne contaminants before being eaten by caribou and reindeer, which are then eaten by humans. Concerns about poisoning from radioactive compounds have diminished since the cessation of aerial testing of nuclear bombs, but the threat of contamination from accidents in nuclear power plants continues. A catastrophic nuclear power plant accident at Chernobyl in the Ukraine region of the former Soviet Union in 1986 resulted in a massive atmospheric plume of radioactive contaminants that drifted across the Russian Federation, eastern, western and northern Europe and into North America, affecting the Sami of Scandinavia and the Inuit and other northern peoples of Canada (Berti *et al.*, 1997; Strand *et al.*, 1998; Kuhnlein and Chan, 2000).

Political decisions from governments and other agencies outside indigenous communities often have unrecognized or unacknowledged impacts on Indigenous Peoples' environments, cultures and food systems (Turner *et al.*, 2008b). In Colombia, for example, government-sponsored large-scale aerial spraying of herbicides to destroy illegal coca crops has had impacts on the Ingano's crops. The herbicides fall on to grazing lands and farms, killing food crops such as manioc and banana. If the crops are mature when this happens, people consume them immediately, risking their own health to utilize crops that would otherwise soon die. The Ingano also suffer when the waste from cocaine production, referred to as cocasa, contaminates the rivers and streams they use for drinking-water and household purposes (Correal *et al.*, 2009).

Global climate change

Global climate change is cited as a major concern in the Inuit and Gwich'in case studies (Chapter 7 – Kuhnlein *et al.*, 2013; Chapter 9 – Egeland *et al.*, 2013; Kuhnlein *et al.*, 2004), and is perhaps the most pervasive, overarching threat to the security of Indigenous Peoples' food systems, both regionally and globally (Damman, 2010; Krupnik and Jolly, 2002; Myers *et al.*, 2005; DFO, 2009; Environmental Change Institute, 2007; Dinar *et al.*, 2008; Keskitalo, 2008; Turner and Clifton, 2009). Whether people rely on agriculture, pastoral systems, hunting, fishing, wild plant harvesting or a combination of food production and harvesting practices, climate change is causing, or has the potential to cause, major disruptions to their food systems. Among the host of interrelated problems attributed to climate change are:

- constrained water availability and water quality;
- unseasonably high temperatures, with threats of desertification;
- droughts and fires;
- unpredictable weather events (blizzards, hurricanes, floods, ice storms);
- shifts in seasonal weather patterns;
- changing sea levels, with impacts on coastal ecosystems;
- retreating glaciers and changing species distributions in high mountains;
- soil erosion;
- melting permafrost;
- spread of insect pests and diseases;
- changing wildlife migration routes;
- impacts on pollinators.

All of these affect Indigenous Peoples' food systems. The direct, indirect and cumulative effects of these factors on human food security are only starting to be noted, with locally based Indigenous Peoples sounding alarms (Environmental Change Institute, 2007). One example cited by indigenous people in Pohnpei (Chapter 12 – Englberger *et al.*, 2013) is that rising sea levels are destroying coastal giant taro gardens. Another is the effect of permafrost melt on the safety of hunters and the turbidity of rivers in northern Canada (B.

Erasmus, personal communication, 2008). There is great concern that global climate change, exacerbated by indiscriminate tree cutting in the Amazonian forests will lead to progressive deforestation (WWF, 2008).

Discussion: maintaining food security and environmental sustainability

> Food security exists when "all people, at all times, have physical and economic access to sufficient safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life".
>
> *FAO, 1996*

> Food sovereignty is recognized as the "right of Peoples to define their own policies and strategies for sustainable production, distribution, and consumption of food, with respect for their own cultures and their own systems of managing natural resources and rural areas", and is considered to be a precondition for food security.
>
> *International Indian Treaty Council, 2002*

The multitude of interrelated impacts of global climate change and other environmental threats described in the previous section illustrate the interactions and cumulative effects of many different factors facing Indigenous Peoples in their efforts to maintain their food security and food sovereignty.

As well as the environmental constraints on food security and food sovereignty, a range of social and economic factors also influence food choices: the impacts of residential schools in preventing intergenerational transference of knowledge and skills relating to food and health; urbanization; lifestyle changes; increased availability of convenience processed, marketed foods; television advertising; and many other pressures that move people away from their healthy original foods (Turner and Turner, 2008; Parrish, Turner and Solberg, 2007; Turner *et al.*, 2008b; Kuhnlein, 1989; 1992; Lambden *et al.*, 2006; Lambden, Receveur and Kuhnlein, 2007; Wernham, 2007).

Addressing such complex, cumulative stresses on Indigenous Peoples' food systems is no simple task. The CINE Indigenous Peoples' Food Systems for Health Program has worked to renew and revitalize indigenous food systems as a way of increasing the health and well-being of Indigenous Peoples. Participants at the 2009 International Congress of Nutrition suggested a number of interventions that would help raise awareness and facilitate and promote local environmental stewardship, good nutrition and the use and relearning of Indigenous Peoples' foodways (Kuhnlein *et al.*, 2006). These included actions under five broad topics:

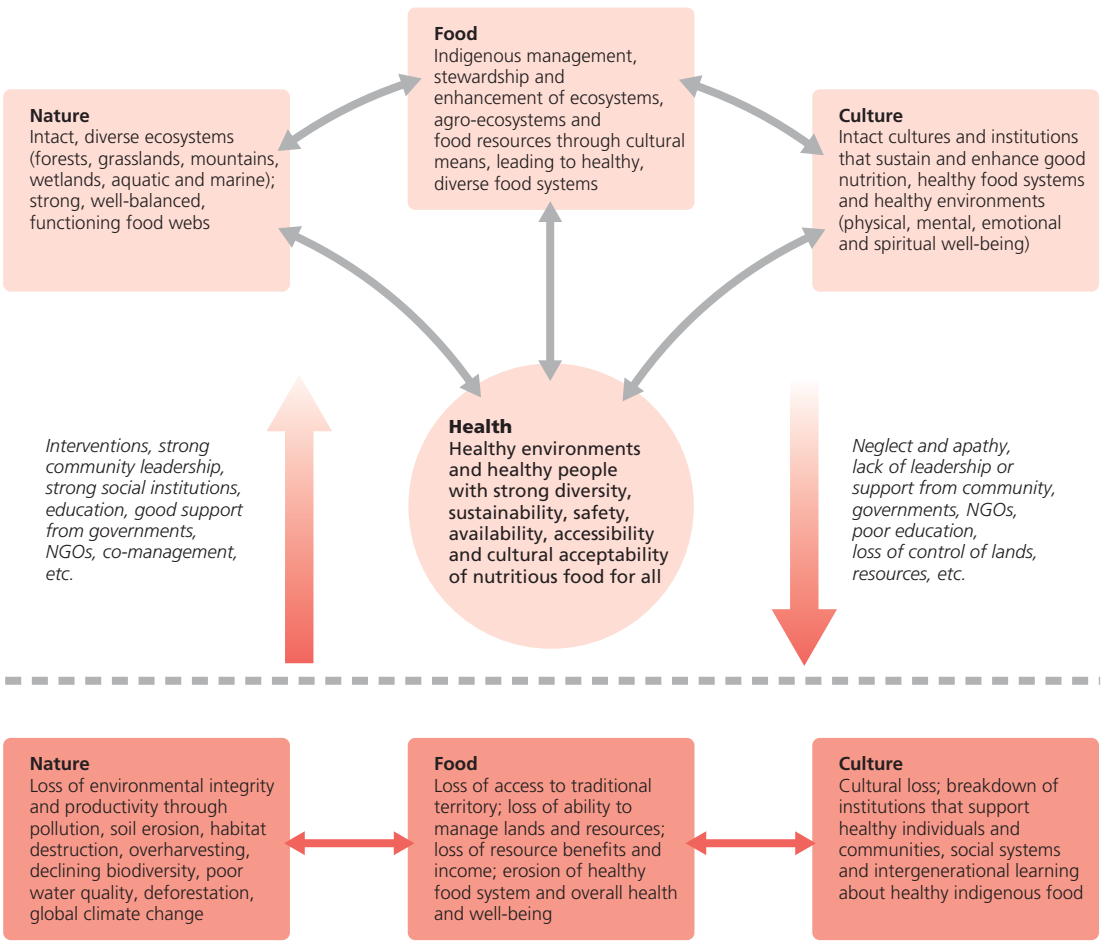
- ***Harvesting wild plant/animal food resources:*** Stimulate more community hunting/gathering/fishing activities, along with conservation training; work to increase access to land and water; teach these activities to youth; share harvests with elders and women; create community-based processing and storage facilities; and work to develop political leverage and agreements to ensure access to harvest areas.
- ***Agricultural activities:*** Stimulate home and community gardens and local food production; plant more trees and other produce; train farmers and others about nutrient-rich crops; develop medicinal plant gardens; form cooperative community groups to undertake agriculture activities; work to enhance access to land; and improve water quality.
- ***Activities in community schools:*** Ensure that school curricula focus on food and nutrition; involve children in teaching their communities about food; develop appropriate teaching materials; hold local food classes; promote healthy indigenous and locally produced snacks; and target unhealthy foods such as high-sugar beverages for elimination from schools.
- ***General community projects:*** Involve elders and cultural committees; encourage participation and cooperative work; train community health workers; prepare educational materials, posters, workshops, etc.; hold community health assessments; and stimulate physical and healthy lifestyle activities, etc.
- ***Links with health care, agriculture, education, government, business and non-governmental***

organizations (NGOs): Engage local steering committees in proactive work; develop prenatal programmes with healthy indigenous and local food; and network with businesses, NGOs, churches and schools to promote local food and health.

Broadly, these suggestions can be characterized as activities for cultural renewal and ethno-ecological restoration, in which Indigenous Peoples' food systems play a pivotal role (Senos *et al.*, 2006). Figure 3.1 illustrates the links and factors affecting Indigenous Peoples' food systems, including the positive effect that various interventions, combined with strong support from community leaders, government and academic institutions and others, can have on the overall health of cultures, environments and food systems. Without such support, the interconnected culture and environmental productivity are lost, resulting in loss of food resources, health and well-being.

Efforts to promote ecosystem enhancement and healthy cultural food systems are under way. Communities are participating in the current case studies and CINE programme, and in other projects with indigenous communities in many different places. Indigenous food harvesting and agricultural activities require government cooperation and collaboration, as

Figure 3.1 Positive and negative links and factors affecting Indigenous Peoples' food systems and health



there is often need to change regulations that prohibit food harvesting or prevent people from practising the management systems they used in the past to sustain their food resources (Posey, 1985; Anderson and Barbour, 2003).

Many environment-based regulations were established during the era of colonial, Euro-centric thinking, without clear understanding of Indigenous Peoples' conservation and management practices. For example, Straits Salish reefnet fishing was banned by the Canadian and United States governments because it was considered a form of "fish trap", and therefore assumed to be bad for conservation. However, this salmon harvesting technology is now recognized as an effective and sustainable management tool that reflects an entire way of life for the Saanich and other Straits Salish peoples (Claxton and Elliott, 1994; Turner and Berkes, 2006), and efforts are under way to reinstate this traditional fishery. Another example, affecting the Indigenous Peoples of western North America, is the banning of traditional landscape burning as being wasteful and destructive (Boyd, 1999; Anderson *et al.*, 2005; Anderson and Barbour, 2003). The positive ecological effects of mid-level human disturbance, including traditional burning practices, are now being revisited, and forestry officials are cooperating in experiments to explore the use of traditional fire regimes to renew huckleberry production and other resources for Indigenous Peoples in the region (Boyd, 1999). In all areas, regulations against Indigenous Peoples' historical hunting and gathering practices should be revisited and either revised or rescinded.

These restrictions could be replaced by more cooperative arrangements for co-management of habitats and resources. There are an increasing number of good co-management models, especially for parks and protected areas, and many have positive implications for Indigenous Peoples' food systems (Anderson and Barbour, 2003; Berkes, 2008; George, Innes and Ross, 2004; Hunn *et al.*, 2003; Nazarea, 1999; Turner, 2005). The United Nations Convention on Biological Diversity (CBD, 1992) and the Declaration on the Rights of Indigenous Peoples, adopted by the United Nations General Assembly in September 2007, contain explicit requirements for governments of Member Nations to respect the rights of Indigenous Peoples, and to consult and collaborate with them in all aspects of resource use affecting their lands and territories.

At the local level, many people are finding small but significant ways to alleviate the environmental problems they face. For example, the Awajún of Peru are starting to raise more chickens and to develop small-scale family fish-raising ponds. Developing these new protein sources has eased the impact on forest wildlife, allowing populations of wild animals to increase to the point where they can be hunted again, on a limited basis (Chapter 5 – Creed-Kanashiro *et al.*, 2013). Other peoples, such as those of the Pohnpei communities, are realizing that their traditional way of serving food on banana and other biodegradable leaves is more environmentally sound than using disposable plastic or other types of dishes (L. Englberger and M. Roche, personal communication, 2008). When practised by an entire community, the use of natural, biodegradable products to harvest, store, cook and serve food, and the recycling and reuse of more durable vessels and containers can have a positive impact on pollution and solid waste outputs (Wilson and Turner, 2004).

As indicated in the intervention ideas from the 2009 International Congress of Nutrition, education is another key factor in efforts to support Indigenous Peoples' healthy traditional food systems. A wide range of education processes should be supported: for indigenous youth and young adults, including the parents of young children, who may not be aware of the cultural or nutritional importance of their indigenous food (Beaton, 2004); for governments and decision-makers outside indigenous communities, and sometimes within them, who may not understand some of the issues regarding indigenous food loss; and for the general public, who could become allies and participants in efforts to restore ecologies and cultures and to renew healthy traditional foods for Indigenous and other local Peoples (Nabhan, 2006).

All Indigenous Peoples have their own educational needs and responses to different strategies for

conveying the information required. Learning-by-doing is a well-tried method for developing knowledge and skills in food harvesting, processing and consumption. Providing children and youth with opportunities for hunting, fishing, berry picking and gardening, with their families or others and through science and cultural camps or school and college field trips, can be very effective in raising their awareness, enhancing their understanding and honing their skills. Participation in the development of demonstration food and medicine gardens and the creation of community and ethnobotanical gardens is also beneficial (Turner and Wilson, 2006). Finding ways for elders' voices to be heard and conveyed, directly in workshops and community meetings or indirectly through films and DVDs, is especially important, as they remember the most about historical food production and preparation. Many communities collaborating with NGOs or government agencies have been able to host cooking events, traditional feasts and other enjoyable, sociable and educational occasions that promote and educate people about the importance of indigenous food, while giving those who have not experienced it a chance to observe and taste such food; examples include Ainu food preparation classes (Chapter 13 – Iwasaki-Goodman, 2013) and community feasts with First Nations around Victoria, involving the Pauquachin, Tsawout, T'souke and Songhees nations (Devereaux and Kittredge, 2008; Pukonen, 2008; Turner *et al.*, 2008a). Programmes that support language and cultural renewal, including potlatches and feasts, dances, stories and ceremonies, are also important, as many indigenous food systems are closely linked to cultural practices and language.

For Indigenous Peoples whose food systems are based on agricultural crops, similar community activities aimed at renewing and reinstating traditional crop landraces and agro-ecology practices can be promoted. Many Indigenous Peoples' resource management systems are sound and sustaining; with cooperation from government and NGOs, these can often be reclaimed and applied to enhance soil fertility, water quality, crop diversity, biodiversity and the overall productivity of traditional food (Colfer, Peluso and Chung, 1997; Englberger *et al.*, 2006; Imhoff, 2003). Indigenous people – particularly women, whose role in conserving crop diversity is often overlooked – are often the best sources of knowledge about traditional landraces for crops such as maize, rice, manioc and many others (Hoyt, 1988; FAO and IPGRI, 2002).

Research undertaken in respectful, effective and collaborative ways is a key element in improving Indigenous Peoples' food systems. Research can help to document and characterize the local foods' contributions to the diet and to nutrient requirements that need special attention. Current dietary conditions can be used as a baseline for understanding dietary change and the environmental and social dimensions of this change. Research can identify the implications of dietary change in terms of threats from chronic disease; focus on issues relating to food safety and availability, including assessing the risk from food contaminants; and document strong cultural traditions and knowledge regarding natural resources, including unique food species held by Indigenous Peoples, as well as the risks of losing this knowledge. Participatory community-based research can build indigenous communities' capacity for improving their own health in the context of their own culture and language. It can identify patterns of land use and local food availability, and help clarify some of the controversies and issues that arise from government policies, such as the establishment of parks and protected areas. It can help to document the tremendous variation in species and varieties of food biota in indigenous areas, which is often unrecognized beyond a particular community, and provide scientific identifications and nutrient analyses of these foods. It can help to guide policy for environmental protection to ensure species habitats, and emphasize the value of cultural expression for retaining traditional knowledge and conserving species (Wyllie-Echeverria and Cox, 2000). It can also assist efforts to frame Indigenous Peoples' perspectives in ways that may be better understood by academics and policy-makers, such as use of the phrase "cultural keystone species" to emphasize the

critically important nature of certain food and other species to particular cultural groups (Garibaldi and Turner, 2004).

Collaborative research on indigenous ecological knowledge systems can also help to create better responses to climate change and other forms of environmental change, through understanding socio-ecological adaptive processes and how these can apply to traditional land and resource management systems (Berkes, 2008; Turner and Berkes, 2006).

Conclusions: sustaining healthy food systems and environments in a changing world

Environmental threats to Indigenous Peoples' food security, food sovereignty and ability to maintain and utilize healthy foods from their own ancestral lands are very real. Although it is widely recognized that the food systems of Indigenous Peoples contain impressive levels of biodiversity (related to plant species, subspecies and varieties/cultivars and to animals and their subspecies), recent environmental impacts range from habitat loss to pollution and from erosion of biodiversity – including crop diversity – to increasingly evident climate change. These effects interact with each other in often unpredictable and insidious ways. The problems must be addressed at the local and global scales, and their complexity must be acknowledged and incorporated into solutions.

Indigenous foods benefit people's physical health, through both the consumption of good food and the physical activity of harvesting and preparing the food. In addition, these foods play a key role in maintaining diverse cultures, languages, heritages and identities – in short, in the mental, emotional, spiritual and physical well-being of Indigenous Peoples.

An important concept in maintaining environmental and cultural integrity – and therefore the integrity of Indigenous Peoples' food systems – is the inextricable linkage between the peoples and their territories. Indigenous Peoples' access to their lands, waters and resources, including genetic resources, is essential for their food security and for sustaining cultural knowledge about traditional food and medicine systems (Laird, 2002; UNPFII, 2009; CBD, 2010). Wisdom and practical knowledge relating to the harvesting, processing, consumption and long-term management of food resources are tied to place and habitat. If these ties to territory are broken, the food system can no longer be maintained. Reconnecting the ties that have been frayed or severed is one of the major ways in which Indigenous Peoples' food security and environments can be enhanced and renewed.

Progress has been made, and Indigenous Peoples now have leading roles in the movement to protect their local food systems; they have participated in national and international controls on contaminant emissions, and initiatives promoting biodiversity in food systems. As is clear from all the case study projects in the CINE programme, the best way forward is to listen to and learn from indigenous elders, study original food systems as a baseline, and address current environmental and social challenges, thereby creating a symbiotic meld of ancient wisdom with modern knowledge and technologies. Such an approach – applied well and patiently – offers hope for not only Indigenous Peoples but also human societies everywhere. Indigenous knowledge can be applied to environmental protection, for example in protecting and conserving genetic resources of nutritious and pest-resistant crop varieties (cultivars or landraces), and in providing practical and effective strategies for sustaining crops, fish, wildlife, forest ecosystems, agroecosystems and other essential habitats. Indigenous worldviews can help other societies by creating a new ethic of respect for other life forms and other cultures.

The viability of Indigenous Peoples' cultures, food systems and ways of life is at stake. If the outside world had listened to the Kogi peoples of Colombia or the Inuit of North America several decades ago, when the impacts of climate change were first noticed, the challenges faced today may have been easier to resolve. Cultivars from indigenous agricultural systems have proved vital to global agriculture by increasing yields and decreasing pests and diseases. Regarding health too, it will be well worth the time and effort to look closely at the changing health circumstances of people

living close to land where there are negative impacts of ecological change. Indigenous Peoples play an immense role, not only in reclaiming the food traditions of individual communities in culturally appropriate ways, but also in maintaining and strengthening the resilience of ecosystems and cultural systems, including the global diversity of healthy food systems

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Chapter 4

Infant and young child complementary feeding among Indigenous Peoples

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"In the Awajún culture a child who goes to the *chacra* [field] with the mother, often has a full belly by the time she comes home."

Awajún elder

Abstract

This chapter examines infant feeding practices among nine of the 12 case studies that formed the Indigenous Peoples' Food Systems for Health Program of the Centre for Indigenous Peoples' Nutrition and Environment (CINE). Information was obtained from key informant interviews, case study reports and published literature. Traditional food practices in these indigenous communities are being altered as a result of environmental and land tenure changes and the influence of outside markets; these changes affect infant feeding practices. Local indigenous fruits, vegetables and animal-source foods can provide macro- and micronutrient-rich options for complementary feeding that may be less expensive and more nutritious than market foods. In all of these communities, there is need for consistent practical nutrition advice to promote exclusive breastfeeding for infants up to six months of age, and the timely introduction of complementary foods thereafter. Nutrition education interventions can help families provide optimal nutrition for their infants by integrating traditional food practices with the wise use of local market foods.

Introduction

The first two years of life involve rapid physical, cognitive and social development that require optimal nutrition. Adequate infant and young child (IYC) feeding practices are needed to support this development and provide protection from the risk of morbidity and mortality in low-resource environments. To achieve this, international IYC feeding recommendations include exclusive breastfeeding until six months of age, after which adequate complementary foods should be added; breastfeeding is recommended to continue for two years or beyond (PAHO and WHO, 2003). Complementary feeding is challenging because it requires selection of foods that are easy to prepare and commonly used in family meals; provide sufficient energy and nutrients for a growing child; are not contaminated; and are accessible, affordable, locally available and culturally acceptable (WHO, 1998). The international recommendations for complementary feeding of breastfed children give clear guidelines for timely, adequate, safe and appropriately fed complementary foods (PAHO and WHO, 2003). However, these recommendations have not been universally adopted by all countries, nor are they well adapted to many local situations. Traditional values and practices regarding food, food preparation and eating are key components of cultures and group identity and affect how infants and young children are fed. In many parts of the world, traditional indigenous food practices are being altered as a result of environmental changes and the influence of outside markets (Kuhnlein and Receveur, 1996). Factors that change access to and preparation and use of traditional foods also have an impact on IYC feeding practices.

It is generally accepted that breastmilk should be an infant's first food. At about six months of age, there is a gap between an infant's nutritional requirements and the energy and nutrients that can be obtained from breastmilk alone, and additional foods must be added to the diet (WHO, 1998). To develop nutrition messages for complementary feeding that are both nutritionally and culturally appropriate for a specific Indigenous People, there is need to understand traditional foods, their uses and the existing complementary feeding practices. While the nutritional

values of many traditional foods (FAO, 2009) have been determined, there is little information on actual IYC feeding practices in indigenous communities. What are the first foods introduced to infants, and at what age are they given? With what frequency are infants fed complementary foods, and how are they fed? Does the feeding behaviour for complementary foods influence breastfeeding patterns? What combinations of foods are given, and are these combinations advantageous for nutrient absorption (Gibson, Ferguson and Lehrfeld, 1998)? Are traditional food processing methods such as fermentation that improve food safety and nutrient availability used at the household-level (Kimmons *et al.*, 1999)? Are there IYC feeding practices such as pre-mastication that expand access to nutrient-rich foods (Pelto, Zhang and Habicht, 2010)? Are there health concerns about these practices (Gaur *et al.*, 2009)? What changes have occurred in IYC feeding, and how can these be expected to affect IYC nutrition and health today?

In response to the pressure of the modern market and the loss of hunting and gathering opportunities, many IYC feeding practices among indigenous communities are expected to have changed. Indicators for complementary feeding are important for assessing current practices, to help determine which traditional and present-day practices may or may not be advantageous for children's well-being, to screen and target vulnerable populations, and to monitor and evaluate interventions (Ruel, Brown and Caulfield, 2003). Recently published indicators (Table 4.1) capture the adequacy of complementary feeding practices and include continued breastfeeding, age of introduction of complementary foods, minimal dietary diversity, minimal meal frequency, consumption of iron-rich foods, and a composite indicator for a minimum acceptable diet (WHO and Lippwe, n.d.).

This chapter examines examples of Indigenous People's IYC feeding practices today and, where possible, discusses changes in feeding behaviours that have occurred in the recent past. Information on indigenous communities was obtained from key informant interviews and direct observations previously collected for nine of the 12 case studies that formed CINE's Indigenous Peoples' Food Systems for Health Program: Awajún (Peru), Baffin Inuit (Canada), Dalit (India), Gwich'in (Canada), Igbo (Nigeria), Ingano (Colombia), Karen (Thailand), Nuxalk (Canada) and Pohnpei (Federated States of Micronesia) (FAO, 2009). The Igbo research team conducted additional interviews in 2008 with seven female Igbo elders aged between 65 and 80 years. Child feeding data from the 2004 baseline questionnaire for the Awajún are also included. Additional information about feeding practices in the

Table 4.1 Indicators for the feeding of infants and young children

Indicator	*Definition*
Early initiation of breastfeeding	Proportion of children born in the last 24 months breastfed within one hour of birth
Exclusive breastfeeding up to 6 months	Proportion of infants 0–6 months fed exclusively with breastmilk
Continued breastfeeding at 1 year	Proportion of children 12–16 months fed breastmilk
Introduction of solid, semi-solid or soft foods	Proportion of infants 6–9 months receiving solid, semi-solid or soft foods
Minimum dietary diversity	Proportion of children 6–24 months receiving foods from 4 or more food groups
Minimum meal frequency	Proportion of breastfed and non-breastfed children 6–24 months receiving solid, semi-solid or soft foods (including milk feeds for non-breastfed children) at least the minimum recommended number of times
Minimum acceptable diet	Proportion of children 6–24 months receiving a minimum acceptable diet (excluding contribution of breastmilk)
Consumption of iron-rich or iron-fortified foods	Proportion of children 6–24 months receiving iron-rich or iron-fortified food that is specially designed for infants and young children, or that is fortified in the home

Source: WHO, 2008.

indigenous communities was obtained either from published literature and interviews with case study partners, or from previous CINE case study reports for the region. It is hoped that this accumulated, albeit limited, knowledge can guide health promotion projects for encouraging the inclusion of appropriate traditional foods and cultural practices that will assist indigenous families in achieving optimal nutrition for their infants and young children.

Asia and the Pacific

Pohnpei – Pingelapese people of the Federated States of Micronesia

Timing of complementary feeding

Early introduction of complementary foods was reported by Englberger, Marks and Fitzgerald (2003). In the 1980s, 48 percent of Pohnpei infants were given solid foods by four months of age. In 2008, mothers based the timing of solid food introduction on advice from Pohnpei public health staff (Englberger *et al.*, 2009). Most mothers gave birth at the local hospital, where they were advised to breastfeed exclusively for the first six months before introducing complementary foods. The definition of exclusive breastfeeding includes the provision of oral rehydration salts and drops but not the introduction of *both* non-breast milk liquids and complementary foods. However, from the reports of public health staff, it appears that the exclusive breastfeeding message has been misinterpreted to mean only that no complementary foods should be offered in the first six months. Of the ten infants in the survey, four were younger than six months and had not been introduced to foods. Of the six who were older, four had been introduced to foods at six months, one before six months, and one at seven months. However, other liquids were given before the infants were six months old. One care giver reported that health staff had told her that it was all right to give water and coconut (*Cocos nucifera*) juice to her infant before six months. Coconut water was given most frequently, to seven out of ten infants, while water was given to five out of ten.

Complementary foods

The five most common foods given to infants in the 1960s were breadfruit (*Artocarpus altilis/mariannensis*), *Karat* (*Musa troglodytarum*, a vitamin A-rich banana cultivar), coconut embryo, other ripe bananas (*Musa* spp.) and ripe papaya (*Carica papaya*) (Englberger *et al.*, 2009). Englberger, Marks and Fitzgerald (2003) reported that in the 1980s, care givers did not believe that food had positive health qualities and so they did not encourage children to eat. Pohnpei mothers refrained from giving meat and fish until their infants were one year old, because they did not want the children to get used to meat and fish and then be sad when they were not available. Mothers also believed that these foods would cause diarrhoea. Late introduction of fish at about one year of age had already been reported by Marshall and Marshall (1980) in a study of 49 Peniyesene infants. In this 1974 to 1976 study, the first complementary foods included mashed banana, papaya and mango (*Mangifera indica*). Soft boiled rice and/or mashed cooked breadfruit were then introduced, along with taro, soft bread, flour soup, mashed sweet potato (*Ipomea batatas*) and coconut sauce.

Changes in feeding practices over the past 50 years were documented by Englberger *et al.* (2009). According to the Mand Community Working Group in Pohnpei, the most popular complementary foods given to infants in 2005 were ripe banana, giant swamp taro (*Cyrtosperma chamissonis*), coconut embryo, imported baby food and ripe papaya. Giant swamp taro and imported baby food were far more commonly used than they were in the 1960s. Additional imported foods that are now more frequently given to infants include bread, flour cooked in water, rice soup, doughnuts, ramen and biscuits. Among the six infants given solid foods, three were first introduced to grated boiled green banana, two to ripe *Karat* and one to imported cereal. Traditional rich sources of iron and zinc were not reported.

Dalit – scheduled caste of India

The Dalit farmers from Medak District of Andhra Pradesh in southern India were studied by Schmid

et al. (2006; 2007). Most of the Dalit families were illiterate, had no land and worked as farm labour. The prevalence of mild to severe underweight (< -2 SD weight-for-age) was 63 percent for children aged six to 39 months among the *sanghams* (Dalit volunteer women's groups) (Salomeyesudas and Satheesh, 2009). A high prevalence of iron deficiency has also been found among children aged 12 to 23 months in the area (Schmid *et al.*, 2006).

Timing of complementary feeding

In 2003, a study on improving access to traditional Dalit foods reported feeding practices for infants (six to 11 months) and young children (12 to 39 months) (Schmid *et al.*, 2007). Season appeared to affect child feeding patterns: exclusive breastfeeding was more common in the summer season, and fewer children were fed complementary foods or weaned in the summer than the rainy season. Among the non-intervention children in the study, rainy season intakes were higher in energy, protein and iron than summer season intakes ($p < 0.01$).

Complementary foods

The main non-breastmilk food source for non-intervention infants in the Schmid *et al.* (2007) study was rice (*Oryza sativa*), contributing about one-third of energy and about 28 percent of protein from complementary foods. During the rainy season, sorghum (*Sorghum vulgare*) provided about one-third of iron (34 percent). Animal-source foods contributed only 4 percent of iron intake and 11 percent of vitamin A. In the summer season, fruits contributed about 24 percent of vitamin A. Some women working on farms gathered traditional leafy green plants and included these in the family diet. Overall, energy, protein, vitamin A and iron intakes were found to be below recommendations for young children.

Karen – Indigenous People of Thailand

The prevalence of stunting among the hill tribe Karen children was twice that of the general Thai population, at 25 versus 12 percent (Panpanich, Vitsupakorn and Chareonporn, 2000). Among the 24 infants who were part of the case study in 2005, there was no incidence of underweight before seven months of age (Chotiboriboon *et al.*, 2009). Prevalence of inadequate weight gain increased with age, with 36 percent of young children being underweight by the second year of life. One-quarter of the infants younger than 12 months were stunted. Studies in older children suggest that nutritional problems intensify after one year of age. A recent survey in northern Thailand found very high rates of malnutrition among northern Karen children aged one to six years: 85.5 percent underweight, 73 percent stunting, and 48.4 percent wasting (Tienboon and Wangpakapattanawong, 2007).

Timing of complementary feeding

The case study data suggested that the Karen in Kanchanaburi Province usually breastfed exclusively until their infants were approximately three months old, when complementary foods were introduced (Chotiboriboon *et al.*, 2009). For some infants, however, complementary feeding was introduced later than the suggested six months of age.

Complementary foods

The case study also found that the Karen often fed a watery broth made by boiling vegetables mixed with rice (*Oryza sativa*) as a first food (Chotiboriboon *et al.*, 2009). Some mothers gave mashed rice with banana (*Musa sapientum*) or salt or clear soup as initial complementary foods. Ripe papaya (*Carica papaya*) or mangoes (*Mangifera indica*) might also be given to infants. Several leafy greens, vegetables and fish were also part of infant feeding. Most of the protein for infants came from breastmilk.

Poor-quality complementary foods led to an inadequate energy intake among infants aged six to 11 months, meeting only 58 percent of the Thai energy recommendations. Given the low micronutrient value of the foods, breastmilk continued to be an important source of nutrients for infants, particularly of vitamin A, for which breastmilk provided the total requirement.

Africa

Igbo – Indigenous People of Nigeria

The Igbo are located in the southeastern region of Nigeria. In the past, a new mother would learn about infant feeding from the experiences of her own mother, who would stay with her for one to three months after the infant's birth (Okeahialam, 1986). Among the Igbo living in urban areas, this tradition is disappearing. Today, urban mothers are less likely to receive this outside help because they often live and work away from their families and their own mothers are also more likely to be working. In the case study, seven Igbo elders described the infant feeding practices when they were children. One elder said that water was given immediately after birth, and breastmilk was first introduced a couple of days later, when the breast had been treated and washed. Today, although breastfeeding rates are still quite high, the Igbo introduce other liquids very early. In a study in a rural area of Igbo-Ora Nigeria, all of the 411 infants received water in the first week (Nwankwo and Brieger, 2002). Health care workers advised 97 percent of the women to give glucose-water shortly after birth, and 72 percent complied during the first week. Nearly half of the infants were given herbal teas in the first week, and 97 percent had received herbal supplements by four months of age. Mothers reported introducing liquids because of health care staff recommendations or beliefs about the inadequacy of breastmilk for their children's nutrition, or because exclusive breastfeeding would be too physically draining on their own health, owing to their inadequate diets.

Okeke *et al.* (2009) cited malnutrition prevalence data from the 2003 Nigeria Demographic and Health Survey for the Igbo Region (southeast Nigeria): 20 percent of children were stunted, 5 percent were wasted and 8.5 percent were underweight. They also cited data from the National Micronutrient Survey showing that 15 percent of children in this area were vitamin-A-deficient.

Timing of complementary feeding

In a 1970s study, Kazimi and Kazimi (1979) reported that 85 percent of mothers introduced complementary foods at between three and seven months of age. Igbo elders asked about complementary feeding when they had young children responded that it was initiated at between three and ten months (although one elder mentioned one week), reflecting variations in practice and the difficulty in recalling the past. Elders reported that infants are now given complementary foods by five to six months of age, but it was documented that infants younger than four months were sometimes introduced to food (Okeke *et al.*, 2009).

Complementary foods

Igbo elders reported that popular foods given in the past after the initiation of complementary feeding included roasted cocoyam (*Colocasia* spp.), cassava (*Manihot esculenta*), millet (*Pennisetum* spp.), cassava paste, cassava soup, maize (*Zea mays*) and beans, all of which are traditional Igbo foods. Elders reported that yam (*Dioscorea* spp.) and some edible insects were roasted or boiled to supplement infants' diets. Cocoyam was typically roasted and mixed with oil, while cassava flour was mixed with hot water and stirred to thicken into a soup. Elders considered these foods good for growth, easing hunger, health and satisfying the infant.

The primary animal-source foods given to infants under one year of age included chicken (*Gallus gallus*), chicken liver and edible insects such as crickets. Most elders said that animal-source foods were introduced at five months. Vegetables were most commonly introduced between three and six months, and included amaranthus (*Amaranthus* spp.) and eggplant (*Solanum macrocarpum*) leaves. Oranges (*Citrus* spp.) and apples were the most common fruits given. Other fruits were bananas (*Musa sapientum*), pears (*Canarium schweinfurthii*) and mango (*Magnifera indica*). These were said to be given at any time between two and ten months of age.

When the elders had their own children, additional complementary foods were introduced between three and eight months to ensure the child's health and growth. These included akamu (a semi-liquid porridge made from maize grains soaked for two to three days), rice (*Oryza sativa*), beans and Cerelac (a commercially processed cereal made from maize and milk). These new foods were introduced when there was exposure to them

through the market, education about them, or an increase in household income making them affordable.

The elders from the case study unanimously reported a reduction in the traditional foods that are given to their grandchildren. Reasons for this reduction relate to: i) cultural beliefs about the foods themselves – "Giving traditional food will make the baby behave foolishly when grown"; ii) food preparation challenges – "Because of a time factor"; and iii) undesirable feeding practices associated with traditional foods – "Overfeeding will cause the child to be 'dull'". Negative perceptions or stigma relating to traditional foods and practices may have emerged recently as families move away from their communities.

According to previous work in the Igbo case study, the complementary foods used today are usually the same as those eaten by the rest of the family, with the addition of maize gruel. Foods that are considered to be healthy for infants are *akara* (bean balls), *ukwa* (*Artocarpus communis*, African breadfruit), *ukpo oka* (plantain pudding), African yam bean (*Sphenostylis stenocarpa*), plantain stew, boiled plantain, and *ujuju* (*Myrianthus arboreus*, a type of fruit) soup (Okeke *et al.*, 2009). In their questionnaire responses, the elders of the Igbo community reported new complementary foods as being milk (powdered, soy and liquid whole bovine) and commercial products, including Bournvita and Milo (chocolate energy drinks), Cerelac and Nan (an infant formula). The availability and use of traditional foods decreased as people had less access to land, new foods became available on the market, and families' income, exposure to external cultures and education increased.

North America

Baffin Inuit – Indigenous People of Canada

A study in Nunavut found that Inuit breastfed for a median duration of eight months (Schaefer and Spady, 1982). Key informant interviews with case study community partners found that the first foods introduced to infants were often meats, including seal meat, a rich source of iron.

Gwich'in Nation – Indigenous People of Canada

For the Gwich'in, the first complementary foods were animal-source foods such as pre-masticated meat, fish broth and fish table food (Kuhnlein *et al.*, 2009). A key food for the Gwich'in is caribou (*Rangifer tarandus granti*), an iron-rich wild meat. Leaders from the Gwich'in case study expressed concern about the migration of caribou due to unpredictable climate change, which will affect access to and availability of this meat in the future.

Nuxalk Nation – Indigenous People of Canada

The Nuxalk placed importance on infant feeding, with key foods including the highly valued ooligan (*Thaleichthys pacificus*), which has disappeared owing to offshore fish farming, among other reasons. Key informant elders mentioned the importance of wild berries and other fish, including salmon (*Oncorhynchus* spp.), for the diets of young children.

South America

Ingano – Indigenous People of Colombia

Although Colombia has made substantial progress in improving the nutrition status of its population, malnutrition remains a problem in some regions. Correal *et al.* (2009) reported a substantial prevalence of stunting among Ingano preschool-aged children (three to six years old), with 22 percent stunted, 19 percent underweight, and 2 percent wasted. Reflecting the nutritional transition in Colombia, 4 percent of preschoolers were obese.

Timing of complementary feeding

Among the Ingano, breastfeeding is the norm, but complementary feeding starts early, sometimes as early as one month after birth, and almost all the infants were given complementary foods by their fourth month

(Correal *et al.*, 2009). Field personnel working with the Ingano were interviewed as key informants. There was some variation in the age at which foods were first introduced, but early introduction appeared to be the norm. The key informants reported that fruits were introduced from two months, fish and banana soups as early as three months, and complementary foods in general by five months.

Complementary foods

Approximately 58 percent of children's diets were traditional Ingano foods (Correal *et al.*, 2009). Key informants also reported that much of the infant diet comes from traditional foods. The main fruits given were banana, *milpes* (*Oenocarpus bataua*, a fruit and palm tree), palm heart and papaya (*Carica papaya*). After five months of age, *cucha* (fish soup), chicken soup, r*allana* (banana and manioc soup), vegetables (such as squash, tomatoes, onions), cimarron or coriander leaves (*Eryngium foetidum*), *anduche* (banana drink), *arepas* (flour and maize mixture) and eggs were commonly given. Fish, chicken and meat from the forest were usually given next. *Mojojoy* (*Rynchophorus palmarum*, a nutritional and medicinal beetle larva) were added to the diet in late infancy. Field personnel reported that foods for Ingano infants were chosen for many different reasons (Table 4.2).

Table 4.2 Ingano complementary foods and value of food reported by staff key informants

Complementary food	*Local importance of food*
Cucha (fish soup)	Important for growth and to avoid malnutrition
Cimarron or coriander leaves (*Eryngium foetidum*)	To improve flavour and as a remedy for hepatitis B and anaemia
Banana (*Musa sapientum*)	For infants' growth
Milpes (Oenocarpus bataua)	As a remedy for coughs
Chontaduro (*Guilielma gasipaes*, a wild palm fruit), all fruits	Infants like them
Mojojoy (Rynchophorus palmarum)	For children with respiratory problems

The same local research team reported that the frequency of feeding for most Ingano traditional foods had not changed substantially from the past. The use of smaller quantities of some traditional foods, such as pheasant, can be attributed to communities no longer harvesting or hunting these foods. New complementary foods include powdered milk, rice, eggs and meat bought at local markets, lentils, beans, white sugar, pasta and snacks.

Awajún – Indigenous People of Peru

A recent study documented a high prevalence of stunting in the Awajún community, reaching 49 percent among children aged three to five years, 26 percent of whom were severely stunted (Roche *et al.*, 2007). Overall, 39 percent of the Awajún children up to five years of age were found to be stunted. Among children younger than two years, 44 percent were stunted, with a mean Z-score of -1.9 ± 1.0 height-for-age (Creed-Kanashiro *et al.*, 2009). Stunting is linked in part to inadequate early feeding.

Timing of complementary feeding

Information on the dietary intake of infants and young children aged 0 to 23 months was collected through interviews with 32 mothers in six Awajún communities in the northern Amazon rain forest (Roche *et al.*, 2010). More than half of the mothers exclusively breastfed their infants for the first six months. Among the remaining 48 percent of infants, complementary foods were introduced as early as two months of age.

Complementary foods

Liquids other than breastmilk were given soon after birth (Creed-Kanashiro *et al.*, 2009). A lightly fermented pre-masticated cassava beverage, *masato*, and *chapo* (roasted ripe banana drink) were the most common beverages given. Other milks (canned evaporated bovine milk) were given to 39 percent of infants, but usually after eight months and while still breastfeeding.

Key informants interviewed in the Awajún community in 2004 mentioned that *aves del monte* (wild birds), *majas* (small wild animal, *Cuniculus paca*),

small fish from forest streams, *patarashka* (fish, including the organs and viscera, tomatoes, onion and sweet chilli baked in green leaves) were common complementary foods, but have become harder to obtain. Access to traditional and local foods such as these has been reduced as a result of increases in population and decreases in land availability. Encroachment on land and overhunting have reduced wild animal populations and increased the time and distance required for hunting. One Awajún key informant reported that the population had access to less biodiversity than before, so some foods were no longer available.

Among the first complementary foods now given to the Awajún are boiled foods (mainly banana), tubers and roots – cassava (*Manihot esculenta*), *sachapapa* (*Dioscorea* sp., a variety of potato) and turnip (Creed-Kanashiro *et al.*, 2009). Soups with added chicken or egg are also quite common. A key informant interview in the communities provided additional information about popular complementary foods: *chapo* (roasted ripe banana drink), ripe banana and *suri* (*Coleopterus* sp., beetle larva). Soon after these had been introduced, infants could be given almost anything else, including *chonta* (palm heart), eggs and *masato*. Tougher wild meats were not given to babies. Another key informant provided different information, reporting that fruits and vegetables were not given to infants younger than eight months because they are believed to cause diarrhoea and make children ill. Fruits were also not thought to have vitamins, so they were not considered important food for children, regardless of whether or not a child liked eating them. However, chonta was given to make children grow. This informant also mentioned that *perdiz del monte* (partridge) (*Tinamus tao* and *Steatornis caripensis*) was a common food given to infants. Other common foods for infants are fish, various animals and *paloma del monte* (*Columba subvinacea*, pigeon). When an infant is ill, *suri* is given.

Roche *et al.* (2010) used an infant feeding history questionnaire to document complementary foods that were commonly introduced. The most popular first foods mentioned were cassava and *chapo*. Following these, banana, palm heart, fish and egg were introduced. For daily consumption, cassava, banana, *chapo*, *aguaje* (*Mauritia peruviana*, palm tree fruit) and seasonal fruits were the foods most often given. Fish, eggs and other animal-source foods were usually given not more than once a week. *Eep* (leafy greens) were usually given once a week. Infants aged six to 11 months were fed complementary foods an average of 0.9 to 1.6 times a day, which is less than the recommended minimum meal frequency, whereas children aged 12 to 23 months old were fed an average of seven times a day. Most Awajún infants were breastfed, making breastmilk a major source of dietary energy (not quantified).

Between six and 24 months of age, most (92 percent) of the energy intake from complementary foods was provided by local Awajún foods such as banana, cassava, *sachapapa* and *pituka* (*Colocasia esculenta*) (Creed-Kanashiro *et al.*, 2009). The remaining 8 percent was purchased or obtained from donations, including milk and rice. The median iron intake (4.9 mg/day) of infants and young children aged six to 24 months was about half the recommendation (7 to 11 mg/day).

Conclusions

The complementary feeding practices of Indigenous Peoples included in the nine case studies provided a spectrum of different geographical and cultural characteristics. However, the available data are limited, and provide only rough estimates of feeding practices. The overall picture to emerge from interviews and a review of statistics on IYC nutrition status at these locations suggests that there is wide variation in complementary infant feeding patterns among indigenous communities, and that these practices generally need to be improved to provide optimal nutrition.

Literature on other indigenous populations that were not included in the case studies concurs with these findings, with examples of both early and late introductions of foods. Early introduction of complementary foods was reported among Canadian First Nations in a study of 102 infants on Walpole Island (Kuperberg and Evers, 2006), where 19 percent of infants received solid foods before they were two

Table 4.3 Complementary feeding practices among Indigenous Peoples

Country	*Age for CF introduction[1] in country* (months)	*Indigenous culture*	*Age for CF introduction in indigenous community* (months)	*Examples of nutrient-rich traditional foods excellent for CF*	*Practices that could be improved for better infant nutrition*
Africa					
Nigeria	3.6	Igbo	5.5	Chicken liver, insects, cocoyam, yam bean	Exclusive breastfeeding for 6 months Use only market foods that are healthy choices
Asia and the Pacific					
Federated States of Micronesia	< 6	Pohnpei	6	*Karat*, mango, papaya	Exclusive breastfeeding for 6 months Use fish as CF
India	6–9	Bhil	10.5	NA	Introduce CF at 6 months
		Dalit	> 9	Wild dark leafy greens, sorghum, pulses	Feed enhancers of iron absorption (e.g., citrus fruit)
Thailand	2–4	Karen	3	Fish, papaya, mango, leafy greens	Exclusive breastfeeding for 6 months
North America					
Canada		First Nations		NA	Exclusive breastfeeding for 6 months Continue breastfeeding after 6 months
		Baffin Inuit		Seal meat	
		Gwich'in		Caribou meat, fish	
		Nuxalk		Salmon, wild berries	
South America					
Colombia	> 4	Ingano	5	Wild plants, insects, meats	Exclusive breastfeeding for 6 months Use only market foods that are healthy choices
Peru	3–4	Awajún	2–6	Local leafy greens (*eep*) and fruits (mango, *aguaje* and papaya), fish, *suri*	Exclusive breastfeeding for 6 months More frequent feeding of infants

NA = information not available.
CF = complementary food.
[1] The average age (months) for introducing complementary foods was obtained from the most recent individual country surveys available through the Demographic and Health Survey Statcompiler program, at www.statcompiler.com.

months of age and 57 percent before four months of age. The food most commonly introduced first was infant cereal, followed by pureed fruit. Infants were given cow milk at between six and 15 months of age, and more than half of the children had been given low-fat milk before two years of age (Kuperberg and Evers, 2006). In contrast, late introduction of complementary foods was common among the Bhils, the primary scheduled tribe in Jhabua District, India, where 1 percent of infants first received complementary foods at between four and six months of age, 18 percent at between seven and eight months, 37 percent at nine to 12 months, and 40 percent after 12 months (Taneja and Gupta, 1998). This was not a new infant feeding practice among these people; references from 1943 to 1954 described the introduction of solids at ten to 11 months among Bhil infants (Sellen, 2001). The consequences of this practice can be seen in the extremely poor nutrition status of the children: 25 percent wasted, 60 percent stunted, and 84 percent with anaemia (Sharma, 2007).

Table 4.3 shows the age of introduction of complementary foods at each of the indigenous sites surveyed, the comparative national rates in the

respective countries, examples of nutritionally valuable indigenous foods that are available, and traditional practices that could be strengthened to improve infant nutrition status and health. Indigenous foods that are hunted, fished or gathered and provide a rich source of highly bioavailable iron and zinc or fat, for example, are important resources that can be prepared for infants and young children and should be preserved. Universally, there is a need for consistent practical nutrition advice (in communities as well as health care facilities) on IYC feeding. The promotion of exclusive breastfeeding during early infancy, with introduction of complementary foods starting at about six months of age is needed at all sites.

Historical information collected from diverse sources suggests that indigenous complementary feeding practices have changed over the years. To varying degrees, communities have incorporated market foods into their complementary feeding practices; such substitutes may be expensive and less nutritious than the local foods they are replacing. These changes have occurred because of necessity (e.g., to replace foods that have become unavailable with the loss of hunting grounds), but probably also because of individual choice (e.g., ease of preparation for market foods such as noodles or rice) and an absence of information about the nutritional and health values of local and market foods. Local indigenous fruits, vegetables and animal-source foods that provide macro- and micronutrient-rich options for complementary feeding exist and should be promoted. Nutrition education programmes can help families make informed decisions that will result in optimal nutrition for infants and young children, the preservation of appropriate traditional dietary practices, and wise use of local markets

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Case studies

Chapter 5

Promotion of traditional foods to improve the nutrition and health of the Awajún of the Cenepa River in Peru

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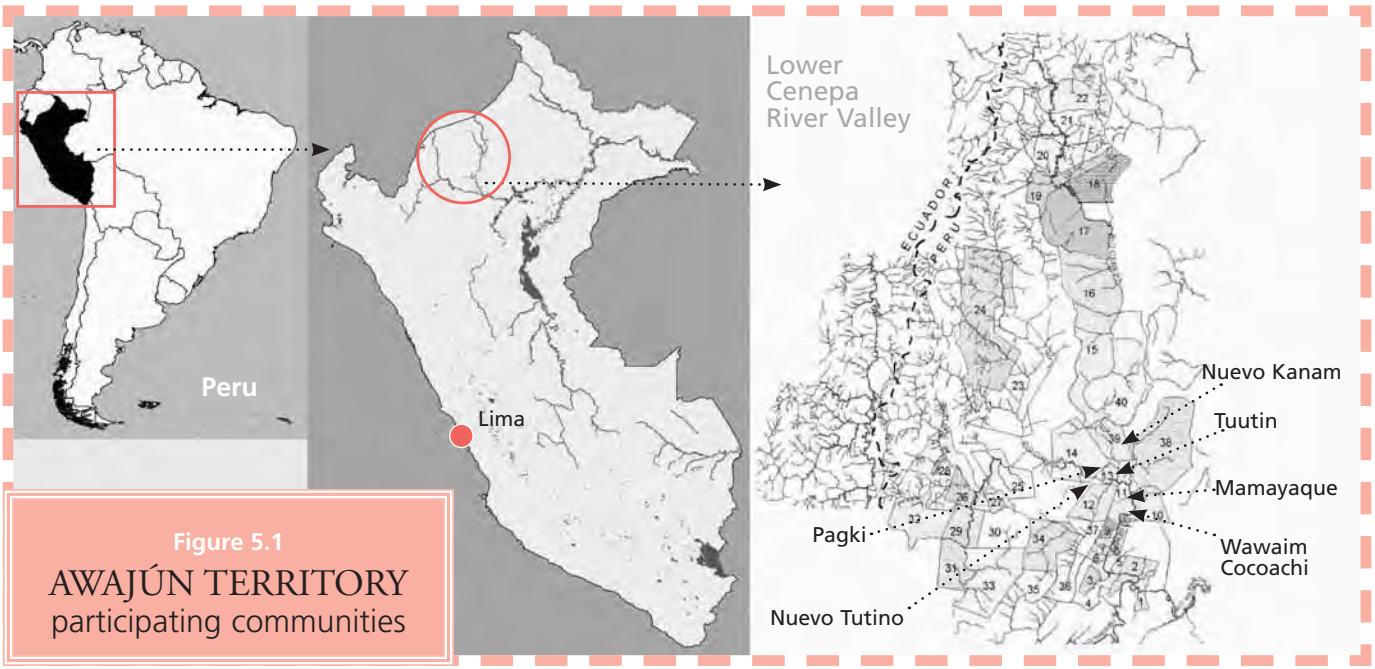

Figure 5.1
AWAJÚN TERRITORY
participating communities

Data from ESRI Global GIS, 2006.
Walter Hitschfield
Geographic Information Centre,
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Key words > Indigenous Peoples, traditional food, Awajún, Peru, Department of Amazonas, food security

Photographic section >> IV

> “Before I didn’t eat well; now I can get fish from my fish pond until the river is full of fish again and I can eat the food that I have in my farm.”
>
> Awajún mother

Abstract

This case study describes a project aimed at enhancing the nutrition and health status of Awajún communities of the Cenepa River through the promotion of key aspects of the traditional food system and culture. The project was built on previous participatory research and focused on increasing the production, accessibility, knowledge and use of nutritious traditional foods. Thirty-two elected nutrition and health promoters, representing 16 communities, participated in nutrition and production workshops. Monitoring of the project showed that these community promoters were effective in conveying the nutrition messages. The project created six community plant and seed nurseries and 400 fish farms.

Evaluation based on a transverse design, in which 64 families formed the baseline for comparison with 41 families post-intervention, found that knowledge about traditional foods’ value and access to them had increased, with the traditional food diversity score increasing significantly, from 8.8 to 10.4 for women and children under five years of age. Ninety percent of energy was provided by locally produced or caught foods rather than market foods in both the baseline and the final evaluations. Although there was variation, mean energy and nutrient intakes – measured by 24-hour recalls for two non-consecutive days – were close to recommended daily intakes for children, but iron, zinc and calcium intakes were low.

Women’s intakes of energy and some nutrients were generally lower than recommended. The percentage of energy from protein and fat increased significantly in children, and protein, iron and zinc intakes from animal sources increased for women and children. Increased amounts of meat (from hunting) and fish contributed to these changes. There were improvements in infant feeding practices, especially in the complementary foods given. In spite of these dietary improvements, however, the high prevalence of childhood stunting (53 percent) did not change over the two-year project period. Diarrhoea and parasite infections also remained high among both mothers and children.

The study demonstrates that the traditional food system can be maintained and accessibility increased by promoting local foods of high nutritional value, but more efforts are needed to address infant and young child feeding practices and the general health of the population.

The programme process and progression

The Awajún are one of the most important Indigenous Peoples of the tropical rain forest of Peru. They live mainly in the Department of Amazonas in northeast Peru, along the Upper Marañón River and its tributaries (Berlin and Markell, 1977). In 2007, the total population of the Awajún was reported to be 55 366 people, living in 281 communities (INEI, 2008) across an estimated area of 22 000 km^2.

The Awajún’s main activities are subsistence farming, hunting and fishing (Ramos Calderón, 1999), and the lands and rivers supporting their traditional food system are their principal sources of livelihood (Creed-Kanashiro *et al.*, 2009). Currently, both the territory that they have owned from time immemorial and their traditional food system are threatened by mineral and petroleum extraction initiatives. The Awajún and other Indigenous Peoples of the Peruvian Amazon region are defending their territories to protect their livelihoods and environment.

Although a variety of traditional foods are available, the nutrition and health situation of the Awajún is not

optimum. Studies have found high prevalences of infant and childhood malnutrition (stunting), and anaemia in women and children (Huamán-Espino and Valladares, 2006; Creed-Kanashiro *et al.*, 2009; Roche *et al.*, 2007). Reasons for this include changing ecological, cultural and food systems, and a high prevalence of infections and parasites (Huamán-Espino and Valladares, 2006).

The traditional food system of the Awajún of the Lower Cenepa River is described by Creed-Kanashiro *et al.* (2009) and Roche *et al.* (2007). Based on this information, which was gained through participatory research with the communities, this chapter describes a participatory project to promote the production and use of nutritious traditional foods that benefit the nutrition and health status of the population and preserve its food culture.

Context

Geographic, cultural and demographic characteristics

The district of Cenepa extends from the mouth of the Cenepa River, where it joins the Marañón, across the mountain ranges (*cordilleras*) to the frontier with Ecuador (Berlin and Markell, 1977). It is in the "high jungle" (*ceja de selva*), covered by dense rain forest vegetation, and has a tropical climate. Cenepa was legally recognized in 1941, and comprises three principal areas – Low, Middle and High Cenepa – with a total of 52 communities and an estimated population of 8 000 people (AECI, CIPCA and SAIPE, 2000). It is the only district in the Alto Marañón with no settlers from other parts of Peru.

The Awajún is one of four tribes of the Jivaroan linguistic family (Shell and Wise, 1971). Traditionally, they lived in widely dispersed hamlets, each consisting of several related households. Today the majority reside on or near the region's major rivers, in communities that range from 13 to 103 families each.[1] Awajún community organizations are headed by an Apu (Chief), with a Vice-Apu, a secretary, a police officer and one other voting member. The communities of Cenepa have formed the *Organización de Desarrollo de Comunidades Fronterizas del Cenepa* (ODECOFROC, Organization for Development of the Frontier Communities of Cenepa), which represents them within the local area and with the government and other institutions.

Awajún houses are built of local materials, especially canes from local *guayaquil* trees, with roofs of matted palm branches and earthen floors. Most houses do not have a separate area for cooking; the kitchen is part of the common living area. Wood is the principal cooking fuel, and houses are usually lit by candles or petrol burners. People obtain all their water for cooking and washing from the river. This water is not treated and there is no sewage system. However, since the early 1990s, latrines have been installed about 20 to 50 m from the houses.

Transportation and communication among Cenepa communities are mainly by river – in canoes or small motor boats – and on foot, along narrow, steep trails (AECI, CIPCA and SAIPE, 2000). Most communities do not have electricity; the few with a generator use it mainly for radio communication. Few communities have public telephones; some have government health posts, but access to health services is difficult for many; and some have a pre- or primary school, but there is only one secondary school in the area, which takes children from all accessible surrounding communities.

Overall health and nutrition status

The major nutritional and health problems of this population include high rates of childhood stunting, anaemia and heavy intestinal parasitic infection (MINSA/OGE, 2002). A study of schoolchildren aged six to 15 years in the Alta Marañón in 2002 showed that the most common parasites were *Entamoeba coli*, *Lodamoeba butschil*, *Anclystoma/Necartor* and *Ascaris lumbricoides* (Ibáñez *et al.*, 2004). In the preliminary study for this chapter, 44 percent of children under two years of age (n = 32) and 50 percent of those aged two to 12 years (n = 39) were stunted (< -2SD height-for-age) (Creed-Kanashiro *et al.*, 2009; Roche *et al.*, 2007). Twenty-five percent of

[1] www.selvasperu.org

children under two years of age were underweight. National data on the nutrition status of children in the Department of Amazonas, including indigenous and *mestizo* populations (INEI, 2001), reported that 36 percent of those under five years were stunted and 42 percent suffered from anaemia. There are no data on the vitamin A status of this population, although researchers found no signs of the clinical deficiency that is typical in most of Peru. The national data for Amazonas reported high rates of childhood diarrhoea and respiratory infections (INEI, 2001).

The body mass index (BMI) of women in the preliminary study was generally within the normal range (Creed-Kanashiro *et al.*, 2009). Data for the Department of Amazonas (INEI, 2001) indicated that 32 percent of women of reproductive age were anaemic (below 12 g/dl). Psychological health is also a concern for this population, with suicides, particularly of young women, being a public health problem. The suicide rate has declined since implementation of ODECOFROC's Women's Programme, but remains a concern (I. Tuesta, personal communication, 2010).

The traditional food system is based on the major crops of cassava (*Manihot esculenta Euphorb*) and banana (*Musa balbisiana X Musa*), which are the main sources of dietary energy (Berlin and Markell, 1977; Creed-Kanashiro *et al.*, 2009; Roche *et al.*, 2007). Most of the foods consumed are cultivated, collected, hunted or fished locally, and there is a wide variety of local foods; the 2004 research identified a total of 215 local foods (Creed-Kanashiro *et al.*, 2009; IIN, CINE and ODECOFROC, 2005). Foods are prepared by boiling, roasting or smoking. Women make cassava beer and the popular drink *masato*, which is prepared from boiled manioc roots, masticated and fermented. Women also cultivate other roots and tubers and a variety of fruits and seeds in their fields (*chacras*).

Awajún men traditionally hunted for game animals and birds, but overhunting and community living have led to scarcities of these animals near river settlements. There is a wide variety of fish, which has traditionally been the major source of animal food, together with other river creatures such as frogs (*Colostethus*), snails (*Pomácea* sp.) and prawns/shrimp (*Macrobrachius brasiliensi*). In the mid-twentieth century, missionaries introduced small domestic animals, including chickens (*Gallus gallus*) and pigs (*Sus scrofa*), which are raised mainly by women and provide a potential source of nutrients. Wild fruits, edible larvae (*suris*) and other insects are also collected for food. The consumption of vegetables, fruits and seeds varies by season.

The earlier research into traditional food systems (Creed-Kanashiro *et al.*, 2009) reported changes in the availability and use of traditional foods. Not all the 215 foods identified by participants were currently available, owing to changes in the environment, living and food activity patterns, overfishing, and more difficult access to wild animals. Intake of animal-source foods, particularly meat and fish, was generally low and infrequent, and depended on seasonal availability and hunting patterns. In recent years, the number of foods cultivated has also declined, to one or two varieties of roots and bananas and a few fruits, owing to people's reduced time for working in the fields and the government's donation of foods to families with young children. Nevertheless, relatively few foods were purchased from out of the area or were donated through government programmes.

By exploring the population's food availability, culture and perceptions, the 2004 study provided information about several nutrient-rich traditional foods that could be promoted through interventions to increase both production and consumption, especially among young children and women, thereby benefiting the nutrition and health status of the population.

Rationale

The project described in this case study was built on the participative research and results of the 2004 study, and was designed to enhance the nutrition, health and well-being of participating communities – especially women and children – through the promotion of key aspects of the traditional food system. It was delivered through close work with community organizations and community health and nutrition promoters, and focused on activities in three principal areas:

- ***Food production:*** Stimulate feasible production activities to increase the accessibility of traditional foods, emphasizing those with high nutritional value. Enhance women's roles in collecting and planting traditional fruit seeds and palms, raising small animals including *suri* (larvae) and participating in fish farms. Involve primary schoolchildren in seed planting projects. Promote full use of existing agricultural land, to avoid losing it to government appropriation.
- ***Education:*** Increase knowledge about the nutritional value, importance and worth of traditional foods within the communities and among schoolchildren, to maintain and recuperate the use of traditional foods and ensure that knowledge is not lost to future generations.
- ***Participation and use:*** Increase the use of a wide variety of traditional foods through activities in food preparation, recipes and diet, with special attention to young children and their nutrition.

Methodology and activities

Preparation for the participatory project

In 2005, the 2004 study results, the food list, composition information about 82 of the 215 traditional foods identified, and the project proposal were presented at the ODECOFROC assembly of representatives of the 52 communities. The project research agreement was signed, and the food composition information was distributed to ODECOFROC leaders, the Women's Programme and the six communities that participated in the earlier study. Contacts and agreements made previously with participating communities were renewed. Approval was obtained from the Ethics Committee of Peru's Institute of Nutrition Research (IIN – *Instituto de Investigación Nutricional*) and the Institutional Review Board of McGill University in Canada. All the people interviewed in the baseline and final evaluations or photographed for educational materials provided their prior consent.

The following subsections describe the methodology, results, monitoring and evaluation of project activities.

Intervention activities

Following the baseline evaluation in February 2006, a variety of activities were implemented over a two-year period to 2008, several of which were proposed by Kuhnlein *et al.* (2006). Project activities started with the training of 32 community nutrition and health promoters from 16 Cenepa River communities, who were elected by their communities and coordinated through the ODECOFROC Women's Programme to promote activities and messages in their own communities. Figure 5.1 on p. 54 shows the distribution of the communities along the Cenepa River.

Participation was voluntary. Most of the communities with reasonable access to the ODECOFROC centre (within two days of river travel) were invited to participate in the training, and all those that were interested were included. Activities were also conducted with pupils, parents and teachers of five local primary schools. The project focused on food production and empowerment, and included education and training activities on food, nutrition and cultural topics to support the promoters' role as nutrition and health leaders in their communities; these were the topics requested by the population. Activities were based on participatory workshops held twice a year in Cenepa and led by the IIN technical team, with follow-up and support through periodic community visits by the local Awajún health and nutrition team led by the ODECOFROC Women's Programme, which also provided translation from Spanish to Awajún when necessary.

Promotion and creation of plant nurseries and recuperation of traditional seeds

Production activities were an essential part of the intervention, and were conducted primarily by specialist plant cultivation and animal raising institutions. To support the conservation, recuperation and diversification of traditional plants, especially food plants for family use, the Women's Programme led an initiative involving the community nutrition and health promoters in collecting seeds and establishing plant and forestry nurseries in the communities. Training in

appropriate management of these resources was provided by a forestry agriculturist at two workshops for the 32 promoters and at primary schools for 146 children and adolescents. A model/central nursery was created at the ODECOFROC centre, providing a source of seedlings for community and family nurseries. The Women's Programme maintained the central nursery and managed seedling distribution, while schoolchildren were responsible for their school nurseries.

In addition to the central nursery, five community nurseries were established. Table 5.1 lists the 16 seedling types planted at the central nursery. Fifty-seven mothers participated in community meetings organized by the promoters and the Women's Programme, receiving seedlings from the central nursery during the project, mostly of fruit and palm trees. Seeds of other vegetables, trees and medicinal plants were exchanged among communities.

Table 5.1 Inventory of plants at the central nursery, 2008

Local name	*Scientific name*	*Tree type*	*No. of plants*
Huasaí	*Euterpe olerácea*	Palm tree	230
Ungurahui	*Oenocarpus bataua* Mart.	Palm tree	113
Naranja	*Citrus aurantium* L.	Fruit tree	52
Macambo	*Theobroma bicolor* Humb	Fruit tree	123
Huevo de toro	–	Fruit tree	340
Pijuayo	*Bactris gasipaes* H.B.K.	Palm tree	130
Caimito	*Pouteria caimito*	Fruit tree	24
Namuk	*Sicana odorifera*	Fruit tree	9
Chonta	*Bactris setulosa*	Palm tree	27
Huacrapona	*Iriartea deltoidea*	Palm tree	11
Sampi	*Inga* sp.	Fruit tree	41
Naampi	*Caryodendron orinocensis*	Almond tree	53
Naam	*Caryodendron orinocensis*	Fruit tree	46
Cedro	*Cedrela odorata* L.	Forestry	4
Cedro rosado	*Cedrela odorata* L.	Forestry	25
Bolaina blanca	*Guazuma crinita*	Forestry	Seedlings

Table 5.2 Numbers of families with food production activities, by community

Community	*No. of families in community*	*Fish ponds*	*Chickens*	*Guinea pigs*	*Pigs*	*Ducks*	*Turkeys*	*Cows*
Bashuim	59	14	18	3	2	3	4	NA
Nuevo Tutino	27	16	all	3	NA	NA	NA	NA
Mamayaque	75	30	all	1	NA	NA	NA	7
Tuutin	50	47	all	2	NA	NA	NA	NA
Kusu Pagata	103	64	56	20	1	NA	NA	NA
Cocoachi	NA	10	all	NA	NA	NA	NA	NA
Nuevo Kanan	25	25	NA	NA	NA	NA	NA	NA
Canga	87	5	40	NA	2	4	NA	1

NA = No information available.
Source: Numbers of families from www.selvasperú.org

Workshops on raising fish and chickens

Community nutrition and health promoters and Awajún leaders received training in other parts of Peru and then held workshops on establishing and managing community or family fish ponds appropriate for local geographic conditions, and on raising chickens; both workshops were facilitated by the Women's Programme. The *Servicios Agropecuarios para Investigación y Promoción Económica* (SAIPE, Agrofishery Service for Economic Research and Promotion) Peru and the World Wide Fund for Nature (WWF) provided technical assistance for the fish ponds, and the project provided building materials. These initiatives complemented and reinforced production activities promoted by other agricultural institutions working in coordination with ODECOFROC and the communities.

By the end of 2008, there were an estimated 400 family fishponds in 32 Cenepa River communities. However, several of these were precarious and were not in continuous production, and there was demand for further technical and material assistance. Table 5.2 shows the animal production activities in the eight communities included in the monitoring of this intervention.

Food, nutrition and culture workshops

Four nutrition workshops were held over the two-year project period, focusing on the sharing of knowledge and experiences of local foods and their nutritional contributions, uses and preparation, and highlighting their positive characteristics, diversity and cultural identification. Special efforts were made to find ways of improving infant and young child feeding and nutrition using locally available foods, owing to concerns about the high prevalence of growth retardation observed in the 2004 study and baseline evaluation. The following topics were included in the workshops and reinforced during the project period:

- traditional local foods;
- food combinations for a balanced diet;
- infant and young child feeding and nutrition;
- feeding of preschool and schoolchildren;
- nutrition for pregnant and lactating women;
- care in food manipulation, hygiene and use of water;
- production and conservation of foods, from the field to the table: local and traditional foods versus market foods, traditional conservation methods;
- illnesses that result from not eating well (e.g. diabetes, hypertension).

Practical and participatory sessions included song, story and socio-drama creations, hand-washing classes, and elders' stories about their experiences and practices in the past. During the training, community nutrition and health promoters developed four or five key messages for each topic, and then promoted the most appropriate of these within their communities. This resulted in:

- 29 educational messages for dissemination in the communities by local radio and loudspeaker;
- three food/nutrition promotion posters;
- two songs in Awajún, disseminated in two primary schools;
- ten stories about good foods and hygiene, based on traditional stories;
- three socio-drama representations showing traditional good habits and customs reinforced with current knowledge;
- 58 food preparations (recipes) for infants and young children, which included animal products and other traditional foods such as cassava, *sachapapa* (*Dioscorea trifida*), *pituca* (*Colocasia esculenta*), *eep* (*Araceae philodendron* sp.), *ugkush* (*Piper* sp.) and palm hearts (various species) prepared in traditional ways, such as *patarashka* (steaming in banana leaves), smoking and boiling;
- preparation of lunch baskets for schoolchildren;
- a T-shirt designed by the promoters and distributed to them, the *Apus* and community leaders, with the message "Eating our own foods we shall be intelligent, strong and happy" written in Awajún.

To enhance dissemination of the nutrition messages, traditional foods and preparation methods were included in a cultural festival of traditional songs, dances and practices held by ODECOFROC, in which all the Cenepa River communities participated.

Workshop for the empowerment of promoters as community nutrition and health leaders

In 2007, the community promoters reported difficulties in transmitting the information and experiences they had obtained through the workshops, particularly regarding the organization and holding of community meetings to promote nutrition. In response, the Women's Programme coordinated a "Reflect-Act" workshop, led by an experienced educator, to facilitate the community promoters' role. At the workshop, the promoters reflected on their strengths, such as their own firm commitment; the recognition they received from their communities, including support from Apus and the community assembly; the population's enthusiasm about the production activities; and the valuable nutrition workshops and visits from the Women's Programme.

These discussions strengthened the promoters' self-esteem and emphasized the value of working in teams of two – often one woman and one man – in each community, to support each other. (There were 19 male promoters and 13 female.) The practical aspects of promoters' nutrition activities were reinforced, such as interpersonal communication through visits to individual families, the use of food preparations to illustrate messages, and the many opportunities for mentioning nutrition messages and practices, even briefly (e.g., when washing at the river, and at community assemblies).

Monitoring of project activities

Community activities were monitored throughout the two years of the project, usually by a nutrition promoter who had received special training in coordination with the Women's Programme and IIN. Three monitoring visits were made to each of the participating communities in Middle and Lower Cenepa, but it was not easy to visit communities higher up the Cenepa River owing to the difficulties and costs of transport. The project provided the Women's Programme with a canoe and outboard motor but the limited availability and high cost of fuel resulted in fewer visits than planned.

Six communities of Lower Cenepa were visited by the principal monitor, who obtained information about the activities implemented and mothers' perceptions about these, through observation and interviews with mothers, Apus and community promoters. These monitoring activities were complemented with information from the President of ODECOFROC and the community promoters attending workshops.

Tables 5.1 and 5.2 show the numbers of nurseries created, seeds sown, fish ponds operating and families raising small animals reported by the Women's Programme, ODECOFROC and promoters in 2008. The monitor visited eight cultivation areas in four communities, and noted that these families were cultivating a wider variety of food plants near to their homes. Fruit and palm trees were the most common crops, and all the families had used seeds (of eight different plants) that their promoters had brought from the central nursery, as well as those that they themselves had collected from the wild and from more distant fields. Mothers spoke positively about this activity, and commented that having these foods nearer to hand had benefited their families and made it easier to have food variety during rainy seasons, when reaching their main fields was difficult.

Of the 25 mothers interviewed in the six communities of Lower Cenepa, ten reported having a fish pond and consuming fish more frequently, thereby improving their families' diet; another ten expressed their intention to build a pond. Almost all the mothers (22) were raising chickens for family consumption. Seven reported improved feeding patterns for their families and children, through having a wider variety of foods in their diets, with more frequent use of animal products. Only four mentioned receiving information on infant feeding, advising them to feed infants breastmilk exclusively for the first six months, introduce the first complementary foods at six months, give foods of a thick consistency using local ingredients, and include animal products.

Evaluation

To evaluate the impact of the project on knowledge, practices and nutrition status a survey was conducted among mothers with small children before

and after the project period, in February 2006 and February 2009, respectively.

The difficult socio-political situation of the Awajún in defending their territories from government appropriation and the arrival of resource extraction industries made it impossible to implement or evaluate activities in the second half of 2008 (AIDESEP, 2010).

Methodology

The baseline evaluation was conducted in six Lower Cenepa communities – Mamayaque, Tutino (Tuutin), Nuevo Kanan, Nuevo Tutino, Wawaim and Cocoachi – and the final evaluation in all except Wawaim and Nuevo Tutino, owing to their distrust of evaluation teams as a result of the socio-political situation.

The following information was collected from mothers in both evaluations:

- socio-demographic characteristics of the family and household;
- current and past health information about the mother and child/children;
- food security, using a version of the United States Department of Agriculture (USDA) Food Insecurity and Hunger Module (Vargas and Penny, 2010) adapted for Peru by IIN;
- consumption frequency of 30 traditional foods, selected for their nutritional value from the preliminary investigation of the traditional food system (Creed-Kanashiro *et al.*, 2009);
- dietary intakes of the mother and child/children from 24-hour recalls on two non-consecutive days; portion sizes were determined by scales measuring up to 5 kg with accuracy of ±1 g;
- physical activity of the mother, using a short version of the International Physical Activity Questionnaire (IPAQ, 2002);
- anthropometry measurements of the mother and child/children, using a height/length board made locally, and bathroom scales measuring up to 150 kg with accuracy of ± 500 g; mothers were weighed with and without the child to assess the child's weight.

For the final evaluation, the following additional parameters were assessed:

- knowledge about nutrition and food production;
- activities of the mother, using an adaptation of the "Home questionnaire for child" (M. Penny, personal communication, 2008), in which mothers were asked to place small balls in containers representing each of their activities; the number of balls assigned to each container depending on the amount of time spent on that activity.

The evaluations were conducted in each community on three non-consecutive days, after consultations between the Apu and members of the Women's Programme. Each interview lasted about two hours and each IIN evaluator was accompanied by a trained translator.

Data analysis

Baseline and final survey data were entered into Visual FoxPro version 8 and analysed using SPSS version 17. Individuals' traditional food diversity scores (TFDS) (Roche *et al.*, 2008) were calculated by assigning 1 point to each local food reported in the 24-hour diet recalls.

Nutrient and energy intakes were also calculated from the food intakes reported in the 24-hour recalls, using IIN's food composition tables (IIN, 2001) complemented with information from other food composition tables where necessary. If the composition of a particular food was not known, that of a similar food was assigned instead. This was done for 18 foods: three fish, three birds, four wild animals, three leafy vegetables and four fruits.

International recommended intakes were used to assess the adequacy of women's and children's intakes (FAO/WHO/UNU, 2004; 2007; FAO/WHO, 2002; Dewey and Brown, 2003). Energy requirements for moderate activity were considered for the women, to account for their agricultural activities.

Comparisons between the baseline and final evaluations were analysed using Mann-Witney non-parametric tests for each variable except for TFDS, for which ANOVA was used.

Results of baseline and final evaluations

Mothers with children younger than five years of age were invited to participate in the evaluations. The difficult socio-political situation meant that fewer families were able to participate in the final evaluation than in the baseline. Numbers of participants in each community are shown in Table 5.3.

Of the 41 families included in the final survey, 14 mothers had also participated in the baseline. Ten children were in both the baseline and final surveys, having been under two years at baseline and in the two-to-five-years age group in the final survey. Within each family, all the children under five years of age were included in the evaluation. The age distributions of the children differed significantly between the two surveys, as shown in Table 5.4 ($p = 0.016$). There were fewer children in younger age groups in the final survey and the mean age was 4.3 months older.

Family characteristics

Most characteristics of households and families were similar in the baseline and final surveys, indicating that although the sample was smaller in the final evaluation, the populations were comparable. Most of the families surveyed lived in their own houses (75 percent baseline, 85 percent final); others lived in relatives' houses. The majority of mothers lived with their married or common-law husbands (89 percent baseline, 80 percent final); others were single, separated or widowed. Most families lived as a nuclear family (70 percent baseline, 80 percent final); the remainder shared their homes with their extended families. On average, six family members lived together in a house of two rooms.

The mean age of the mothers was 25 years at baseline and 29 years in the final survey. The mean number of years of education was six, indicating completion of primary school. At baseline, 4.8 percent of mothers had no schooling and 63 percent had some primary school education. In the final survey, these figures were 7.7 and 54 percent, respectively. The majority of mothers in both baseline and final surveys reported working in their own fields as their major occupation (86 percent) as well as caring for their families, and 8 percent worked principally in the fields of others. Some mothers reported doing artisan work in the final survey (13 percent).

Knowledge about foods and nutrition

The surveys explored the changes in mothers' knowledge and attitudes resulting from the community health and nutrition promoters' education activities. At baseline, 47 percent of mothers reported having received advice related to food and nutrition, and 16 percent had attended an education session on the subject. In the final survey, 62.2 percent reported having received advice about nutrition, mainly from a promoter in the Women's Programme. The topics most remembered were infant and young child feeding, with mention of specific infant preparations, and how

Table 5.3 Numbers of families participating in baseline and final evaluations

Community	*Baseline*	*Final*
Mamayaque	10	16
Tutino	20	5
Wawaim	7	0
Nuevo Kanan	9	10
Nuevo Tutino	8	0
Cocoachi	10	10
Total	**64**	**41**

Table 5.4 Age distributions of children in baseline and final surveys

Age group	*Baseline*	*Final*
0–5.9 months	10	1
6–11.9 months	16	7
12–23.9 months	27	13
2–3 years	15	8
3–4 years	11	8
4–5 years	3	5
Total	**82**	**42**
Mean age of children	23.7 ± 12.8 months	28.0 ±15.3 months

to have a balanced and varied diet using local foods. Forty-nine percent of mothers reported putting the advice into practice.

Traditional and market foods

Mothers were asked about their knowledge and perceptions regarding traditional local food and market or donated foods from outside the area. At baseline, mothers reported that traditional foods were good (80 percent), natural (41 percent) and good for children and families (16 percent). In the final survey, more mothers mentioned that traditional foods were good for health (34 percent), natural and without chemicals (29 percent). Mothers mentioned their suspicion that market foods may contain chemical contamination – especially the canned foods distributed through government programmes – and thought that their traditional foods were better. However, they also mentioned certain foods from outside as good complements to the diet and useful in times of scarcity. Other market foods, such as sodas, biscuits and sweets, were recognized as not being healthy foods.

Regarding traditional foods, women stated that "they are natural, we know they do not contain chemicals". Regarding market foods they reported "we don't know what we are buying".

At baseline, 73.4 percent of mothers reported that the number of traditional food species to which they had access was diminishing over time, and mentioned specifically that animals were further away from communities: "before there were trees and animals near, now there aren't". In the final survey, 58 percent mentioned that the number of species had diminished, and 21 percent said it was increasing, as people were cultivating more foods: "before there were more foods, now there is more population and so there is scarcity, but we are now sowing in our fields"; "before we didn't sow much, we only collected from the wild, but now we are bringing plants from the wild and sowing them in our fields".

Mothers' feeding practices for children

The final survey included questions about knowledge of feeding practices. Eighty-nine percent of mothers said that breastmilk was the first food to be given to a baby and the only food to be given for the first six months of life: "the baby's stomach is not yet developed and breastmilk is what the baby needs for development".

Forty-six percent of mothers said that the first complementary food should be introduced to a baby at six months of age, while 43 percent said this should occur at more than six months, as "[babies] will only then start to be hungry", "they do not know how to eat before this" or "[this is] when the teeth come". The mothers use these milestones as they do not necessarily keep precise track of their children's ages. Most mothers (76 percent) said that the first food should be thick food and fed after six months, according to the advice they had received on good infant feeding practices. Sixteen percent of mothers said that meat can be given at six months of age (the message given), but the majority (73 percent) considered that it should only be given at seven months or older, when the infant has teeth and is thus able to chew. Only 24 percent of mothers reported making food preparations specifically for their infants and young children.

The education sessions included nutrition for primary schoolchildren, especially regarding foods to be taken to school, as children generally only took cassava and banana to eat during the school day. In the final survey, 74 percent of mothers said that the lunch box should consist of a mixture of foods, including egg, fish and fruits, as well as the staples.

The education sessions also promoted healthy diets for pregnant and lactating women. In the final survey, 60 percent of mothers responded appropriately about the foods needed by pregnant women, with 68.5 percent stating that a lactating mother needs to eat more food of greater variety as "her body needs more".

Food production activities

Half of the mothers interviewed in the final survey had heard about producing food, cultivating seeds or raising small animals and fish ponds from the promoters of the Women's Programme and from other institutions supporting these activities in the area. Of these mothers, 86 percent reported that they had begun to raise chickens, 69 percent had established a household garden and planted

seeds, and 44 percent had established a fish pond and were raising fish, mainly tilapia (*Tilapia melanopleura*). Thirty-eight percent of the mothers said they were now eating foods that they did not formerly eat. Of these mothers, 43 percent were eating new foods they produced or hunted themselves, 14 percent were eating new market foods, and 43 percent were eating both.

Eighty percent of mothers in the final survey said they preferred using their own produce to feed their families. They gave the following reasons:

- "They are the nicest tasting foods, as well as more healthy."
- "They are better quality because they are grown without fertilizer."
- "They are not contaminated, they are natural."
- "The plants are ours, they are not watered by others, we can eat them confidently, including without washing them."
- "I don't have money to buy, but I have my own land anyway so I can sow my food."
- "I don't need more food, I have sufficient."
- "Foods that we produce are free."
- "When you grow them and they are there you can eat them anytime."
- "We can vary our foods."

Table 5.5 Numbers of different foods consumed in baseline and final surveys (24-hour recall)

	Baseline	*Final*
No. of families	64	41
Local/traditional foods	76	72
Market foods (from out of the area)	25	25
Total foods	**101**	**97**

Table 5.6 Traditional food diversity scores (24-hour recall)

	n	*Mean (± SD)*	*Range*
Baseline survey			
Women	64	9.4 ± 3.39	3–18
Children	67	8.1 ± 3.63	1–18
Final survey			
Women	40	10.7 ± 3.62[1]	4–17
Children	42	10.1 ± 3.72[2]	0–18

[1] Women, difference between baseline and final $p = 0.04$.
[2] Children, difference between baseline and final $p = 0.01$.

Food diversity

Table 5.5 shows the total numbers of foods consumed by families, as reported in their two 24-hour recalls for the baseline and final surveys. Although fewer families were included in the final than in the baseline survey, the total numbers of foods consumed were similar, at 101 and 97 respectively. The numbers of traditional/local and market foods were also similar, indicating that food variety and the use of local foods were maintained during the project period in spite of the introduction of more market foods into the area.

Traditional food diversity score

The TFDS indicating the number of traditional foods consumed by each individual in the 24-hour recalls are shown in Table 5.6. There were significant increases in the TFDS for both women and children after the project, showing that the use of traditional foods was maintained or increased.

Frequency of food consumption

The frequency of consumption of 30 traditional foods was explored in both surveys. In general, the consumption of seasonal local fruits was reported to have increased in the final evaluation, which recorded frequent consumption of *carotene aguaje* (*Mauritia fleuxosa Palmae*), *pijuajo* (*Bactris gasipaes*) and *sachamango* (*Grias Peruviana* Miers. [Lecythidaceae]). Traditional vegetables promoted during the project were eaten more frequently (weekly as opposed to monthly at baseline) as were some wild animals, such as frogs and wild pigeons, and organ meats. Children aged six to 12 months consumed fish more frequently, with 50 percent consuming it weekly after the project, compared with 23.5 percent at baseline; this was an effect of the family fish farms.

Food security

The food security questionnaire that is generally used to derive a score for food insecurity (Vargas and Penny,

2010) was used. However, some of the questions were difficult to apply with the Awajún population, as they sounded similar or repetitive to both the translators and the mothers; the following results are therefore derived from only some of the questions on the questionnaire and are not total scores.

When asked about the food available in their homes during the past year, most mothers reported that they had sufficient, but not always what they would like (67.2 percent baseline, 60.5 percent final). Thirty percent at baseline and 34 percent in the final survey said they sometimes did not have sufficient food, but only 4 percent reported that this situation occurred frequently. The main reasons given were the scarcity of food in their fields at certain times and the difficulty of obtaining foods they would like, such as by hunting animals from the wild. In response to this situation, about 40 percent of mothers said that they sometimes gave less food to their children, but 86 percent at baseline and 95 percent in the final survey said their children never went without food. In both the baseline and final surveys, 90 percent of mothers said they were sure of their food supply for the whole year.

The respondents' principal concerns regarding food supply were that they may not have new fields to cultivate (19 percent baseline, 29 percent final) or access to quality foods (16 percent baseline, 13 percent final). Only 8 percent at baseline and 13 percent in the final survey mentioned uncertainty about whether or not they would have sufficient money for food. Mothers reported that when they lacked sufficient food at home, they collected it from their fields (67.2 percent baseline, 60.5 percent final), hunted animals in the wild (10.9 percent baseline, 12.1 percent final) or ate only cassava (12.5 percent baseline, 10.5 percent final). Obtaining food on credit from shops was mentioned by 5 percent in the final survey.

Mothers reported that they obtained their food mainly from their fields (93.8 percent baseline, 80 percent final); the use of money was mentioned by 3.2 percent at baseline and 20 percent in the final survey, indicating that purchasing food from others or from small local shops may have become more common during the project period, as evaluated in this small and non-representative sample. Ninety-two percent of mothers at baseline and 80 percent in the final evaluation reported sharing food with their neighbours.

Families' participation in government social programmes

The government has several social programmes, mainly distributing food for populations classified as poor or extremely poor; Table 5.7 shows family participation in these as reflected in the evaluations. The Glass of Milk programme distributes canned milk or fortified milk powder from the municipality, for children aged six months to seven years and pregnant and lactating women. The community kitchens programme is run by the National Programme for Food Assistance of the Ministry of Women and Social Development and distributes foods such as beans, oil, rice and canned fish, which are prepared in community kitchens. JUNTOS is a conditional cash transfer programme implemented by the government for families classified as living in extreme poverty; it started in the Cenepa area in May 2008. Mothers of children under 14 years of age receive PEN (*nuevos soles*) 100.00 (approximately USD 35.00) a month on condition that their families take part in health, nutrition and education activities and that they present identity documentation for their children.

More than half of the families interviewed participated in a social programme, and participation generally increased over time (Table 5.7). Foods distribution to the Glass of Milk and community

Table 5.7 Participation in government social programmes in baseline and final surveys

Programme	*% of population participating in social programme*	
	Baseline	**Final**
All programmes	59.4	64.1
Glass of Milk programme	42.2	61.6
Community kitchens	42.2	18.0
JUNTOS	-	66.7

Several families participated in two or three programmes.

kitchens programme were not regular, owing to slow administration and the relative inaccessibility of the area, so participation in these programmes was reported to be variable. Mothers reported using the money received from JUNTOS to purchase school supplies for their children, market food and medicines.

Forty-seven percent of families at baseline and 29 percent in the final survey reported that their children had received foods from a community kitchen in the previous months. The principal reasons given were that it was a free government programme and that children "like to eat rice", a commonly served food. Those who did not participate said it was because they did not have this facility in their community. About half of the families reported that their children received milk from the Glass of Milk programme, but not all the time, only when it was available. The principal reason given was that milk is a good food for children and complements their diet (27 percent baseline and final); in the final survey 32 percent said it was assistance from the government. Those who did not receive milk said that the programme did not reach their communities – particularly at baseline, 27 percent compared with 5 percent in the final survey – while a few reported that their children did not like milk or the programme (12.5 percent baseline, 8 percent final).

Infant feeding patterns

All mothers reported breastfeeding their children, and breastmilk was the first food or liquid received by 95.3 percent of children at baseline and 97.4 percent in the final survey, indicating that this was a prevalent practice and was reinforced during the project. Breastfeeding prevalence is shown in Table 5.8. Of the 11 children in the youngest age group at baseline, four (36 percent) were exclusively breastfed. However, as shown in Table 5.8, breastfeeding during the second year of life was not a common practice, and needs to be stressed in future interventions. Mothers said they breastfed because it was what they were taught to do by their elders, and must be good. Their reasons for stopping breastfeeding were that their children had teeth and bit their nipples, they felt they did not eat good enough food to be able to breastfeed, or they became pregnant with the next baby.

Table 5.8 Breastfeeding in baseline and final surveys, by age group

Age group	*Baseline*		*Final*	
	n	%	*n*	%
0–5.9 months	11	100	1	100
6–11.9 months	16	94	8	88
12–23.9 months	27	41	12	17
2–3 years	15	6	8	0
> 3 years	14	6	13	0

In the surveys, 85 percent of children had received water, infusions and *chapo* (a drink made from banana) as well as breastmilk. The mean age for introducing liquids was 6.5 months at baseline and nine months in the final survey, indicating that the timing for introduction was delayed after the project. Thirty-seven percent of children at baseline and 48.7 percent in the final survey had received milk other than breastmilk; the mean ages for introducing other milk were 8.9 months at baseline and 10.6 months in the final survey. Feeding bottles were used to give liquids to infants. *Masato* (a pre-masticated drink prepared from cassava) was given to 58 percent of infants at baseline and 67 percent in the final survey. The mean ages for introducing *masato* were 9.7 months (ranging from three to 24 months) at baseline and 13.2 months (six to 36 months) in the final survey. The *masato* given to young children is fresh (i.e., unfermented) and is considered good for young children as it can satisfy hunger, forms stools and – together with *chapo* – makes the child "chubby".

The average ages at which mothers reported first feeding their infants solid foods were five months at baseline (ranging from one to nine months) and 6.6 months in the final survey (four to eight months), showing reduced incidence of very early introduction of solids. The most common first foods given were watery broths or soups, and boiled banana and cassava, which were mashed or pre-masticated to make them soft and prevent the child from choking. Consumption of pre-

Table 5.9 Median percentages of daily recommended energy and nutrient intakes among young children

Nutrient	*Infants and children 6–23 months*			*Children 2–5 years*		
	Baseline	**Final**	**p value**	**Baseline**	**Final**	**p value**
	n = 38	**n = 19**		**n = 29**	**n = 23**	
Energy	116	109	ns	122	118	ns
Protein	179	256	0.064	182	178	ns
Vitamin A	93	167	0.056	232	200	ns
Ascorbic acid	297	405	ns	350	404	ns
Thiamin	79	103	ns	120	138	ns
Riboflavin	115	156	ns	239	190	ns
Folate	149	116	ns	99	93	ns
Iron	45	55	ns	62	83	ns
Zinc	49	80	ns	99	81	ns
Calcium	31	33	ns	56	43	ns
Dietary characteristics						
% energy from protein	7.4	10.3	0.009*	6.5	7.1	ns
% energy from fat	7.8	13.8	0.015*	6.3	7.5	ns
% energy from carbohydrate	89.0	75.3	0.023*	90.0	88.3	ns
% protein from animal sources	37	65	0.004*	28	41	ns
% iron from meat, fish, poultry	4.4	27.0	0.003*	5.2	11.3	ns
% zinc from animal sources	16.6	60.2	0.001*	11.3	31.6	ns

* Controlled for age owing to the difference in age distributions of children 6–23 months between the baseline and final evaluations.

masticated foods is discouraged by health personnel, and was reported less frequently in the final evaluation. The introduction of meat, commonly pre-masticated or mashed, was reported to occur at a mean age of 7.3 months at baseline compared with 6.5 months after the project. Twelve percent of children at baseline and 8 percent in the final survey had received an iron supplement at the health post to treat or prevent anaemia. In general, these results, and the interviews with mothers who reported using varied complementary food combinations, demonstrated improved complementary feeding practices after the project.

Energy and selected nutrient intakes

Tables 5.9 and 5.10 show the adequacy of energy and selected nutrient intakes for two age groups, compared with recommended intakes and calculated from the 24-hour recall data from the baseline and final evaluations. There was wide variability in intakes, so the tables present median values. Median intakes for children in both age groups met the recommendations for energy, protein, vitamins A and C, riboflavin and folate. However, median intakes for iron, zinc and calcium were well below recommendations, and although intakes of iron and zinc (in the younger group) appear to be higher after the project, they were still below recommended intakes. After the project, for all nutrients, the proportions of children consuming less than 80 percent of the recommended intake were lower than at baseline.

The energy contributions from protein and fat were low, but increased significantly in the youngest age group after the project, owing to the increased consumption of animal-source foods. The proportions of protein, iron and zinc from high-bioavailable animal sources also increased in this age group.

Table 5.10 Median percentages of daily recommended energy and nutrient intakes among lactating and non-lactating mothers

Nutrient	*Lactating mothers*		*Non-lactating mothers*	
	Baseline	**Final**	**Baseline**	**Final**
	n = 36	**n = 11**	**n = 22**	**n = 25**
Energy	79	73	88	98
Protein	60	65	76	80
Vitamin A	157	124	211	233
Ascorbic acid	338	298	442	510
Thiamin	61	55	60	87
Riboflavin	136	95	143	140
Folate	55	43	61	61
Iron	34	35	23	29
Zinc	57	87	79	103
Calcium	48	34	39	43
Dietary characteristics				
% energy from protein	5.9	5.3	7.6	6.1
% energy from fat	5.2	4.3	5.8	7.2
% energy from carbohydrate	92.3	93.6	91.0	87.6
% protein from animal sources	33.8	43.7	35.2	46.5
% iron from meat, fish, poultry	6.6	21.0[1]	10.3	20.0
% zinc from animal sources	14.2	24.0[2]	18.7	24.0

[1] $p < 0.05$.
[2] $p = 0.066$.

There was wide variation in daily energy intakes for women, but median intakes were lower than recommended intakes in both the baseline and the final evaluation, as shown in Table 5.10 (which does not present results for pregnant women as there were very few of them). Energy recommendations were calculated on the basis of moderate activity for these women, who frequently spend several hours a day doing agricultural work in their fields. Most women were within the normal range for BMI, as seen in Table 5.11, indicating that overall energy intakes were near to their requirements. Median protein intakes were lower than recommended. Women's median intakes of vitamins A and C and riboflavin were adequate, but – similar to children's – their intakes of iron, zinc, calcium and thiamine were low, although median intakes of zinc were significantly higher after the project, probably owing to eating more fish.

Table 5.11 Percentages of non-pregnant women carers with adequate BMI

BMI	*Baseline* %	*Final* %
	n = 56	**n = 34**
< 18.5	1.8 (1)	2.9 (1)
18.5–24.9	94.6 (53)	88.2 (30)
25–29.9	3.6 (2)	8.8 (3)

Food sources of energy and nutrients

The major sources of energy in the diet were cassava and banana. Together these provided more than half the energy in the diet, although for young children the proportion was less after the project (51 percent baseline, 44 percent final), indicating that more (non-breastmilk) energy came from other food sources. For

young children, the proportion of energy from fruits (excluding banana) increased after the project; fruits are grown locally.

There was an increase in the proportion of protein from animals. Protein from wild animals increased from 8.4 percent of dietary protein at baseline to 14.1 percent after the project, for all women and children; the increase was even greater for young children (from 3.1 to 12 percent). These foods were consumed more frequently and in larger quantities after the project, including by young children. There was also an increase in the proportion of protein from fish, rising from 12.3 to 18.9 percent of dietary protein for all women and children, and from 13.8 to 22.7 percent for young children. Young children consumed more milk after the project.

Traditional and market sources of food energy

Most dietary energy for all groups was provided by traditional, locally produced or hunted foods, with only a small proportion coming from market or donated foods, as shown in Table 5.12. This proportion is higher for young children, mainly owing to the milk and food they receive from donation programmes, and to snack foods purchased from local shops.

Health situation – childbirth

The majority of children were born in the home, with the mother alone or with a family member present (80 percent baseline, 70 percent final); in both surveys, 17 percent were born at home with a health worker or midwife attending. In the final survey, 13 percent of children were born in a health facility, compared with 3 percent at baseline. The Ministry of Health is promoting institutional birthing to reduce maternal mortality, but accessibility to health facilities is very difficult in this remote area.

Child morbidity

There was high prevalence of illness among children in this population, especially younger ones, and particularly high incidences of diarrhoea, respiratory infections and parasites, which were recorded as higher in the final survey than at baseline (Table 5.13). The project did not include testing or treatment for parasites; health promoters recommended herbal treatments and referred mothers to the health post. Mothers may have become more aware of ill health and parasites after the project, as they had had more contact with health promoters.

Women's health

Sixty-seven percent of mothers reported that they were in good health all or most of the time at baseline, and 63 percent in the final survey. Eighteen percent of mothers reported having diarrhoea during the past

Table 5.12 Median percentages of dietary energy derived from traditional/local and market foods, by age group

Age group	*Traditional/local foods*		*Market foods*	
	Baseline	**Final**	**Baseline**	**Final**
6–23 months	84.3	86.3	15.7	13.7
2–5 years	83.7	92.3	16.3	7.7
Lactating mothers	94.7	94.4	5.3	5.6
Non-lactating mothers	93.9	94.1	6.1	5.9

Table 5.13 Health status of infants and young children as reported by mothers

Health status	*Age group in years*	*% children*	
		Baseline	*Final*
		n = 64	**n = 39**
Child is healthy	< 2	64.1	61.9
	2–4	83.9	73.9
Child had diarrhoea yesterday	0–4	6.3	17.9
Child had fever yesterday	0–4	9.4	10.3
Child had cough yesterday	0–4	25.0	17.9
Parasites: present	< 2	26.4	47.6
Parasites: no/unknown	< 2	73.6	52.3
Parasites: present	2–4	54.8	47.7
Parasites: no/unknown	2–4	45.1	52.2
Diarrhoea in the last month	< 2	43.4	47.6
Diarrhoea in the last month	2–4	25.8	30.4

month at baseline, and 26 percent in the final survey. Similar to the children, the presence of parasites among women was high: 40 percent reported parasites at baseline and 50 percent in the final survey, with most of the others saying they did not know whether or not they had parasites. Other illnesses reported by mothers included malaria, dengue, tuberculosis and typhoid fever (with prevalences between 1.6 and 7.9 percent). In the final survey, two mothers reported diabetes and one hypertension. Forty percent of mothers reported that they had had a health problem during their pregnancies, and 31 percent reported mastitis.

Maternal mental health

Mothers were asked some simple questions regarding their mental health. About half of them did not answer these questions, perhaps because they did not understand what the translator was asking. Among those who did answer, 35 percent at baseline and 45 percent in the final survey said they felt animated during the day, whereas 44 percent at baseline and 50 percent in the final survey reported feeling tired, bored or sleepy. In both surveys about 90 percent of those who answered said they felt valued by their family; 70 percent at baseline and 91 percent in the final survey felt valued by their community, and 95 percent in both surveys said they considered that what they did was important.

Children's nutrition status

Table 5.14 indicates that there was no improvement in the nutrition status of young children during the project period, as measured by anthropometry. Although there appears to have been an increase in stunting in the younger age group and a decrease in the older group, no clear conclusions can be drawn, owing to the small sample size.

Women's nutrition status as measured by BMI

The mean BMIs of non-pregnant mothers in the survey were 21.8 at baseline and 22.3 at the final evaluation. The distribution of BMI shown in Table 5.11 shows that the majority of mothers were within the normal range, with no change after the project. Nevertheless, there was a slight (statistically insignificant) increase in overweight women in the final survey in this small sample.

Women's activities

Information about women's daily activities was derived from interviews with mothers and an interactive exercise of assigning balls to containers (see the previous section on Methodology). Typical daily activities involved rising very early, cooking (boiling) cassava and other food, eating and going to the fields (on only two or three days a week during the rainy season) to collect food for about six hours. On the days they did not go to the field, the mothers did housework, and in the afternoons they washed clothes (they estimated spending a total of 7.5 hours on housework and caring for family members) and engaged in recreational activities or sports (e.g., volleyball) for an estimated two hours. In the evenings they prepared the evening meal and went to bed early as they lacked light or electricity. Forty-two percent of

Table 5.14 Proportions of children with ≤ -2SD for height-for-age, weight-for-age and weight-for-height Z scores

Nutrition status	*% children*					
	0–23 months			*2–4 years*		
	Baseline	**Final**		**Baseline**	**Final**	
	n = 53	*n = 20*		*n = 29*	*n = 21*	
≤ -2SD height-for-age Z	43.4	55.0	ns	62.0	52.0	ns
≤ -2SD weight-for-age Z	20.8	20.0	ns	24.0	24.0	ns
≤ -2SD weight-for-height Z	0	5.0	ns	0	10.0	ns

the mothers interviewed did some paid work out of the house, mostly in other people's fields or caring for other people's children.

Discussion

The Awajún have always lived in close equilibrium with their natural surroundings. Their forests and rivers are their life-blood and livelihood: "…if the rainforest disappears, the Awajún disappear" (Chang and Sarasara, 1987). The food system was based on more than 200 traditional foods, but the nutritional and health situation of the Awajún is not optimum (Creed-Kanashiro *et al.*, 2009; Roche *et al.*, 2007). Increased nutritional knowledge – especially regarding the needs of infants and young children – greater access to disappearing high-quality foods, the integration of appropriate market products and improved health strategies are needed. This case study project, aimed at enhancing the nutrition and health of Awajún women and young children along the Cenepa River through the promotion of nutritionally appropriate traditional foods, led to increased knowledge about these foods. The project increased the production, accessibility and use of these foods for better nutrition, thus contributing to maintaining their essential role in the food system and in the population's diet, culture, ecosystem and environment.

Nutrition and health promotion requires access to appropriate foods and educational processes that lead to behaviour change. The project activities were based on the results of an earlier participatory study documenting the food system, and responded to community leaders' requests to address the nutritional situation. The project strategy focused on training elected community health and nutrition promoters following the ODECOFROC structure, and using innovative adult education methodologies. The community promoters then implemented food production and education activities in their communities, supported by intermittent visits from the leaders of ODECOFROC's Women's Programme. The promoters were enthusiastic and very interested participants, but had some difficulties in transmitting the information in their communities owing to their education level, logistics and gender issues, and the population's misperception that foods from "outside" are better than local ones. These issues were addressed in workshops, emphasizing practical aspects and key messages, but this resulted in the project being delivered differently in each community and delayed the communities' exposure to activities.

In spite of these difficulties, mothers remembered the food and nutrition messages; knowledge of the importance and benefits of traditional foods increased; the production of foods was greatly enhanced, through the local cultivation and recuperation of seeds and plants and the introduction of family fish farms; and more meat was obtained from hunted animals. The promoters found it easier to promote food production than impart nutrition information. The benefits of some of these activities, such as the cultivation of fruit, palm and other trees, will increase in the future, because of the time required for trees to grow and produce fruit, so the effects immediately after the two-year project were somewhat limited.

The total number of foods consumed by all the families evaluated, as measured by 24-hour dietary recall, was very similar in both the baseline and final surveys, in spite of the smaller sample size in the final survey. This was true of both traditional foods (76 baseline, 72 final) and market/government-donated foods (25 in both). At the individual level, the TFDS at baseline was similar to that described by Roche *et al.* (2008), but had increased significantly after the project, for both women and young children. These results indicate that food diversity and the traditional food system were maintained and enhanced despite the increased presence of market foods in the area, which has been shown to have a negative effect on the nutrition of other populations (Kuhnlein *et al.*, 2004; Kuhnlein and Receveur, 1996; Port Lourenço *et al.*, 2008; FAO, 2009).

The biodiversity available to populations with limited economic resources enhances their food security (Claverías and Quispe, 2001). The Awajún mothers interviewed generally expressed confidence in their current food supply, although it was not always of the quantity or quality that they would have liked, especially

regarding animal products and fruits – use of both these foods increased after the project. However, the mothers expressed concerns about not having access to new fields to cultivate and about difficulties in reaching animals for hunting in the future.

Exclusive breastfeeding during the first six months of life and continued breastfeeding with complementary foods until two years of age provide optimum nutrition and protect against illness (PAHO/WHO, 2003). The final survey sample size was too small to evaluate the project's impact on exclusive breastfeeding, but the introduction of complementary drinks and foods was delayed until about six months of age, reflecting the adoption of improved practices. Good breastfeeding practices, especially during the second year, still need to be reinforced. There were high incidences of illness among infants and young children, and improved breastfeeding and complementary feeding practices are needed to help protect against illness. Foods were sometimes reported to be pre-masticated by the care giver, to facilitate acceptance and digestion by the child, and this may have a protective effect against illness (Pelto, Zhang and Habicht, 2010). This practice is decreasing, however, owing to health personnel's current recommendations to avoid pre-mastication.

With the exception of iron, zinc and calcium, children's median energy and nutrient intakes were estimated at close to recommended levels in both the baseline and final evaluations. For every nutrient, the proportion of children under 24 months not meeting 80 percent of the recommended intake decreased, indicating an improvement in dietary intakes. Some indicators of dietary quality improved significantly in children aged six to 23 months, including the proportions of energy from protein and of iron and zinc from high-bioavailable animal sources. Meat and fish intakes were higher after the project, a direct result of having more meat from hunted animals and fish from fish farming. These were foods distributed within the family to favour younger children. Fat intake also increased, which is important considering the low fat content of the children's diets.

The dietary intakes of energy and, especially, iron, zinc and calcium of adult women with moderate activity tended to be lower than recommended in both the baseline and final evaluations. As with the children, there were significant increases in the proportions of energy from protein and of iron and zinc from high-bioavailable animal sources among the women, indicating a similar increase in meat and fish intake after the project.

The case study recorded improved feeding practices and dietary intakes for children, but no impact on their nutrition status; rates of stunting were high, as in other studies of this and similar indigenous populations (Huamán-Espino and Valladares, 2006; Roche *et al.*, 2011; Soares Leite *et al.*, 2006), and remained high after the project. Besides diet, other factors also affect growth (WHO, 1998), particularly illness. The rates of illness (especially parasitic infections) reported in this study were extremely high, and are likely to have contributed to the lack of improvement in nutrition status. Mothers also had high rates of parasitic infections, which have also been reported in similar indigenous communities of the Peruvian and Brazilian rain forest (Ibáñez *et al.*, 2004; Carvalho-Costa *et al.*, 2007).

There were several limitations to this study:

- Health and nutrition promoters had variable success in transmitting activities and messages to the project communities.
- The limited access to communities in this remote area of difficult terrain made follow-up and monitoring activities very difficult and expensive.
- Although the project included home, food and personal hygiene information, it did not cover the evaluation or treatment of parasites and illnesses. Future interventions should include more on health problems, including water quality.
- Anaemia was not evaluated (owing to the population's concern about giving blood samples) or treated, although it is known to be a public health problem (INEI, 2001).
- The evaluation did not include a control group, which limits the validity of the results. (This is a frequent issue for interventions.)
- The small sample size in the final evaluation and the inclusion of some of the same families as in the baseline also limited the value of the results.

Despite these limitations, however, the project contributed to local awareness and knowledge about the value of traditional foods. The enhanced production of seeds and animal-source foods had a modest positive effect on feeding patterns, the distribution of food within families and dietary quality, particularly for young children. The Awajún people were aware of the changes that were occurring, and responded positively to the need to defend their culture and improve their food. They appeared eager to learn more about nutrition and better feeding for their families and young children. Further similar initiatives are needed to benefit the nutrition and health of the Awajún.

Lessons learned

Coordination with local community organizations was effective, and ODECOFROC considered the project leaders' interactions with ODECOFROC staff and the communities as setting a good example to follow, especially the research agreements and delivery of reference material on local foods prior to project commencement. However, the project and local health facilities would have benefited from greater coordination with government institutions such as the local Ministry of Health and food donation programmes. This could have increased the consistency of key messages and activities relating to traditional foods and nutrition in the area, and would also have facilitated the incorporation of health promotion into an integrated approach that included the treatment and prevention of illnesses in addition to the project's hygiene, nutrition and local food production components.

The project's community nutrition and health promoters were committed and involved in the project, and rapidly grasped information about local and traditional foods through the practical sessions on food selection and preparation. Working with promoters was an appropriate strategy for reaching communities along the riverbanks and in the hills, as designated by ODECOFROC and the Women's Programme. However, several promoters had difficulties in transmitting their knowledge and skills to their communities, although the project's increasing focus on practical aspects and key messages helped. Efforts are needed to remediate these aspects in future interventions of this nature. The IIN technical team was present for education activities only twice a year during the two-year project, which reduced the support it was able to give to the promoters. In future, more frequent technical support and accompaniment would benefit the promoters and their activities in the communities. Finding ways of compensating promoters for the time they dedicate to their community work may also allow them to spend more time on project activities.

The ODECOFROC Women's Programme was key to this project, especially its work to improve the quality of life in the communities, largely through promoting fish farms, reforestation and the raising of small animals; all of these were successful programmes that increased access to and use of local, traditional and nutritious foods. Without this, effective coordination with other institutions working in these areas could not have occurred. The Women's Programme was also key in coordinating and supporting the promoters, assuring continuity, assisting project implementation in the communities, and monitoring activities

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Chapter 6

The Dalit food system and maternal and child nutrition in Andhra Pradesh, South India

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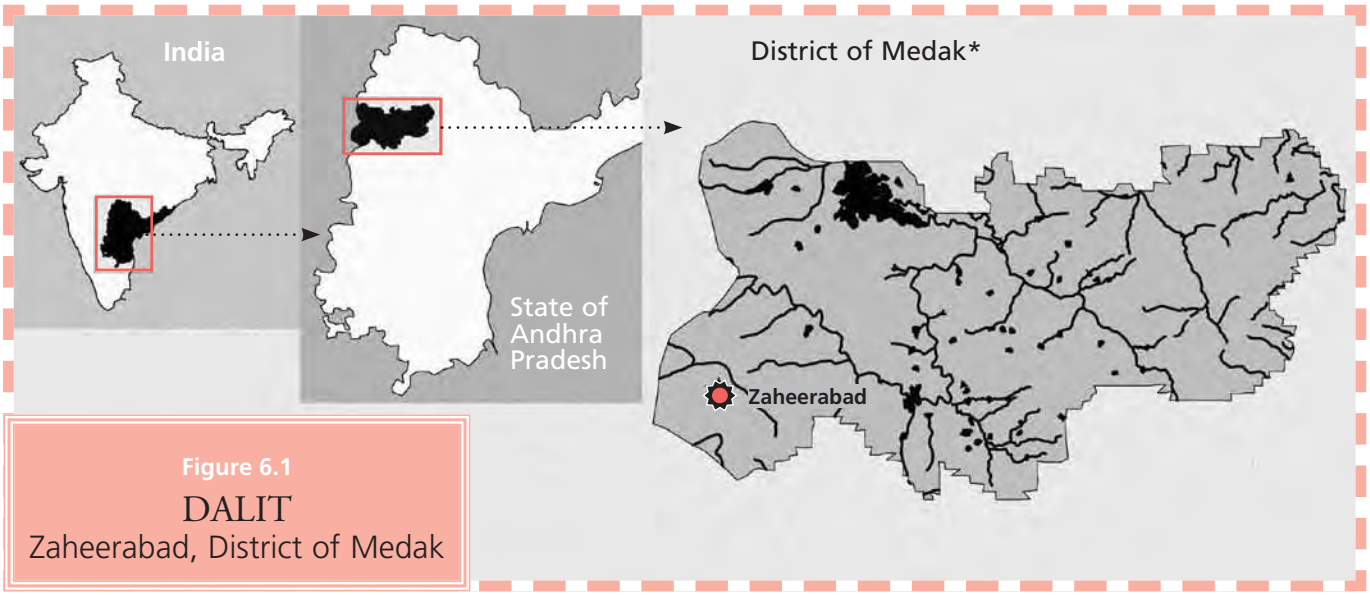

Figure 6.1
DALIT
Zaheerabad, District of Medak

Data from ESRI Global GIS, 2006.
Walter Hitschfield
Geographic Information Centre,
McGill University Library.
**Digitized from*
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Key words > traditional food, dietary intake, micronutrients, anthropometry, biodiversity, Dalit, India, maternal and child nutrition, food security

Photographic section >> VII

> “Today, if I look back, I can sense a sea-change in my life, and what is so exhilarating about it is the feeling of control that we are experiencing. Earlier, we were like drift-logs being swept here and there by external forces. We had to work for others on lands alien to us. We did not feel that anything belonged to us. We were just being used. But now, thanks to the *sangham*, we are shaping our life in a way that we have chosen on our own.”
>
> Susheelamma, Raipally village, Jharasangam Mandal, Medak Distict, Andhra Pradesh State, India

Abstract

The food system of Dalit rural communities in the Zaheerabad region of south India includes 329 species/varieties of plants and animals, and unique patterns of food use. This chapter describes the effectiveness of using the local food system promoted through women farmers' organizations – called *sanghams* – in the area. The *sanghams* modified a national food distribution system for the poor, and named it the Alternative Public Distribution System (APDS). *Sanghams* worked closely with the Deccan Development Society to conduct many activities promoting local foods. A cross-sectional evaluation of APDS was conducted among pairs of a Dalit mother and her child (aged six to 39 months), from 57 villages in Medak District, 19 of which had active *sanghams*. Information was collected through dietary interviews in two seasons, socio-cultural interviews, anthropometry, and clinical examinations in the rainy season when health risks are highest. Results demonstrated that 58 percent of mothers suffered from chronic energy deficiency (CED), with higher rates among illiterate and active women; one-third of women were affected by night blindness during pregnancy; and 10 percent were identified as iron-deficient, based on pallor under the eyelid.

While children in all villages were similarly nourished, mothers in villages with the APDS programme had higher intakes of energy, protein, fibre, vitamin C and iron from greater consumption of sorghum, pulses, vegetables and animal-source foods. Traditional food fats, pulses and vegetables, roots and tubers showed protective associations against women's CED, after adjusting for number of children under five years of age and sanitation situation. Greater consumption of eggs and dairy products protected against night blindness, and uncultivated leafy greens were important for providing vitamin A during the rainy season. In conclusion, traditional Dalit foods were widely consumed, with associated positive health benefits in poor, rural communities in this district of India. These biodiverse, often unique foods should be promoted for their contributions to ecological farming and local culture and their benefits for food and nutrition security.

Context

Sorghum (*jowar*), pearl millet (*bajra*), finger millet (*ragi*) and foxtail millet (*korra*) are coarse cereals that have been mainstays of agriculture, diet and cultural systems in rural India. This is especially so in the vast dryland belts spreading across the Deccan plateau, north Karnataka, Marathwada, the deserts of Rajasthan, and many tribal areas in central India. These drylands are heavily populated with poor rural people. Agriculture is rainfed, and farming of these crops covers

up to 65 percent of the geographical area, demanding few external inputs such as irrigation and fertilizer. For poor rural communities, such crops provide food security and sustainability at minimal cost. However, there is lack of political will in the country to achieve food security through such coarse cereals.

The Dalit are recognized as the "untouchables" (formally known as the "scheduled castes"), the fifth group below the four classes in the Hindu religion. There are more than 180 million Dalit in India; the majority are illiterate and landless, and work as farm labourers. Although the term "untouchability" has been abolished in law, Dalit are known to suffer severe caste-imposed discrimination that affects every aspect of life (IHEU, 2010; Minority Rights Group International, 2010), and Dalit women and children are likely to be the most poorly nourished sub-groups in India. Within the area studied, self-identified Dalit women are farm labourers, living and working close to the food growing areas of Zaheerabad.

Surprisingly, one of the major contributors to the problem of food insecurity for Dalit and others is the Public Distribution System (PDS). Possibly the largest affirmative action in the world, the PDS provides subsidized food at cheap prices to the poor, but concentrates on only two grains: refined rice and wheat. This massive programme covering all of India provides a regular and continued supply of these grains from the market and distributes them to the poorest people; the resulting steady prices make agriculture remunerative and attractive for rice and wheat farmers, who are already supported by subsidized irrigation, subsidized fertilizers and adequate crop insurance.

Deccan Development Society initiatives

This is the context in which the Deccan Development Society (DDS) operates. The 5 000-plus members of this grassroots organization are primarily agricultural labourers and marginal farmers owning 1 or 2 acres (about 0.4 to 0.8 ha) of farmland. In most cases, these lands are either *inam* (gift) lands given to the farmers by their landlord-employers, or lands assigned by the government as part of its land reform programme. Most of these lands are degraded red soils, producing only about 30 to 50 kg of grains per acre (75 to 125 kg/ha). The grains produced by members of DDS *sanghams*[1] satisfy food needs for six to seven months a year. Addressing food insecurity for the other four to five months is a challenge, for both families and DDS.

The PDS has the potential to be a crucial policy instrument for food security and political stability in India. It plays an important role in averting famines by purchasing grain from surplus regions to be sold for a fair price in food-deficit/low-income regions. However, as part of the market-driven/irrigation-centred agricultural policies of the government and development agencies, the PDS has encouraged a new pattern of food consumption in the semi-arid tropical regions of India. The poor have shifted from a diet of locally grown rainfed cereals such as sorghum and millets to one of rice and other irrigated crops imported from distant areas, leading to a decline in the cultivation of dryland cereals and associated intercrops (pigeon pea, field bean, cow pea and other beans). Recognizing that the cheap rice-based PDS was destroying the agriculture of the poor in dryland areas, women members of DDS articulated the crux of the problem:

- "Cheap rice is attractive. But in the bargain we left our lands fallow."
- "We hanker after rice and neglect our own lands."

Extended discussions between women farmers and DDS since as far back as the mid-1980s have sought solutions to the problems of threatened agricultural practices and food insecurity for rural societies. When imports of subsidized rice through the PDS made it uneconomical for small farmers to cultivate their lands and grow the coarse cereals and pulses that are the backbone of their agriculture and traditional food, the plots owned by small and marginal farmers were left fallow, leading to the abandonment and degradation of productive land. The direct result of this increase in fallow land was a marked decline in the production and availability of traditional cereals, pulses and animal fodder. This affected the nutrition of rural people,

[1] A *sangham* is a volunteer collective of poor women farmers, primarily Dalit, working within DDS in Andhra Pradesh, where each village has its own *sangham*.

especially women and children, and increased the shortage of draught animal power (Women's *Sangham*s of the Deccan Development Society, Satheesh and Pimbert, 1999).

One strategy suggested was to reclaim the fallow land, and to use deep ploughing and manure to grow food crops for family use. However, this approach required investments of approximately 2 600 rupees (INR) per acre (equivalent to about USD 83 per acre at the time). To obtain funding, women farmers of dryland crops campaigned to reverse unfavourable loan policies, and DDS approached the Indian Ministry of Rural Development. In 1994, this resulted in approval of the Community Grain Fund (CGF), which was distributed in agreement with the Government of India through the PDS. Under this arrangement, groups of largely illiterate and poor women set up and ran a community-managed Alternative PDS (APDS) based on coarse grains, which are produced, stored and distributed locally in 30 villages around Zaheerabad. The women deposit their excess grain in the CGF to repay for the loans they receive from the PDS.

Each *sangham* formed a committee of about five women to design and implement activities on about 100 acres (40 ha) of fallow land in each of the 30 villages. Overall, the committees found a total of 2 675 acres of suitable land, divided fairly equally among the villages. The women's committees then each selected about 20 acres (8 ha) on which to supervise the work of other women farmers, to ensure appropriate ploughing, manuring, sowing and weeding practices on the reclaimed fallow land. The committee members collect input support funds from the government and distribute them among the women's collectives managing the reclaimed fallow land. Under the current system, after each crop harvest, the committee members are responsible for collecting loan repayments in the form of grain from participants, and for storing the grain. Later in the year, during the season of food scarcity, the committee members sell this grain at greatly reduced prices to poorer households in the village, applying a quota system, with sale proceeds deposited in the village CGF account. Each of the 30 villages has its own account, controlled and managed by women committee members who are accountable to the villagers and to DDS.

By using the grain received from participating farmers to distribute to poorer households at a subsidized price, this system feeds the participating farmers' loan repayments back into the local village economy to support the very poorest, allowing them to obtain sufficient food and become more productive members of the community. Transparent procedures ensure that the money earned from sales of sorghum goes back into the CGF account held by the village committee. This money is used annually to reclaim more fallow land in the village, thus helping to increase productivity through diversifying farming systems and the use of locally available resources. More food is produced and sold locally, and job opportunities are created for people who would otherwise be excluded from the mainstream economy.

DDS documented the local food resources of the APDS communities in the Zaheerabad region of Andhra Pradesh. An amazing array of 329 species/varieties of local foods were recorded in their scientific, local Telugu and common English names, along with information about how they are prepared by village women (Salomeyesudas and Satheesh, 2009). Several previously unidentified plants were documented, as well as several plants recognized as "uncultivated greens". Nutrient composition was analysed in collaboration with scientists at the National Institute of Nutrition (NIN) in Hyderabad, and several food items were analysed for the first time. These food data were instrumental in creating the database for nutrient analysis of dietary data reported in this chapter.

Other major intervention activities

In addition to reclaiming land and redistributing it to women farmers, other community interventions that had a large impact on the food and nutrition security of families, mothers and children included:

- awareness campaigns focusing on traditional food systems;
- establishment of "Café Ethnic", serving millet-based foods;

- establishment of a community media trust, producing films on millets, recipes and uncultivated foods;
- cooking classes for family carers and hostel cooks;
- development of a millet processor;
- distribution of educational material to various agencies;
- promotion of food production systems based on agricultural biodiversity;
- food festivals at public places, fora, schools and colleges;
- formation of an organic farmers' association;
- formation of Zaheerabad consumer action group;
- provision of millet-based meals at day care centres;
- mobile biodiversity festivals;
- development of a mobile organic shop;
- networking with voluntary organizations from the local to the international level;
- establishment of an organic shop for sales of traditional foods;
- participation at national and state-level food festivals;
- publication of scientific information in the local language (Telugu);
- recipe competitions;
- screenings of recipe films;
- training in product packaging for traditional food crops;
- creation of a women's radio station by a community media trust.

Major impacts of the Alternative Public Distribution System

The main impacts of the APDS perceived by participants and others are:

- increased soil fertility;
- increased soil conservation;
- decreased crop disease, due to diverse cropping systems;
- increased availability of uncultivated greens from *sangham* fields;
- increased diversity of food for families;
- increased self-reliance;
- more work opportunities in the villages;
- reduced seasonal migration;
- increased animal fodder and livestock population;
- more dried plant materials for roofing, fencing, etc.;
- revival of rural livelihoods, such as blacksmithing and basket weaving;
- better and more food;
- improved health in families;
- increased knowledge about nutrition from local foods;
- more children attending school.

Rationale and research questions

The rationale for the study reported in this chapter was the need to evaluate the overall effects of APDS activities on the health of *sangham* households, especially among mothers and children, in the Zaheerabad Region of Medak District, Andhra Pradesh, south India. Mothers and young children agreed to take part to help increase knowledge about the seasonal use of traditional food crops; intakes of energy, protein, iron, vitamin A and other nutrients; and clinical signs of malnutrition. Comparative evaluation was conducted in villages with and those without the APDS. The following research questions were asked:

- Do Dalit mothers and their young children aged six to 39 months living in villages where the APDS is operating consume more traditional food during the summer season and the rainy season than Dalit mothers and their children from control villages (without the APDS)?
- Do Dalit mothers and their young children living in villages with the APDS have higher nutrient intakes (energy, protein, carbohydrates, fat, dietary fibre, iron, vitamin C and vitamin A) during the summer season and the rainy season, and better nutrition status during the rainy season than Dalit mothers and their children in control villages?
- Are consumption patterns and nutrient intakes predictors of nutrition status (chronic energy deficiency [CED], anaemia and vitamin A

deficiency) in Dalit mothers and their young children during the rainy season?

The research was epidemiological in nature. This chapter summarizes its results to evaluate the overall impact of DDS activities on food use and nutrition status among Dalit in the Zaheerabad Region of Andhra Pradesh.

Methods

Participatory research process

All the villages participating in the study were asked for their consent. *Sangham* leaders were consulted first, and the purpose of the study was explained to them at a meeting organized by DDS. Formal ethical approval was obtained from the Human Research Ethics Committee of McGill University (Canada). The village leaders discussed issues with the researchers and project leaders, and agreed to cooperate in the study. Researchers then visited individual villages to participate in *sangham* meetings and select individual study participants. Written consent was obtained from each of the identified mothers and from the *sangham* leaders. NIN trained six graduate students from Indian universities in interview techniques, which included a seasonal food frequency questionnaire, a 24-hour recall, a socio-cultural questionnaire, anthropometric measurement, and assessment of clinical signs. All interview schedules were translated into the local Telugu language and field tested to improve their validity. Data were obtained at the subjects' convenience, in their own homes and with their families' consent. The objectives and purpose of the study were clearly explained in *sangham* meetings to ensure maximum cooperation, and results were similarly presented. Two fruit trees were given to each participating household, in appreciation of its time and effort.

A cross-sectional sampling design was used in six rural townships (*mandals*) in Medak District, where a total of 263 Dalit mothers, each with a child aged six to 39 months, were found eligible, from 19 villages that had been implementing the APDS since its inception in 1995 and 18 villages without the APDS. All the participating households were members of their village DDS *sangham*, and only one mother per household was included. In households were there were two eligible mothers, the mother who was at home at the time of the survey was chosen. Mothers under 15 years of age and/or with twins were excluded. Of the 263 eligible mothers contacted, 223 participated in interviews in both the summer season and the rainy season of 2003. Of the 43 (16 percent) mothers who were unable to participate, 19 were working in the nearby city (7 percent), seven had recently given birth (3 percent), 16 were absent from the village at the time of the survey (6 percent), and one refused.

Summer season interviews administered an 83-item food frequency questionnaire (FFQ) and rainy season interviews one of 106 items. The FFQs were based on existing information from DDS on the seasonal availability of food species, personal preferences and market availability. Thirty-one items of foodgrains, nuts, oilseeds, pulses and animal foods were included in both seasons. Fruits, green leafy vegetables, other vegetables, roots and tubers were included according to seasonal availability. The summer season FFQ included 14 vegetables, six cultivated green leafy vegetables, ten wild green leafy vegetables, 11 cultivated fruits and 11 wild fruits. The rainy season FFQ included 15 vegetables, 14 cultivated green leafy vegetables, 36 wild green leafy vegetables, six cultivated fruits and three wild fruits. Frequencies were in number of days that the food item had been consumed during the season (each season was of two months or 60 days). Mothers' consumption frequencies of nuts and oilseeds, vegetables, roots and tubers, animal foods, green leafy vegetables, eggs, milk and milk products, meat and fruits were averaged across both seasons. The two-season average consumption frequencies of sorghum, rice and pulses were combined with the average amounts consumed, obtained from 24-hour recalls, to estimate average total amount consumed per day.

Mothers' nutrient intakes were calculated from a minimum of two 24-hour recalls per season. Recalls were obtained according to standard procedures adapted from the National Nutrition Monitoring Bureau surveys used by NIN. Each mother was asked

to recall her own and her child's food intakes from the preceding day, and detailed descriptions of all the food and beverages consumed were recorded, including cooking methods and brands. Quantities of food consumed were weighed on digital kitchen scales (ATCO Model No D2RS-02-W) to the nearest gram, or were estimated with household measures or standardized vessels. For cooked dishes, such as dhal and curry, all the raw ingredients used for the family were weighed, and the volumes consumed by the mother and child were estimated from this. A standardized 12-vessel set was used to estimate volumes of cooked foods and liquids. The individual raw intake of each ingredient of cooked dishes was calculated, and standardized recipes and standard conversion factors for cooked rice were used for missing ingredients or missing volumes of dishes cooked for the family. Standard breastmilk consumption was assumed for breastfed children: 500 ml per day for children aged six to 12 months, and 350 ml per day for those aged one to three years (Belavady, 1969).

Nutrient values published by India's NIN (Gopalan *et al.*, 1989) were used, with missing nutrient values or food items and the values of total dietary fibre taken from Association of Southeast Asian Nations (ASEAN) food composition tables (Puwastien *et al.*, 2000) or European food composition and nutrition tables (Souci, Fachmann and Kraut, 1994). Food energy was calculated by assuming protein, carbohydrate and fat yields of 4, 4 and 9 kcal/g respectively. These were then converted into kilojoules (kJ) using the conversion rate of 4.2 J per calorie (4.2 kJ = 1 kcal). Pro-vitamin A carotenoids were converted into retinol equivalents (RE), assuming 6 µg β-carotene equals 1 µg RE. In the absence of β-carotene values, it was assumed that 6 µg total carotene equals 1 µg RE. The β-carotene values determined by high-performance liquid chromatography from recent publications were used whenever available (Bhaskarachary *et al.*, 1995; Rajyalaksmi *et al.*, 2001).

For some multivariate analyses, nutrient intakes from intervention (with APDS) and control (without APDS) villages were determined as population group totals for mothers and children, using a single 24-hour recall. Within each population group, nutrients were pooled into nine food groups, separately for the summer season and the rainy season: other food grains (wheat and maize); nuts and oilseeds (eight species); pulses (nine species); animal foods (nine items); green leafy vegetables (nine cultivated and seven wild species); vegetables (20 species); fruits (seven species); drinks (three items); and miscellaneous (11 items). The percentage contribution to each season's total nutrient intakes made by each of the food groups and single food items (sorghum, rice, cooking oil) was determined and ranked. Nutrient intakes were estimated using Candat (Canadian Nutrient Data Analysis Toronto, Version 5.1, 1988, Godin Incorporated, London, Ontario, Canada), based on nutrient values from the Indian food composition tables (Gopalan *et al.*, 1989).

Anthropometric measurements

Anthropometric measurements, a socio-cultural questionnaire and an eye examination were administered during the rainy season. Portable height rods (Galaxy Informatics, Delhi, India) were used to measure the height of mothers, with an accuracy of 1 mm. Mothers' weights were measured on a digital balance (SECA BELLA 840, Hamburg, Germany), with an accuracy of 100 g. Women with a body mass index (BMI) of less than 18.5 kg/m² were classified as CED, using standard cut-off points (James, Ferro-Luzzi and Waterlow, 1988). Pregnant women (n = 14) were excluded from the CED analyses.

Young children were measured with portable infantometers (Galaxy Informatics, New Delhi, India), measuring lengths of 56 to 92 cm with an accuracy of 1 mm; the digital balance was a Tansi (Tamilnadu Small Scale Industry) hanging manual baby balance with a maximum measurable weight of 20 kg and an accuracy of 50 g; non-stretchable plastic tape (Dritz, Germany) with an accuracy of 1 mm was used to measure arm circumference.

Standard procedures based on international standards were used for all measurements (Lohman, Roche and Martorell, 1988). Weight and height

measurements were taken without shoes and with minimal clothing. Mid-upper-arm circumference (MUAC) was measured on the left arm. The weight of the jewellery worn by mothers and children was recorded – mothers know this weight because of the economic value of silver. If a mother or child had more than 100 g of jewellery, which was rare, the weight was subtracted from the measured weight. Interviewers had one day of training, with practice measurements performed on children in a nearby village school.

Table 6.1 Variables of interest for determinants of CED, clinical vitamin A deficiency symptoms and iron deficiency in Dalit mothers

Variable	*Index category*
Variables for chronic energy deficiency (BMI < 18.5 kg/m²)	
Energy intake	kcal/day
Carbohydrate intake	% of energy
Fat intake	% of energy
Dietary fibre intake	g/day
Rice consumption	g/day
Sorghum consumption	g/day
Pulse consumption	g/day
Frequency of nuts and oilseeds	days
Frequency of vegetables, roots and tubers	days
Frequency of animal foods (meat, eggs, milk, milk products)	days
Variables for clinical vitamin A deficiency (Bitot's spot, conjunctival xerosis, night blindness)	
Nutritional supplement (enriched flours)	yes
Fat intake	% of energy
Vitamin A intake (RE)	µg RE/day
Sorghum consumption*	g/day
Pulse consumption*	g/day
Frequency of green leafy vegetables	days
Frequency of eggs, milk and milk products	days
Frequency of fruits	days
Variables for iron deficiency (under eyelid pallor)	
Nutritional supplement (enriched flours)	yes
Iron-folic acid tablets	yes
Energy intake	kcal/day
Dietary fibre intake	g/day
Iron intake	mg/day
Vitamin C intake	mg/day
Rice consumption*	g/day
Sorghum consumption *	g/day
Pulse consumption*	g/day
Frequency of green leafy vegetables	days
Frequency of meat	days

Dietary intakes and consumption frequencies for the summer season and the rainy season of 2003.
* Obtained from averages of two to four 24-hour recalls and food frequency questionnaires during the summer season and the rainy season.
Source: Adapted from Schmid *et al.*, 2007.

Table 6.2 Variables of interest for determinants of stunting, wasting, underweight and iron deficiency in Dalit children aged 6 to 39 months

Variable	*Index category*	*Reference category*
Adjusting variables		
Age	6–12, 13–24 or 25–39 months	6–12 months
Sex	male or female	female
Housing	permanent house or traditional hut	permanent house*
Feeding status	weaned, complementary fed or breastfed	weaned
Duration of exclusive breastfeeding (including water)	≥ 6 months or < 6 months	≥ 6 months
Nutrition supplements (enriched flour)	yes	no
Vitamin A drops	yes	no
Protein energy malnutrition (stunting, wasting, underweight)		
Energy intake	≥ 1 220 kcal/day or < 1 220 kcal/day	≥ 1 200 kcal
Protein intake	≥ 21 g/day or < 21 g/day	< 21 g
Vitamin A intake (RE)	≥ 200 µg RE/day or < 200 µg RE/day	< 200 ±g
Frequency of sorghum consumption	days	-
Frequency of pulses consumption	days	-
Frequency of green leafy vegetables consumption	days	-
Frequency of animal food consumption	none, less than daily or daily	none
Iron deficiency (under eyelid pallor)		
Energy intake	≥ 1 220 kcal/day / < 1 220 kcal/day	≥ 1 200 kcal
Fibre intake	≥ 5 g/day / < 5 g /day	< 5 g
Iron intake	≥ 6 mg /day / < 6 mg /day	< 6 mg
Vitamin C intake	≥ 25 mg /day / < 25 mg /day	< 25 mg
Frequency of sorghum consumption	days	-
Frequency of pulse consumption	days	-
Frequency of green leafy vegetable consumption	days	-
Frequency of meat consumption	none/less than weekly/weekly	none

Nutrient intakes (from 24-hour recalls) and food consumption frequencies (from food frequency questionnaires) for the rainy season of 2003.
* House with or without a permanent roof.
Source: Adapted from Schmid *et al.*, 2007.

Eye examination

Mothers self-reported any night blindness (XN) they were suffering at the time of the survey and/or had suffered during their last pregnancy, noting the month(s) of pregnancy affected. Standardized terms for night blindness in Telugu were used, according to NIN procedures. The eyes of mothers and children were examined by trained interviewers who assessed the prevalence of clinical vitamin A deficiency, including Bitot's spot (X1B), conjunctival xerosis (X1A) and corneal xerosis (X1A), as classified by the World Health Organization (WHO) (McLaren and Frigg, 2001). Iron deficiency was classified according to whiteness or pallor in the inside lower eyelid (Gibson, 1990).

Statistical analysis

Data from mothers and children were analysed separately for the summer season and the rainy season. Chi-square analysis was used for dichotomous and categorical characteristic variables. When the expected count of the Chi-square was below 5, Fisher's Exact Test was used. The non-parametric (Wilcoxon) test

was used for abnormally distributed data, including for all the nutrient intakes of children, and for the fat, dietary fibre, iron, vitamin C and vitamin A intakes of mothers. The paired Student's t-test was used to compare the means of normally distributed continuous variables between intervention and control villages. The paired Student's t-test and signed rank test were used to compare summer season and rainy season data in intervention and control villages. Differences in the intakes of each nutrient in each season between the intervention and control groups were tested for, and no significant differences were observed. A two-sided alternative hypothesis was tested with alpha at 0.05. Data from one child from a control village in the summer season were missing.

Descriptive statistics were used to provide means, standard deviations and percentages. Unadjusted relative risks and 95 percent confidence intervals (CIs) were calculated for categorical risk factors. Beta coefficients, standard errors and p-values were obtained from multivariate logistic regression analyses in which nutrient exposures were evaluated for their associations with outcomes, taking into consideration important determinants. Determinants for CED, clinical vitamin A deficiency and iron deficiency in mothers were examined separately. The following variables were considered in univariate and multivariate analyses: mother's age (years), number of children under five years of age (one or more), mother's physiological status (lactating, pregnant or neither), mother's activity level (moderate or low), household income above or below the poverty line (INR 1 000 per month), mother's literacy (ability to read and write), and household's lack of sanitation (i.e., an open field toilet). One woman was both pregnant and lactating, and was considered pregnant in all analyses.

Table 6.1 gives the nutritional variables explored for their association with CED, clinical vitamin A-deficiency symptoms and iron deficiency (pallor) in mothers. Nutritional factors that were correlated with each other in bivariate analyses were not entered together into multivariate models. Variables of interest for determinants of stunting, wasting, underweight and iron deficiency (pallor) in children aged six to 39 months are given in Table 6.2. Statistical analyses were conducted with SAS Version 8 (SAS Institute Inc., Cary, North Carolina, United States of America). Data sampling, rationale and analysis processes are described in greater detail by Schmid *et al.* (2006 and 2007).

Results and discussion

Mothers' dietary intake

The characteristics of mothers in intervention and control villages are given in Table 6.3. Mothers in both groups were similar with respect to most variables, but mothers from intervention villages (who were generally further from village centres) were daily labourers in the rainy season, so were assumed to have increased energy needs. More mothers were pregnant during the summer season than the rainy season, and about half of the mothers had taken iron-folate tablets while pregnant with the child included in the study.

Mothers from intervention villages had significantly higher intakes of energy (by about 1 000 kJ), protein (by about 8 g) and dietary fibre (by about 8 g) during both the summer season and the rainy season than mothers from control villages (Table 6.4). The percentage of total energy from fat was approximately 10 percent for all mothers in both seasons. The median iron intake of mothers from intervention villages was higher in both seasons, and significantly higher during the rainy season. Vitamin C intakes during the summer season were similar in both groups, but the median vitamin C intake in mothers from control villages was significantly higher during the rainy season. Mothers' fat and vitamin A intakes were similar in both intervention and control villages. In both groups, all nutrient intakes except for vitamin C were higher ($p \leq 0.05$) during the summer season than the rainy season.

Mothers' main sources of energy and protein were sorghum, rice and pulses, contributing 31, 48 and 9 percent, respectively, of total energy, and 35, 36, and 22 percent of total protein in intervention villages; similar values were found in control villages. Millet was consumed by fewer than 1 percent of mothers in both groups.

Table 6.3 Characteristics of Dalit mothers in intervention and control villages

Variable	*Description*	*Mothers* (*n* = 220)
Age	mean years (SD)	24.3 (3.9)
Weight*	mean kg (SD)	40.9 (5.7)
Height	mean cm (SD)	150.0 (5.0)
MUAC	mean cm (SD)	22.5 (2.0)
BMI*	mean kg/m² (SD)	18.2 (2.2)
BMI	grade 0 (BMI ≥ 18.5 kg/m²)	42%
	grade 1 (BMI < 18.5 kg/m²)	28%
	grade 2 (BMI < 17.0 kg/m²)	20%
	grade 3 (BMI < 16.0 kg/m²)	10%
Literate	read and write	79%
Open field toilet	lack of sanitation	94%
Woman's status	lactating	81%
	pregnant	6%
	neither	13%
Active	work in fields and other agricultural activities	71%
Clinical vitamin A deficiency		
None	no symptoms	84%
Night blindness (XN)	self-reported	7%
Bitot's spot (X1B)	examined	5%
Conjunctival xerosis (X1A)	examined	6%
Reported night blindness during pregnancy	yes	35%
Iron deficiency		
Inside of lower eye lid	white (pallor)	10%

Figures are means with SDs in brackets, or percentages from data collected during the rainy season of 2003.
* n = 207, pregnant mothers excluded.
Source: Adapted from Schmid *et al.*, 2007.

Primary sources of iron were sorghum, rice and pulses (Figure 6.2), contributing 56, 16 and 15 percent, respectively, to total iron intake in intervention villages, and similar percentages in control villages. Animal-source food contributed less than 2 percent in both groups. Cereals (sorghum, rice and wheat) contributed 79 percent in intervention villages compared with 68 percent in control villages. Cultivated and uncultivated green leafy vegetables contributed 2 percent of total iron intake and 11 percent of total vitamin C intake in intervention villages, and about three times as much to intakes in control villages.

Fruits and vegetables were major sources of vitamin A (Figure 6.3). During the summer season (mango season), fruits contributed 54 percent of vitamin A in intervention villages and 40 percent in control villages; in the rainy season, uncultivated green leafy vegetables contributed 43 percent of vitamin A in intervention villages and 36 percent in control villages. Vegetables, roots and tubers contributed 19 percent in intervention villages and 26 percent in control villages. Overall, sorghum and animal-source food items contributed 9 and 8 percent, respectively, of vitamin A in intervention villages, and similar percentages in control villages.

Mothers from intervention villages had higher energy and protein intakes in both seasons than mothers from control villages. Surprisingly, the difference in energy intakes was similar in both the summer season

Table 6.4 Nutrient intakes of Dalit mothers in intervention and control villages, by season

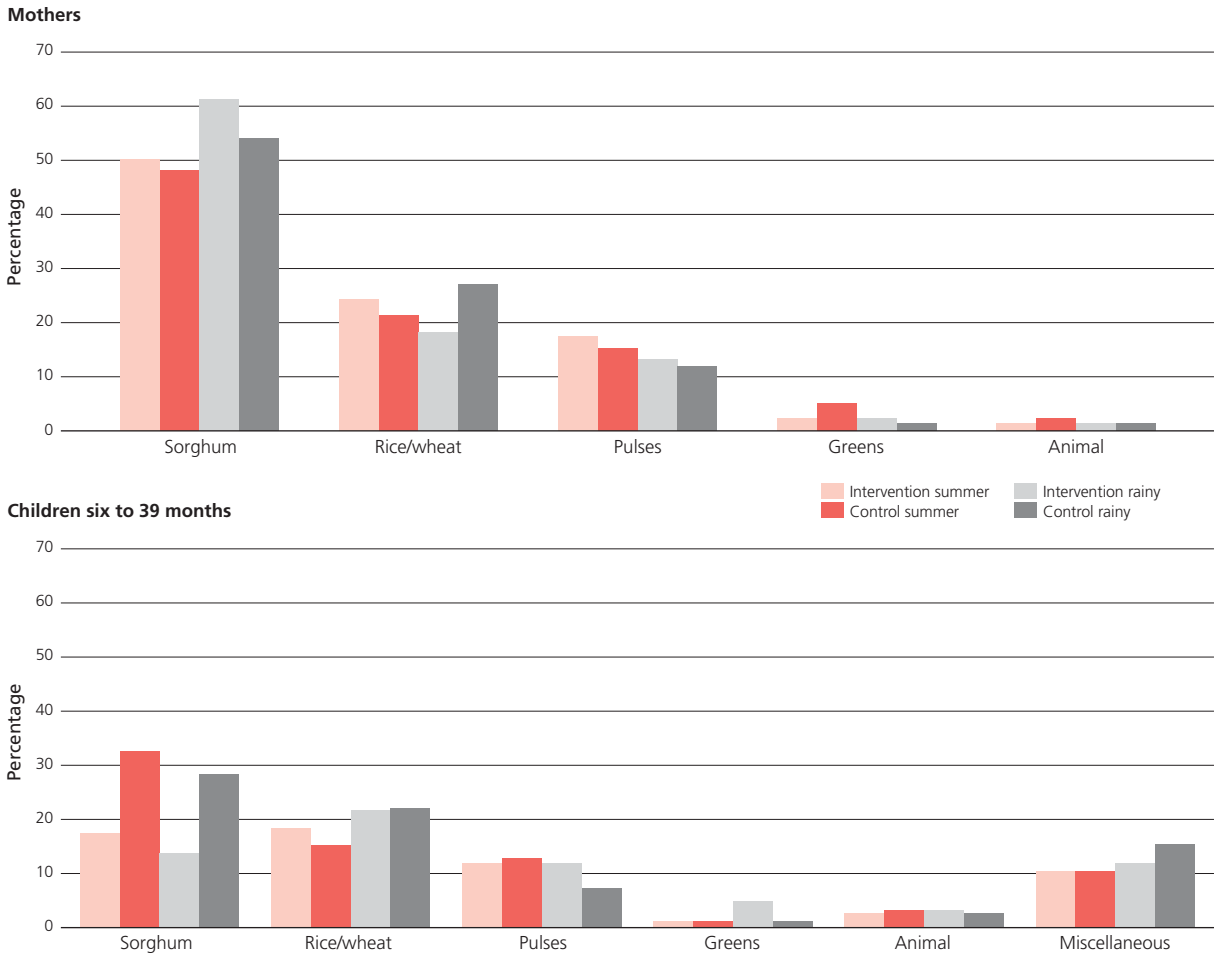
	Summer season			*Rainy season*		
Nutrient	**Intervention villages** *(n = 125)*	**Control villages** *(n = 109)*	***p***	**Intervention villages** *(n = 124)*	**Control villages** *(n = 96)*	***p***
Energy, kJ[a]	12 218 (3 511)	11 155 (3 347)	0.02[b, c]	11 189 (3 335)	10 193 (3 738)	0.04[b, c]
	11 437	11 117		10 769	10 038	
	(9 941 14 713)	(9 173 13 663)		(8 623 12 986)	(7 850 12 432)	
Protein, g[a]	77.5 (25.1)	71.1 (25.2)	0.05[b, c]	68.9 (22.6)	60.4 (23.8)	< 0.01[b, c]
	74.8	69.5		66.4	61.8	
	(60.2 98.6)	(50.5 87.8)		(53.5 82.2)	(42.6 75.2)	
Carbohydrates, g	578 (175)	519 (170)	0.01[b, c]	535(162)	490 (191)	0.06[b]
	549	525		513	479	
	(467 705)	(416 636)		(425 626)	(384 606)	
Fat, g	31.6 (14.4)	32.9 (15.5)	0.54	27.1 (14.7)	24.6 (11.7)	0.36
	27.6	29.2		24.2	23.9	
	(21.2 37.6)	(22.7 40.2)		(17.1 33.9)	(17.9 28.3)	
Dietary fibre, g	48.5 (23.2)	42.0 (23.1)	0.03[c]	40.8 (19.6)	32.5 (19.3)	< 0.01[c]
	46.8	39.4		41.8	33.6	
	(32.6 60.1)	(22.5 54.8)		(25.9 52.6)	(16.0 46.3)	
Iron, mg[a]	20.8 (12.0)	18.8 (12.1)	0.09	15.8 (6.6)	13.7 (9.1)	< 0.01[c]
	18.9	16.5		15.3	13.0	
	(13.0 24.5)	(12.1 22.4)		(10.8 20.5)	(7.6 18.2)	
Vitamin C, mg[a]	26.4 (31.0)	33.0 (66.4)	0.91	19.7 (35.5)	21.7 (26.1)	0.04[c]
	15.4	12.4		8.3	11.0	
	(2.1 38.9)	(2.3 33.6)		(2.1 22.1)	(4.2 31.4)	
Vitamin A, µg RE[a, d]	354 (629)	275 (503)	0.42	155 (271)	163 (250)	0.65
	110	103		73	75	
	(54 423)	(53 376)		(48 137)	(49 146)	

Figures are means with SDs in brackets, or medians with first and third quartiles in brackets. Non-parametric test (Wilcoxon).
[a] Recommended levels for pregnant and lactating women with moderate activity level, respectively (26): energy – 10 517 kJ, 10 937 kJ; protein – 60 g, 63 g; iron – 37 mg, 30 mg; vitamin C – 40 mg, 80 mg; vitamin A – 600 µg RE, 950 µg RE.
[b] *p* from two-sample pooled Student t-test.
[c] $p \leq 0.05$ statistically significant, all nutrient intakes (expect vitamin C) are higher ($p \leq 0.05$) in the summer season than the rainy season: intervention villages – summer season (17), rainy season (11); control villages – summer season (11), rainy season (12) repeated 24-hour recall.
[d] 1µg retinol = 1µg RE, 6 µg provitamin A carotenoids = 1µg RE.
Source: adapted from Schmid *et al.*, 2007.

and the rainy season, perhaps because in both seasons more mothers in the intervention villages were pregnant. According to 1993/1994 data from the National Sample Survey, about 80 percent of India's rural population had energy intakes below the 10 080 kJ recommended for adults in rural areas. The poorest 30 percent of India's population consumed on average less than 7 140 kJ per day, and the poorest 10 percent less than 5 460 kJ (Measham and Chatterjee, 1999). In this study of the poorest segment of rural Dalit communities, mean energy intakes in both seasons and both groups were higher than 10 000 kJ, indicating the better provision of food sources in settings where poor rural women control their own agricultural production.

It was assumed that the activity levels of mothers in all villages were sedentary during the summer season, when labour demand was low. During the rainy season, mothers who were working as agricultural labourers

Figure 6.2 Percentages of total iron intake in Dalit mothers and children from intervention and control villages and by season



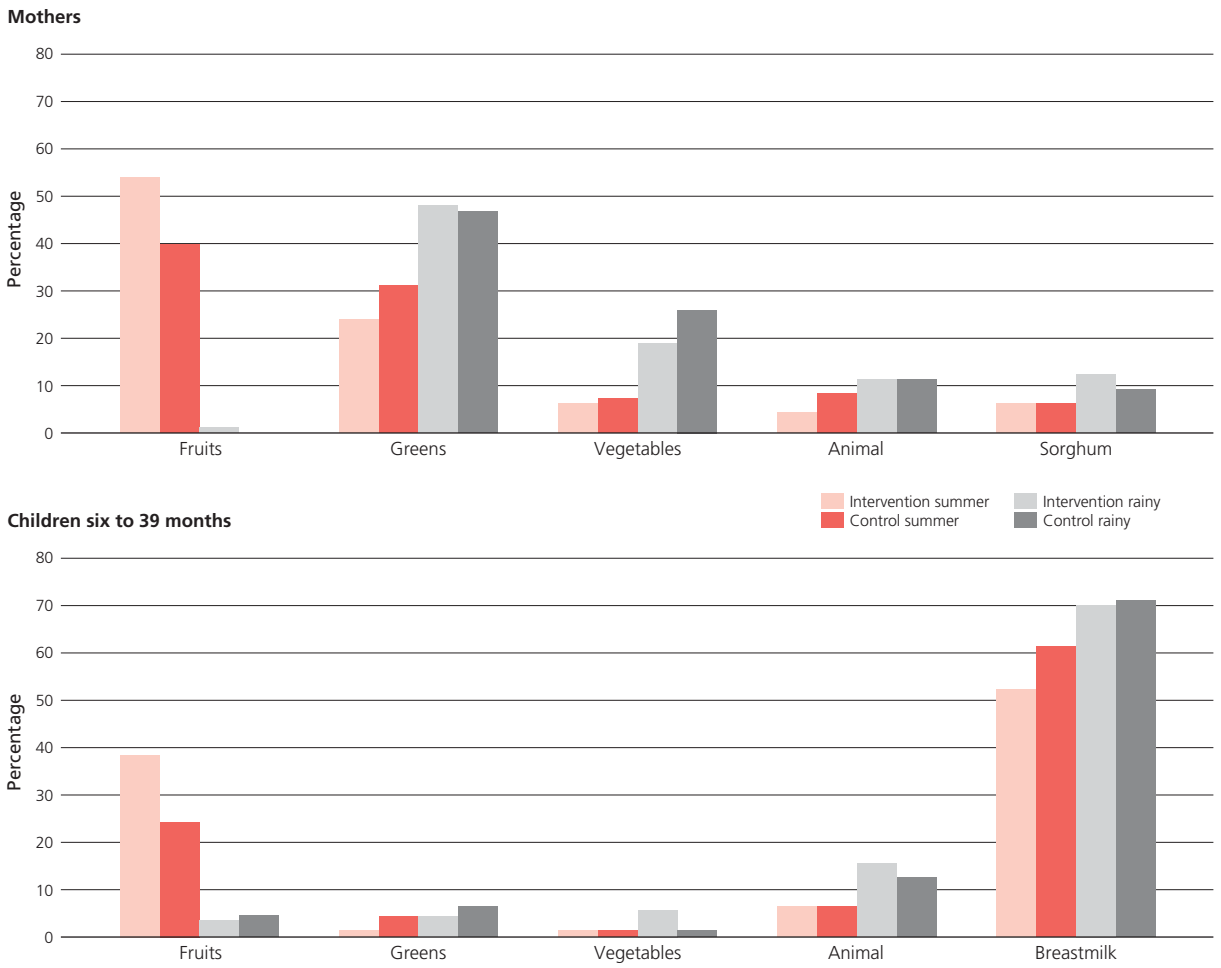
Pulses: chickpea, black gram, green gram, *khesaridal*, lentil, pigeon pea, dry pea; ***greens:*** nine species of cultivated and seven of uncultivated green leafy vegetables; ***animal:*** eggs, five species of meat, milk and milk products; ***miscellaneous:*** jaggery, white bread/bun, iron-fortified biscuits, iron-fortified babyfood (Cerelac®, Boost®) and local nutritional supplement (corn-soya blend).

Source: Adapted from Schmid *et al.*, 2007.

were classified as moderately active. According to the Indian recommended dietary allowance (RDA), the energy requirement of an average Indian woman (weighing 45 kg and aged between 18 and 30 years) increases by approximately 1 500 kJ/day with moderate activity level, to reach 9 257 kJ, compared with the 7 792 kJ of sedentary women (ICMR, 1990). For both groups of women in the study, mean energy intake surpassed that calculated for the moderate activity level.

The Indian adult requirement for protein is 1.0 g/day per kilogram of body weight, with an additional 15 g during pregnancy and 18 g during lactation, to give average standard requirements of 60 g of protein for pregnant and 63 g for lactating women (ICMR, 1990). In this study, mean protein intakes in the intervention and control groups were greater than 60 g in both seasons. According to Gopalan *et al.* (1989), the majority of Indians obtain 70 to 80 percent of daily energy needs and more than 50 percent of daily protein needs from cereals; intakes of cereals tend to be highest in low-income families. Marginal-farmer households in rural India are reported to obtain 72

Figure 6.3 Percentages of total vitamin A intake in Dalit mothers and children from intervention and control villages and by season



Fruits: banana, grapes, mango, mulberry, orange, guava, lime and papaya; ***greens:*** nine species of cultivated and seven of uncultivated green leafy vegetables; ***vegetables:*** 20 species of vegetables, roots and tubers; ***animal:*** eggs, five species of meat, milk and milk products.

Source: Adapted from Schmid *et al.*, 2007.

percent of energy and 68 percent of protein from cereals, which are similar to the findings of this study, but only 4 percent of energy and 10 percent of protein from pulses, which are lower than this study's findings (FAO, 2002). This too demonstrates the relatively higher quality of the diet of impoverished Dalit Indian women.

India's iron RDAs are 30 mg for lactating and non-lactating women and 37 mg for pregnant women, based on an average absorption rate of 3 percent (ICMR, 1990). In North America, the estimated average requirements for women aged 19 to 30 years are 8.1 mg for non-lactating women, 6.5 mg for lactating women and 22 mg for pregnant women, based on an absorption rate of 18 percent (Food and Nutrition Board Institute of Medicine, 2001). In this study, mothers from all villages had median intakes of less than 20 mg of iron in both seasons. Although cereals are not rich sources of iron, they are important contributors when they are consumed regularly. Mothers from intervention villages consumed more iron and dietary fibre during the rainy season, probably

Table 6.5 Characteristics of Dalit children aged six to 39 months in intervention and control villages

Variable	*Description*	*Intervention villages* (*n = 124*)	*Control villages* (*n = 96*)	*p*
Gender	Female	60 (48%)	50 (52%)	0.59
	Male	64 (52%)	46 (48%)	
Birth order	First	40 (32%)	36 (37%)	0.48
	Second	38 (31%)	34 (35%)	
	Third	25 (20%)	14 (15%)	
	≥ Fourth	21 (17%)	12 (13%)	
Nutrient supplement in 2003[a]	Yes	51 (39%)	41 (41%)	0.67
	No	80 (61%)	60 (59%)	
Vitamin A supplement since birth[b]	1–4 times	58 (44%)	53 (48%)	0.22
	No	73 (56%)	48 (52%)	
De-worming tablet since birth	Yes	12 (9%)	2 (2%)	0.03[c]
	No	119 (91%)	99 (98%)	
		Summer season		
		(n = 125)	*(n = 108)*	
Age	6–12 months	47 (38%)	39 (36%)	0.57
	13–24 months	46 (37%)	46 (43%)	
	25–39 months	32 (27%)	23 (21%)	
Feeding status	Breastfed	27 (22%)	31 (28%)	0.25
	Complementary fed	70 (56%)	56 (52%)	
	Weaned	28 (22%)	21 (20%)	
		Rainy season		
		(n = 124)	*(n = 96)*	
Age	6–12 months	30 (24%)	23 (24%)	0.20
	13–24 months	41 (33%)	42 (44%)	
	25–39 months	53 (43%)	31 (32%)	
Feeding status	Breastfed	12 (9%)	8 (8%)	0.62
	Complementary fed	74 (60%)	60 (63%)	
	Weaned	38 (31%)	28 (29%)	

Figures are counts with percentages of n in brackets. Chi-square test.
[a] Corn-soya blend and muruku (enriched chickpea flour).
[b] Vitamin A Prophylaxis Programme for children aged six to 36 months: six monthly doses of 100 000 IUs of vitamin A for infants and 200 000 IUs for young children.
[c] $p \leq 0.05$ statistically significant.
Source: Adapted from Schmid *et al.*, 2007.

because of frequent sorghum consumption. However, pulses, rice and grains are also rich in phytates and tannins, which interfere with iron availability. Vitamin C may enhance availability, but median vitamin C intakes in the study were less than 15 mg, which is lower than the Indian RDAs of 40 mg for non-lactating and pregnant women and 80 mg for lactating women (ICMR, 1990).

The Indian RDAs for vitamin A are 600 µg RE for non-lactating and pregnant women and 950 µg RE for lactating women (ICMR, 1990). Median vitamin A intakes for all mothers in the study were below these recommendations during both seasons, and fat intakes were fairly limited (at approximately 10 percent of total energy). During the rainy season, green leafy vegetables provided half of the vitamin A

for mothers, mainly from uncultivated greens, especially in intervention villages. In a study of rural Andhra Pradesh (National Nutrition Monitoring Bureau, 2002), sedentary lactating women aged ≥ 18 years had lower mean energy (9 131 kJ), mean protein (50 g) and median iron (8.9 mg) intakes than those observed in this study. However, median fat (25.6 g) and vitamin A (106 µg) intakes were similar, and vitamin C intake (22 mg) was higher. In India (FAO, 2002), adults in marginal-farming households (with 0.5 to 1 acre/0.2 to 0.4 ha) were reported to have lower energy (9 500 kJ) and protein (59 g) intakes and a similar fat (33 g) intake compared with those reported in the current study.

Children's dietary intake

The characteristics of children in intervention and control villages (Table 6.5) were similar. Most were either the first- or second-born in their families, and were given complementary foods. About half received vitamin A drops at least once. More children in intervention than control villages were given de-worming tablets at least once.

Similar amounts of energy, protein, carbohydrate, fat, dietary fibre, iron, vitamin C and vitamin A were consumed by children in both intervention and control villages in both seasons (Table 6.6). These children had higher dietary fat, vitamin C and vitamin A intakes relative to requirements than their mothers. For all children, in both seasons, approximately 23 percent of energy came from fat. Among children in the intervention group, intakes of protein ($p \leq 0.04$), dietary fibre ($p \leq 0.05$) and iron ($p \leq 0.05$) were significantly higher during the rainy season, and vitamin A intake ($p \leq 0.02$) was higher during the summer season. In the control group, energy ($p \leq 0.01$), protein ($p \leq 0.01$), carbohydrate ($p \leq 0.01$), dietary fibre ($p \leq 0.01$) and iron ($p \leq 0.01$) intakes were higher during the rainy season.

Overall, in intervention villages, breastmilk, rice and pulses contributed 34, 33 and 5 percent, respectively, of total energy intake, and 29, 28 and 14 percent of total protein intake. Percentages were similar in control villages (data not shown). Sorghum, rice and pulses provided most dietary iron (Figure 6.2). Miscellaneous food (including iron-fortified baby food) and animal-source food items contributed about 13 and 4 percent, respectively, of iron intake in both intervention and control villages. During the rainy season, sorghum contributed 41 percent of iron intake in intervention villages and 34 percent in control villages; cultivated and uncultivated green leafy vegetables contributed 6 percent of vitamin C in both groups. Breastmilk was the primary source of vitamin C, contributing about 70 percent in both groups.

Breastmilk, fruits and animal foods were main vitamin A sources for children aged six to 39 months (Figure 6.3). Overall, breastmilk and animal food contributed 61 and 11 percent, respectively, of vitamin A intake in intervention villages, and similar percentages in control villages. Sorghum contributed approximately 1 percent of vitamin A in both groups. During the summer season, fruits contributed 38 percent of vitamin A in intervention villages and 24 percent in control villages. During the rainy season, vegetables, roots and tubers contributed 5 percent of vitamin A in children from intervention villages.

Continued breastfeeding with delayed initiation of complementary feeding is common practice in India. In this study, 75 percent of all children aged six to 39 months were breastfed either exclusively or in combination with complementary food. In the summer season, more than half of the children aged six to 12 months had not yet begun to consume complementary food. Limited supplementation programmes distributing enriched flour, iron-folic tablets, iodized salt and vitamin A drops reached fewer than half of the rural Dalit families in this study.

Requirements for Indian children aged one to three years are estimated to be 5 208 kJ/day of energy and 21 g/day of protein (ICMR, 1990). In this study, 37 percent of children in the summer season and 24 percent in the rainy season were under one year of age, and their energy and protein intakes were below recommendations. Indian dietary standards recommend that young children aged one to three years have an iron intake of 11.5 mg/day (ICMR, 1990); the median

Table 6.6 Nutrient intakes of Dalit children aged six to 39 months from intervention and control villages, by season

	Summer season			*Rainy season*		
Nutrient	**Intervention villages** *(n = 125)*	**Control villages** *(n = 108)*	***p***	**Intervention villages** *(n = 124)*	**Control villages** *(n = 96)*	***p***
Energy, kJ[a]	3 003 (1 625)	2 646 (1 449)	0.17	3 356 (1 856)	3 230 (1 491)	0.90
	2 780	2 352		2 881	2 940[b]	
	(1 365 4 166)	(1 365 3 734)		(1 835 4 670)	(1 953 4 200)	
Protein, g[a]	15.4 (10.8)	13.9 (10.0)	0.24	18.5 (12.4)	17.2 (10.0)	0.90
	12.0	10.1		14.6[b]	15.5[b]	
	(5.5 22.9)	(5.5 21.6)		(7.8 26.2)	(8.8 22.5)	
Carbohydrates, g	121 (84)	99 (72)	0.06	139 (95)	131 (76)	0.99
	101	78		117	117[b]	
	(37 191)	(35 154)		(58 204)	(67 189)	
Fat, g	17.5 (6.7)	17.7 (6.1)	0.87	17.9 (7.2)	17.9 (6.5)	0.62
	17.0	17.0		17.1	17.8	
	(14.6 20.1)	(14.6 20.0)		(13.7 21.2)	(15.0 21.0)	
Dietary fibre, g	4.7 (6.5)	4.0 (5.7)	0.20	6.7 (8.7)	5.6 (6.8)	0.81
	1.7	0.8		3.4[b]	2.7[b]	
	(0.1 7.4)	(0 6.5)		(0.4 10.6)	(0.5 10.2)	
Iron, mg[a]	2.8 (3.4)	2.5 (3.5)	0.19	3.4 (3.4)	3.3 (4.1)	0.86
	1.5	1.0		2.3[b]	2.2[b]	
	(0.3 4.2)	(0.2 3.9)		(0.7 5.0)	(0.7 4.7)	
Vitamin C, mg[a]	22.8 (14.2)	23.0 (14.1)	0.82	21.4 (16.8)	20.4 (11.8)	0.97
	25.0	25.0		20.0	20.8	
	(17.5 25.0)	(15.5 25.0)		(17.5 25.0)	(17.0 25.0)	
Vitamin A, µg RE[a, c]	248 (229)	215 (172)	0.17	163 (86)	165 (93)	0.64
	205[b]	205		179	182	
	(146 216)	(145 205)		(120 206)	(132 205)	

Figures are means with SD in brackets, or medians with first and third quartiles in brackets. Non-parametric test (Wilcoxon).
[a] Recommended levels for boys and girls aged one to three years (26): energy – 5 208 kJ; protein – 21 g; iron – 11.5 mg; vitamin C – 25 mg; vitamin A – 400 µg RE.
[b] $p \leq 0.05$ statistically significant higher intake during the summer season or the rainy season within group. Breastmilk consumption standardized at 500 ml for children aged six to 12 months, 350 ml for children over 12 months (20): intervention villages – summer season (8), rainy season (11); control villages – summer season (5), rainy season (11) repeated 24-hour recall.
[c] 1µg retinol = 1µg RE, 6 µg provitamin A carotenoids = 1µg RE.
Source: Adapted from Schmid *et al.*, 2007.

intakes of iron for all the children in this study were well below this in both seasons. Most iron came from sorghum, rice and pulses. Sorghum is not recommended as a major food source for children because of its poor digestibility (McLean *et al.*, 1981). As median vitamin C intakes were similar to the Indian RDA of 25 mg/day (ICMR, 1990), it may be assumed that iron is absorbed. However, the Indian vitamin A RDA for children aged one to three years is 400 µg RE (ICMR, 1990), and median intakes in the study were less than 200 µg RE in the rainy season.

Limitations to the dietary evaluation in this study include likely overestimated intakes of vitamin A because, by necessity, they were derived from the values estimated by colorimetry representing the sum of total carotene, converted into β-carotene (no values

were available for α-carotene and β-cryptoxanthin). RE was used instead of the retinol activity equivalent recently recommended for Indian dietary analysis. The finding that the bioconversion of carotene from dark-green leafy vegetables is less than previously thought has raised doubts about the efficacy of green leafy vegetables in improving vitamin A status (Castenmiller and West, 1998); nevertheless, epidemiological evidence from India implies there is good bioavailability of dietary carotenoids, because vitamin A deficiency is rarely seen in communities where many carotene-rich foods are consumed (Tontisirin, Nantel and Bhattacharjee, 2002). In addition, although it is well established that 24-hour recalls are most appropriate for assessing average intakes of food and nutrients for large groups, vitamin A is not easily estimated from this technique (Food and Nutrition Board Institute of Medicine, 2001), nor are the nutrient intakes of young children (Gibson, 1990). A further limitation arises from the assumption that breastmilk intakes were standard for age, which reduced the true variance of nutrient intakes and may have limited the validity of comparisons, particularly in children in the younger age groups.

Mothers' health

The average age of the mothers was 24.3 years (SD = 3.9) (Table 6.7). Some 16 percent of the mothers were less than 145 cm in height, and mean BMI was slightly below the cut-off point for a healthy body weight (BMI ≥ 18.5 kg/m²) (James, Ferro-Luzzi and Waterlow, 1988). Overall, 58 percent of mothers were classified as having CED, and 10 percent of these were classified as severely malnourished (BMI < 16 kg/m²); 1 percent were classified as overweight (BMI ≥ 25 kg/m²). The majority of women were illiterate (78.6 percent), used open field toilets (94.1 percent), and were lactating at the time of the study (80.9 percent). In addition, 41.4 percent of the women had a household income below the poverty line. The majority of women were characterized as moderately active owing to their work in agricultural fields (70.9 percent). Literate women were less likely to use an open field toilet and be characterized as active than illiterate women were (Fisher's exact test, $p \leq 0.01$).

In evaluating CED (Table 6.8), mothers with only one child under five years of age had a 45 percent greater risk of CED than those with two or more children under five (rate ratio [RR] = 1.45, $p \leq 0.05$); and mothers without sanitation in their homes had a fourfold greater risk (RR = 4.1, $p \leq 0.05$) of CED. Illiterate and active women were more likely to have CED than literate and non-active women (RR = 1.6 and 1.4, respectively, $p \leq 0.05$), but literacy and activity level were not significant in multivariate analyses including sanitation and number of children under five years of age (not shown). Increasing levels of fat as a percentage of total energy were significantly associated with lower risk of CED (the RR of the lowest 25th percentile compared with that of the 75th percentile or above was 1.6, $p \leq 0.05$); these findings remained significant in multivariate analyses. Intake of pulses (g/day) was also inversely related to CED in univariate and multivariate analyses. Carbohydrate as a percentage of total energy was inversely related to percentage of energy from fat (RR = - 0.96, $p \leq 0.010$), and although positively related to CED in univariate analyses, carbohydrate consumption was not significant in multivariate analyses. Vegetable, root and tuber consumption was inversely related to CED in analyses adjusting for sanitation, having children under five years of age, and pulse intake (g/day) ($p \leq 0.05$). As consumption of vegetables, roots and tubers was significantly related to fat intake, these two variables were not considered in the same model. Intake of pulses (g/day) was highly related to energy intake (RR = 0.48, $p \leq 0.001$). Mothers' total energy intake, age, physiological status and income level were not related to CED in univariate or multivariate analyses. There was too little variability in the percentage of energy from protein to evaluate this variable as a determinant of CED (i.e., the 25th percentile was 9.8 and the 75th percentile 10.9).

At the time of the survey, 16 percent of mothers were suffering from one or more signs of clinical vitamin A deficiency, including night blindness, Bitot's spot and conjunctival xerosis (Table 6.3). Mothers'

Table 6.7 Characteristics of Dalit mothers in intervention and control villages

Variable	*Description*	*Intervention villages* (*n* = 124)	*Control villages* (*n* = 96)	*p*
Age	Years (SD)	24.5 (4.1)	24.0 (3.5)	0.30[a]
Total children per mother	1–2	74 (60%)	67 (70%)	0.30
	3–4	43 (34%)	25 (26%)	
	> 4	7 (6%)	4 (4%)	
Illiterate	Yes	101 (81%)	72 (75%)	0.25
	No	23 (19%)	24 (25%)	
Nutrient supplement in 2003[b]	Yes	51 (41%)	42 (44%)	0.70
	No	73 (59%)	54 (56%)	
Iron-folic tablet in 2003	Yes	28 (23%)	18 (19%)	0.49
	No	96 (77%)	78 (81%)	
Iodized salt usage	Yes	19 (15%)	17 (18%)	0.64
	No	105 (85%)	79 (82%)	
		Summer season		
		(n = 125)	*(n = 109)*	
Physiological status	Non-lactating, non-pregnant	13 (10%)	9 (8%)	0.30
	Lactating	96 (77%)	92 (85%)	
	Pregnant	6 (5%)	1 (1%)	
	Pregnant and lactating	10 (8%)	7 (6%)	
		Rainy season		
		(n = 124)	*(n = 96)*	
Physiological status	Non-lactating, non-pregnant	13 (10%)	14 (15%)	0.19
	Lactating	100 (81%)	78 (81%)	
	Pregnant	7 (6%)	1 (1%)	
	Pregnant and lactating	3 (2%)	3 (3%)	
Work as daily labourer	Yes	100 (81%)	55 (57%)	< 0.001[c]
	No	24 (19%)	41 (43%)	
BMI[d]	Body weight (kg)/height (m)^2	18.2 (2.0)	18.3 (2.3)	0.71[c]
		Both Seasons		
		(n = 140)	*(n = 114)*	
Participated in both seasons	Yes	110 (79%)	91 (80%)	0.81
	No	30 (21%)	23 (20%)	

Figures are counts with percentages of n in brackets, or means with SDs in brackets. Chi-square test.
[a] *p* from two-sample pooled Student t-test.
[b] Corn-soya blend and *muruku* (enriched chickpea flour).
[c] $p \leq 0.05$ statistically significant.
[d] Pregnant women were excluded: experimental villages n = 114; control villages, n = 91.
Source: Adapted from Schmid *et al.*, 2007.

age in years and income were positively related to these signs of vitamin A deficiency, with 20 percent of women with incomes above the poverty line having symptoms, compared with 11.0 percent of women below the poverty line (X^2, $p = 0.07$), a difference that became significant in multivariate analyses including the mother's age (Table 6.8). Mothers' physiological status (lactating, pregnant or neither), activity level, number of children under five years of age, sanitation conditions and literacy were unrelated to vitamin A

Table 6.8 Prevalence, RRs and adjusted ORs of correlates of CED and vitamin A deficiency symptoms in Dalit mothers

Variable	*Category*	*No.*	*%*	*RR*	*Adjusted OR (95% CI)*
Chronic energy deficiency (BMI < 18.5 kg/m²)					
No. of children ≤ 5 years of age[a]	1	139	64	1.5[b]	2.54 (1.39–4.99)
	> 2	61	44	1.0	
Open field toilet[a]	Yes	194	61	4.1[b]	7.99 (1.66–38.81)
	No	13	15	1.0	
Fat intake[a]	% of energy				
	< 25th percentile	51	75	1.6[b]	2.97 (1.19–7.42)
	26th–74th percentile	104	54	1.1	0.99 (0.47–2.11)
	> 75th percentile	51	47	1.0	
Vegetables, roots and tubers[c]	Days/season	207	-	-	0.99 (0.98–0.99)
Pulses[a.,d]	g/day	207	-	-	0.99 (0.98–0.99)
Clinical vitamin A deficiency[e]					
Age[f]	Years	220	-	-	1.12 (1.02–1.23)
Income > poverty line of INR 1 000/month[f]	Yes	91	20	1.8	2.41 (1.02–5.20)
	Below	129	11		
Sorghum consumption[f]	g/day	208	-	-	0.99 (0.99–0.99)
Dairy[g. h]	Low, intermediate, high	220	-	-	0.69 (0.42–1.12)
Night blindness during past pregnancy					
Dairy[g]	Low	56	42.9	2.0[b]	2.74 (1.26–5.94)
	Intermediate	94	39.4	1.8[b]	2.38 (1.18–4.82)
	High	70	21.4	1.0	1.0

[a] Model includes number of children up to five years of age (one or more), sanitation situation (open field or toilet), fat intake and intake of pulses.
[b] $p \leq 05$.
[c] Includes 20 species of vegetables, roots and tubers (green leafy vegetables excluded).
[d] Includes seven pulses: chickpea, black gram, green gram, *khesaridal*, lentil, pigeon pea and dry pea.
[e] Bitot's spot, conjunctival xerosis and/or night blindness.
[f] Model includes age, income (above or below the poverty line) and sorghum intake.
[g] Includes eggs, cow and buffalo milk, curd, butter milk and ghee.
[h] Model includes age, income (above or below the poverty line) and dairy intake.
Source: Adapted from Schmid *et al.*, 2007.

deficiency in univariate and multivariate analyses. Analyses with dietary exposure showed that sorghum consumption was significantly and inversely related to vitamin A deficiency (β = -.004, SE =.002, p =.04), and the consumption of dairy products (coded as low, intermediate or high consumption of eggs, cow and buffalo milk, curd and ghee) was protective (but not statistically significant) against it (β = - 0.420, SE = 0.257, p = 0.10) in analyses adjusting for mother's age and income level. Sorghum consumption was also positively related to iron intake (RR = 0.49, $p \leq$ 0.001), and iron intake was positively related to intake of vitamin A (RR = 0.34, $p < 0.001$) and vitamin C (RR = 0.53, $p \leq 0.001$) (not shown). No nutritional variables other than sorghum and dairy products were significant or of border-line significance in univariate or multivariate analyses.

Approximately one-third (35 percent) of the women reported having experienced symptoms of night blindness during their pregnancies. Of these, 75 percent said it occurred in the last trimester. This is of concern given the WHO recommendation that a prevalence

of 5 percent of pregnant women with night blindness be considered of public health significance (Christian, 2002).

Mothers' age was positively related to night blindness during pregnancy, and consumption of eggs, milk and milk products was negatively associated. Women consuming low, intermediate or high amounts of dairy products had prevalence rates of night blindness during pregnancy of 42.9, 39.4 and 21.4 percent, respectively (providing RRs of 2.0 and 1.8, with the highest consumption group serving as the referent). These findings were significant in age-adjusted analyses (Table 6.8). No other nutritional variables were identified as significant determinants of night blindness during pregnancy.

Some 10 percent of women were classified as iron-deficient, based on pallor under the eyelid (Table 6.3). In univariate analyses, income, physiological status, literacy, activity level and number of children under five years of age were not significantly related to iron status. In multivariate analyses, mothers' age in years ($\beta = 0.18$, SE = 0.06, $p \leq 0.01$), physiological status ($\beta = 2.5$, SE = 1.3, $p \leq 0.05$) and activity level ($\beta = -1.1$, SE = 0.58, $p \leq 0.06$) were determinants of iron deficiency. No nutritional variables were identified as determinants of iron deficiency.

Correlates of diet with women's health

After controlling for important correlates of CED, including age, and adjusting for number of children under five years of age and sanitation situation, women's intake of traditional food (fat, pulses, and vegetables, roots and tubers) showed protective associations against CED. Paradoxically, women with only one child had higher prevalence of CED, perhaps reflecting higher infertility in the most malnourished women.

Women's consumption of sorghum showed protective association for clinical vitamin A deficiency symptoms after adjusting for age and income. This may be because sorghum (as *roti*) is consumed with vegetables and fat. Mothers with higher fat and pulse intakes and more frequent consumption of vegetables, roots and tubers had odds ratios (ORs) below 1 for CED.

For women during their last pregnancy and at the time of the survey, higher consumption of dairy products (buffalo and cow milk, curd and buttermilk) was protective against occurrence of night blindness, and no other variables were significant. The percentages of mothers suffering night blindness, Bitot's spot and/or conjunctival xerosis at the time of the survey, and especially the prevalence of night blindness during the last pregnancy, were higher than those reported in other Indian data (ICMR, 1990).

Other studies have shown that consumption of traditional foods improves vitamin A status. Among Bangladeshi men with low vitamin A diets, daily consumption of cooked and pureed Indian spinach (*Basella alba*) had a positive effect on vitamin A stores (Haskell *et al.*, 2004). In this study of Dalit women, the amount of sorghum consumed every day was negatively associated with clinical vitamin A deficiency symptoms; and low frequencies of egg, milk and milk product consumption were positively associated with night blindness during pregnancy. The surprising finding that mothers from households with incomes above the poverty line were at greater risk of clinical vitamin A deficiency than those with lower incomes may be explained by the higher-income households' lower intakes of traditional foods such as sorghum and the green vegetable dishes with which it is usually consumed.

WHO reported that 87 percent of pregnant women in India were suffering from iron deficiency in 1995 (WHO, 2000). Iron deficiency data distinguishing between moderate (7.0 to 9.9 g Hb/dl) and severe (< 7.0 g Hb/dl) deficiency reported prevalence rates in married or previously married rural women aged 15 to 45 years in Andhra Pradesh of 16 percent moderate deficiency and 2 percent severe, which were similar to findings from women in scheduled caste (IIPS and ORC Macro, 2000). The current study identified 10 percent of mothers as iron-deficient, using the subjective measure of eyelid pallor, but – as in other studies – this study was unable to support the hypothesis that nutritional variables are correlates of iron status.

Anthropometry and clinical data were collected during only the rainy season, whereas dietary data were

collected in both the summer season and the rainy season and averaged between the two for data analysis. Ideally, data on seasonal variations in women's health and diet would have been collected for all the three major seasons of the Dalit annual cycle in Medak District, and averaged to give an annual estimation. Despite this constraint, however, the finding that consumption of traditional dietary items has a positive effect during the season of greatest health risk is important.

Dalit women are probably the most disadvantaged of Indian adults. Prevalence rates of CED and night blindness during pregnancy were higher among Dalit mothers in rural Medak District than the national data reported for rural women from scheduled castes. However, the consumption of traditional Dalit food items – including sorghum, pulses, vegetables, roots, tubers, eggs, milk and milk products – was negatively associated with the prevalence of CED and clinical vitamin A deficiency symptoms in the women in this study. Mothers from APDS villages had higher energy, protein, dietary fibre and iron intakes than mothers from control villages. Mothers in all study villages had mean energy and protein intakes above, and median iron, vitamin C and vitamin A intakes below the recommendations, in both study seasons. Despite the assumed higher energy needs during the rainy season, energy and nutrient intakes were higher during the summer season, confirming that food is scarce during the rainy season. For mothers, traditional food items including sorghum, pulses and green leafy vegetables were major sources of energy, protein, iron, vitamin C and vitamin A. Uncultivated green leafy vegetables were a particularly important source of vitamin A in the intervention villages during the rainy season.

Children's health

Anthropometry and clinical signs of vitamin A and iron deficiency are summarized in Table 6.9. Based on the 1977 National Center for Health Statistics growth curves, mild and severe stunting were reported in more than 30 percent of children; mild and severe wasting in more than 50 percent; and underweight in about two-thirds (National Center for Health Statistics, 1977). Clinical signs of vitamin A deficiency were seen in 4 percent of children, and pallor in the lower eyelid in 8 percent. These measures were addressed with multivariate models using the variables of interest for children shown in Table 6.2. ORs for the determinants of stunting, wasting, underweight and iron deficiency (pallor) are shown in Table 6.10. Children aged 25 to 39 months were at highest risk of stunting, followed by those aged 13 to 24 months, who were at greatest risk of underweight. Young boys were at higher risk than young girls. Children in houses classified as "permanent" were at higher risk than those in traditional huts (with earthen floors and plant materials for walls and roofs). Exclusive breastfeeding after six months also presented higher risk of wasting and symptoms of iron deficiency (pallor) (Schmid, 2005).

From 1998 to 1999, the second National Family Health Survey collected data on nutritional status in Indian children aged six to 35 months (IIPS and ORC Macro, 2000). It reported slightly greater percentages of severe (24 percent) and mild (24 percent) stunting, and much lower percentages of severe (3 percent) and mild (13 percent) wasting than found by the current study. Another survey of children aged one to five years from scheduled castes in rural Andhra Pradesh (National Nutrition Monitoring Bureau, 2002) reported more severe stunting (26 percent) among children, but less severe underweight (23 percent) and severe wasting (3 percent). Similar proportions of children were reported stunted in the current and the Andhra Pradesh studies, but this study reported higher percentages of severely wasted and underweight children.

It is well established that the prevalence of stunting increases in children up to 24 or 36 months, and then tends to level off (WHO Working Group, 1986). In the Andhra Pradesh study, the proportion of children who were underweight (< 2 SD) increased rapidly with age from 12 to 23 months (IIPS and ORC Macro, 2000). This is reflected in the current study's findings, where the highest risk of stunting was in children aged 25 to 39 months and the highest risk of underweight in those aged 13 to 24 months.

Protein-energy malnutrition may result from not only poor food supply and early growth faltering,

Table 6.9 Anthropometric measurements and the prevalence of clinical vitamin A deficiency symptoms and iron deficiency (pallor) in Dalit children aged six to 39 months

Variable	*Description*	*Children* (*n* = 220)
Anthropometric measurement		
MUAC	> 13.5 cm	110 (50%)
	12.5–13.5 cm	76 (36%)
	< 12.5 cm	34 (15%)
Stunted*	Normal (≤ -2 SD height-for-age Z-scores)	148 (67%)
	Mild (> -2 SD height-for-age Z-scores)	44 (20%)
	Severe (> -3 SD height-for-age Z-scores)	28 (13%)
Wasted*	Normal (≤ -2 SD weight-for-height Z-scores)	105 (48%)
	Mild (> -2 SD weight-for-height Z-scores)	55 (25%)
	Severe (> -3 SD weight-for-height Z-scores)	59 (27%)
Underweight*	Normal (≤ -2 SD weight-for-age Z-scores)	81 (37%)
	Mild (> -2 SD weight-for-age Z-scores)	49 (22%)
	Severe (> -3 SD weight-for-age Z-scores)	90 (41%)
Clinical vitamin A deficiency		
None		212 (96%)
Night blindness (XN)	Reported	6 (3%)
Bitot's spot (X1B)	Examined	0 (0%)
Conjunctival xerosis (X1A)	Examined	2 (1%)
Iron deficiency	White (pallor)	18 (8%)
Inside lower eyelid	Pink	202 (92%)

Figures are counts with percentages in brackets from data collected during the rainy season of 2003.
* Based on 1977 NCHS growth curves.
Source: Adapted from Schmid *et al.*, 2007.

but also low birth weight, inappropriate feeding practices and high morbidity rates (Gopaldas, Patel and Bakshi, 1988; Bhandari *et al.*, 2001). In India, delayed introduction of complementary foods, the use of foods with low energy and nutrient density, small servings at meals, and food restrictions due to cultural beliefs are all common (Bhandari *et al.*, 2004). The study results show that predominantly breastfed children aged six months and more had higher risks of wasting and iron deficiency. It is suggested that other factors, including the availability of health care facilities and a protected water supply, personal hygiene and environmental sanitation are also important determinants of nutrition status in preschool children (Laxmaiah *et al.*, 2002). The study found that children living in permanent houses were at greater risk of stunting than those living in traditional huts. This surprising finding might be explained by the more frequent consumption of traditional foods such as sorghum, pulses and wild fruits by children living in rural households with incomes below the poverty line.

The National Nutrition Monitoring Bureau (2002) reported absence of night blindness in rural preschool children in Andhra Pradesh and prevalence rates of 0.2 percent for conjuctival xerosis and 0.7 percent for Bitot's spot. A survey conducted in five states reported prevalence of 0.7 to 2.2 percent for Bitot's spot in children aged six to 71 months. Night blindness was reported in 1.6 to 4.0 percent of children aged 24 to 71 months (Chakravarty and Sinha, 2002). The current study reported higher percentages of children with night blindness and conjunctival xerosis than those reported

Table 6.10 Adjusted ORs and 95 percent CIs of significant determinants for stunting, wasting, underweight and iron deficiency (pallor) in Dalit children aged six to 39 months

Variable	*Category*	*n = 220*	*%*	*OR (95% CI)*
Stunting (< 2SD height-for-age)				
Age group	6–12 months	53	8%	1.00 (reference)
	13–24 months	83	33%	8.46[a] (1.93–37.14)
	25–39 months	84	48%	23.86[b] (4.50–126.41)
Gender	Female	110	25%	1.00 (reference)
	Male	110	41%	2.10[a] (1.08–4.09)
Housing	Traditional hut	64	19%	1.00 (reference)
	Permanent house[c]	156	39%	2.43[a] (1.07–5.54)
Wasting (< 2SD weight-for-height)				
Duration of exclusive breastfeeding (including water)	≥ 6 months	156	58%	1.98[a] (1.00–3.90)
	< 6 months	64	39%	1.00 (reference)
Underweight (< 2SD weight-for-age)				
Age group	6–12 months	53	40%	1.00 (reference)
	13–24 months	83	80%	3.67[a] (1.12–12.03)
	25–39 months	84	62%	1.27 (0.31–5.18)
Energy intake	≥ 1 220 kcal/day	38	42%	1.00 (reference)
	< 1 220 kcal/day	182	68%	3.33[a] (1.13–9.85)
Iron deficiency (under eyelid pallor)				
Duration of exclusive breastfeeding (including water)	≥ 6 months	156	10%	10.16[a] (1.05–98.2)
	< 6 months	65	2%	1.00 (reference)

Stunting, wasting and underweight were calculated from the NCHS growth curves (1977). Nutrient intake and food frequency consumption were obtained during the rainy season of 2003.
[a] $p \leq 0.05$.
[b] $p \leq 0.01$.
[c] House with or without a permanent roof.
Source: Adapted from Schmid *et al.*, 2007.

for Andhra Pradesh, but its results were similar to those from other smaller studies. More than 50 percent of the children did not receive vitamin A supplementation, which is normally provided by the Indian Government, so breastmilk and complementary foods were the primary sources of vitamin A. The second National Family Health Survey (IIPS and ORC Macro, 2000) reported that 46 percent of Indian children aged six to 35 months were moderately and 5 percent severely iron-deficient. This study found 8 percent of children to be iron-deficient.

Young children in both APDS and control villages had median energy, protein, iron and vitamin A intakes that were below recommendations, putting them at risk of malnutrition. No differences were seen between the two groups. Breastmilk was a major source of energy, protein and vitamin A, and traditional food items, including sorghum and pulses, were important sources of energy, protein and iron.

Conclusions

This study examined the highly diverse food system of the Zaheerabad Dalit to identify its significance for Dalit women and children according to whether they were or were not participating in a food intervention programme that promoted knowledge about and use of local food systems. The great diversity of Dalit food systems in rural India has still to be studied and compared with non-Dalit food systems in the same

ecosystem, to develop understanding of and remedies for social injustice and disparities. In the meantime, existing studies already indicate the potential for improving health by promoting local traditional foods, as in the APDS applied by DDS.

The study found that traditional cultural food items were widely consumed and were the main sources of energy, protein, iron, vitamin C and vitamin A for both mothers and young children in all the study villages. However, mothers in APDS villages, which supported the traditional food system through the promotion of indigenous agricultural practices, had higher energy, protein and iron intakes than mothers in control villages. These findings provide evidence for evaluating, considering and promoting traditional food systems as a first step to increasing the intakes of critical nutrients in poor rural communities in India.

The prevalence rates of CED and night blindness during pregnancy were higher among Dalit mothers in rural Medak District than the national average reported for rural women from scheduled castes. The consumption of traditional food items including sorghum, pulses, vegetables, roots and tubers, eggs, milk and milk products was negatively associated with the prevalence of CED and clinical vitamin A deficiency symptoms in these women.

Severe stunting and wasting were important problems among preschool children and were found to be more prevalent than the usual for rural Andhra Pradesh. Above-recommended energy intakes were associated with lower prevalence of underweight among children. While there were no differences between children from intervention and control villages, the findings clearly show the importance of and potential for using the traditional food system and its dietary diversification to combat malnutrition.

When poor, rural Dalit mothers have access to agricultural land for home food production and to work as field labourers both they and their children have greater intakes of many foods that protect against chronic energy and protein deficiency and micronutrient deficiencies of vitamin A and iron. Sorghum, millet, wild fruits and uncultivated greens are of particular importance in this. These and many other foods –particularly those of animal source – in the traditional Dalit food system should be promoted to improve nutrition status. High frequencies of CED, night blindness and clinical vitamin A deficiency indicate a need for public health interventions for all Dalit women, which should include the promotion of locally available, traditional food for the women and their children

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Chapter 7

Gwich'in traditional food and health in Tetlit Zheh, Northwest Territories, Canada: phase II

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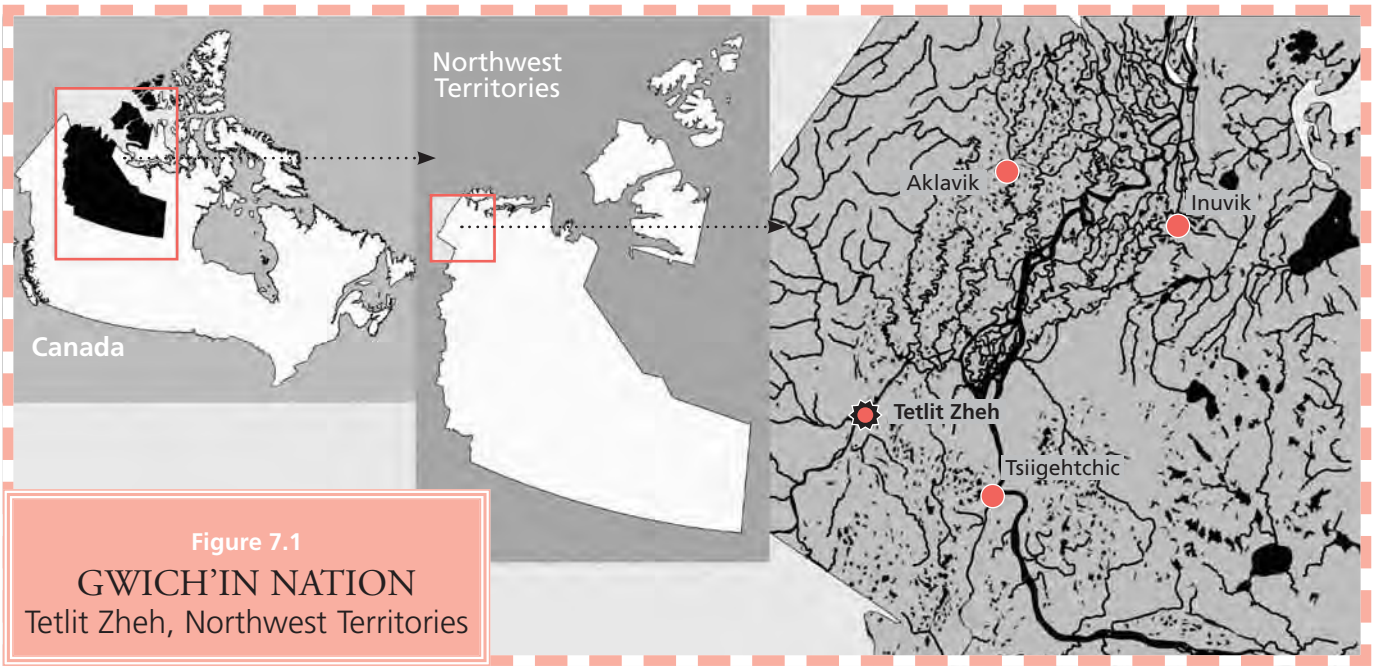

Figure 7.1
GWICH'IN NATION
Tetlit Zheh, Northwest Territories

Data from ESRI Global GIS, 2006.
Walter Hitschfield
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Key words > Indigenous Peoples, traditional food, Gwich'in, Dene Nation, First Nations, Northwest Territories, food security

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> “Through harvesting traditional foods you practise your culture and live your heritage.”
>
> Gwich’in community member

Abstract

The First Nations Gwich’in community of Tetlit Zheh in the Northwest Territories of Canada has been undergoing a nutrition transition. Studies conducted in the mid-1990s indicated that the majority of the Gwich’in diet consisted of store-bought (market) food, a high proportion of which was calorie-rich but nutrient-poor. As part of the Indigenous Peoples’ Food Systems for Health Program, Tetlit Zheh agreed to participate in activities to increase the consumption of traditional (local) food and healthier market food.

Pre-intervention assessment was carried out in winter (February to March) 2006 among youth aged ten to 15 years and young women aged 20 to 40 years. Compared with the overall Canadian population, data indicated a similar proportion of overweight/obese youth, but a greater proportion of overweight/obese women. Compared with overall Canadian youth, Tetlit Zheh youth spent similar amounts of their leisure time with television or computers. The majority of women were assessed as moderately active, and youth reported having participated in a wide range of physical activities throughout the year.

The most important traditional food species consumed by youth and women were caribou, moose and whitefish. The majority of both youth and women consumed at least one traditional food item regularly. Post-intervention activity assessments were not conducted because external forces precluded the documentation of behaviour and food consumption change.

Climate change and other factors that reduced access to traditional food species, and a sharp increase in market food and fuel prices (2008) were important challenges.

Introduction

Similar to many other indigenous groups worldwide, the Dene and Métis of northern Canada have witnessed many diverse changes in their recent history. Among the most dramatic have been transformations in their ecosystem, food use and lifestyle as they strive for a balance between traditional and modern practices. Before colonial contact, the Dene relied solely on traditional foods harvested from their local environment. Since the turn of the twentieth century, the overwhelming influence of the south has resulted in increased reliance on commercial market foods for Dene/Métis communities (Kuhnlein and Receveur, 1996; Receveur, Boulay and Kuhnlein, 1997; Kuhnlein *et al.*, 2004; Nakano *et al.*, 2005a; 2005b).

This nutrition transition has been marked by a well-documented loss of dietary quality among the Dene, as many market foods of relatively poor nutritional value are replacing nutrient-dense traditional foods (Receveur, Boulay and Kuhnlein, 1997; Kuhnlein *et al.*, 2004; Nakano *et al.*, 2005a; 2005b). Lifestyle patterns have also been interrupted, as many traditional methods of trapping, hunting and fishing are becoming less common. These rapid cultural changes have led to declining health status (Kuhnlein *et al.*, 2004). A sharp increase of many non-communicable diseases, including obesity, diabetes and cardiovascular disease, has emerged as a public health concern, with prevalence now disproportionately high among Canadian Indigenous Peoples compared with the national population (Health

Canada, 2001; 2003; Statistics Canada, 2003; First Nations Regional Longitudinal Health Survey, First Nations Centre, 2005).

At the same time, special concern has been expressed about climate change and its many effects on the quality of the local environment. In addition, elders have been concerned about a decrease in transmission to youth of traditional knowledge about the environment and how to use it effectively. Climate change has exacerbated the nutrition transition for Arctic peoples because it has a direct impact on the availability of local traditional food species. In 2004, the Canadian Government expressed the need for research on how climate change affects the sustainability, health, safety and food security of northern communities (Natural Resources Canada, 2004). Qualitative research among Inuit residing in Nunavik and Labrador documented potential direct and indirect climate-related health impacts. Inuit perceptions of climate-related health impacts were consistent with the Intergovernmental Panel on Climate Change Fourth Assessment Report and the Arctic Climate Impact Assessment, with additional insight into the negative impact of decreased access to traditional food on social and cultural values (Furgal and Seguin, 2006), and the need for coping and adaptation strategies. However, there has been little documentation on the impact of climate change and the adaptation to it by western Arctic Indigenous Peoples. Guyot *et al.* (2006) reported observations in two Yukon First Nations that demonstrated changes in water levels and species availability and the need to adopt new traditional food harvest strategies.

As the Dene continue to undergo cultural transformation, a balanced diet based on both traditional foods and healthy market foods will be important for supporting health. Lifestyles that incorporate physical activity also make significant contributions to well-being. Taking a proactive stance, the Dene have called for research to improve understanding of environmental change and to combat the negative effects of acculturation. This chapter addresses data, discussions and conclusions from the Gwich'in community of Tetlit Zheh of the Dene Nation.

Context

Totalling approximately 5 000 people, the Gwich'in First Nations live in communities across the northern interior of Alaska in the United States of America, and the Northwest Territories (NWT) and northern Yukon in Canada. The Gwich'in community of Tetlit Zheh (Fort McPherson) is located in the Gwich'in Settlement Area (Figure 7.1 on p. 102), which is on the east bank of the Peel River and in the Richardson Mountain range. Via the Dempster Highway, the community is accessible year round, apart from during the spring ice break-up and autumn freeze-up on the Peel and Mackenzie Rivers. About 800 people reside in Tetlit Zheh, and the majority are of indigenous descent. Community members continue to speak their traditional Gwich'in language dialect as well as English. The income of community residents has been documented as low, with an average family income of CAD 61 348 and 28.6 percent of households living on less than CAD 25 000 a year (NWT Bureau of Statistics, 2007). By contrast, during the same period, average family income in NWT – a region with high costs of living – was CAD 101 622, with 14.3 percent of families living on less than CAD 25 000. The Canadian average family income in 2007 was CAD 88 300.[1]

The Dene National Office and the Assembly of First Nations Regional Office are located in Yellowknife, NWT. The annual Dene National Assembly convenes Dene First Nations from the five regions of the Dene Nation: Akaitcho, Dehcho, Gwich'in, Sahtu and Tlicho. Concerns arising from land-use, resources, lifestyle and health issues have been addressed at annual assemblies.

As did all Dene, the Gwich'in traditionally led a nomadic subsistence lifestyle of hunting, fishing and gathering, which started to change in the mid-nineteenth century when a trading post was established. Small communities began to emerge, and the Gwich'in population settled year round in the 1960s. The Gwich'in retain extensive knowledge of their traditional food system, which consists of 75 to 100 species

[1] www.statcan.gc.ca/tables-tableaux/sum-som/l01/ind01/l3_3868_2812-eng.htm?hili_famil21.

of animals, fish and food plants. Approximately 60 percent of households in Tetlit Zheh were shown to consume most or all of their meat or fish as traditional food (NWT Bureau of Statistics, 2007). Of particular importance is the caribou subspecies, Porcupine caribou (*Rangifer tarandus granti*), which was recently documented as making significant contributions to the diet (Kuhnlein *et al.*, 2009).

Owing to southern influences, the majority of the Tetlit Gwich'in diet in recent years has been shown to consist of market food, with adults consuming an average of 33 percent of dietary energy as traditional food, and children aged ten to 12 years about 6 percent (Receveur, Boulay and Kuhnlein, 1997; Nakano *et al.*, 2005b). In 2006, two grocery stores in the community offered an array of food shipped from southern cities, including many convenient and processed options. Because of the high shipping costs, market food costs in Tetlit Zheh were more than 50 percent higher than in southern Canadian areas. In addition to the high costs, the lack of variety, availability and quality resulting from long-distance shipping can also be a barrier to purchasing food in northern communities (Ladouceur and Hill, 2001; Lawn and Harvey, 2001; 2003; 2004a; 2004b; Chan *et al.*, 2006; Skinner, Hanning and Tsuji, 2006).

Recently, the extreme escalation of food prices on global markets has exacerbated the high costs of purchased foods in northern Canada, and human rights aspects of the rising global food costs resulting from biofuel production and commodity and energy trading have been documented (FAO, 2008). The impact of surging food prices has forced millions of people into increased poverty and hunger, with the risk of health consequences, particularly for women and children (Shrimpton, Prudhon and Engesveen, 2009).

As traditional food use and lifestyle patterns decline, the Gwich'in are experiencing increases in many non-communicable health conditions influenced by suboptimal nutrition, as mirrored among other indigenous groups in northern Canada. Poor nutrition and high prevalence of obesity were also observed among northern indigenous children (Nakano *et al.*, 2005a).

Beginning in the mid-1990s, the Tetlit Gwich'in partnered the Centre for Indigenous Peoples' Nutrition and Environment (CINE) to research their traditional food system and the benefits and risks involved in consuming traditional foods (Kuhnlein *et al.*, 2006; 2004; Kuhnlein and Receveur, 2007; Lambden, Receveur and Kuhnlein, 2007; Lambden *et al.*, 2006; Receveur, Boulay and Kuhnlein, 1997; Receveur *et al.*, 1996). In 2000, this partnership continued with a study assessing dietary patterns among Dene children (Nakano *et al.*, 2005a; 2005b). In 2005, further cooperation led to Tetlit Zheh's participation in CINE's Indigenous Peoples' Food Systems for Health Program (FAO, 2009), which set in motion the project described in this chapter, with activities to promote health by improving access to traditional food and better-quality market food.

Objectives

The aim of the project reported in this chapter was to increase understanding of the food use and health status of the Tetlit Gwich'in and of how recent ecosystem changes have influenced access to traditional food. Activities were developed to increase awareness about local food resources, with particular focus on youth aged ten to 15 years and young women aged 20 to 40 years, as sentinels of the community's future.

In 2006, assessment of youth included measurement of anthropometry, physical activity and dietary parameters; assessment of women included measurement of anthropometry, physical activity, employment status, frequency of traditional food use, dietary self-efficacy, food security status and socio-cultural experiences, including food preferences and the accessibility/availability of food. Adult men and women were interviewed for their perceptions of the impacts of climate change on access to traditional food and of escalating food prices on access to healthy market food. All assessment activities were devised to enhance capacities and provide a foundation for community-driven activities to improve access to healthy food. A summary of results was returned to community leaders in June 2006, and suggestions for improving

the use of traditional food, promoting purchases of fruits, vegetables and healthy beverages, and increasing physical activity were discussed.

The original aim was to complete before-and-after assessments following a multi-activity intervention programme guided by the community. However, two formidable external factors precluded this: the impacts of climate change and other factors, which seriously reduced access to traditional food species; and the highly publicized steep increases in food and fuel prices in 2006 to 2008, due to global forces. Although several excellent education activities were delivered within Tetlit Zheh, the community agreed that post-intervention activity assessments would not be carried out, because programme impacts would be imperceptible in the face of these external factors. This chapter describes the findings from the pre-intervention assessment in 2006 and perceptions about the impacts of climate change and high food prices. It closes with a description and discussion of the education activities undertaken to date, and possibilities for the future.

Methods and measurements

The project was encouraged by the Dene Nation and approved by the Tetlit Zheh Council as part of the activities of the Tl'oondih Healing Society. Approval for the research was granted by the Human Research Ethics Committee of the Faculty of Agricultural and Environmental Sciences at McGill University, Montreal, Canada, and a research licence was obtained from the Aurora Research Institute at Aurora College in Inuvik, NWT. All subjects gave their informed consent to participate.

CINE researchers and local community organizations collaborated to collect data on anthropometric, dietary and health indices of women and youth during the winter (January to February) of 2006. All community-resident Gwich'in women aged 20 to 40 years and youth aged ten to 15 years were invited to participate. Women were asked to attend the assessment at the research station, and youth were evaluated at their schools.

The diets of women and youth were assessed using the 24-hour dietary recall research tool. Participants were asked to recall all the food items they had eaten during the previous 24 hours. Measurement aids included cups, plates, bowls and food models; local food products were used as references to facilitate the quantification of all food items. A second 24-hour recall was requested of all participants, but administered to only 20 percent of women and 89 percent of youth on non-consecutive days. When available, two recalls from one individual were averaged for analyses, to maximize the dietary information provided.

To assess micronutrient intake, youth were divided according to dietary reference intake (DRI) categories based on gender and age. Adjusted median micronutrient intake values were determined using the Beaton adjustment technique (Beaton *et al.*, 1979). Unadjusted median values were reported when the group's intra-individual variation was larger than the inter-group variation. Where adjusted median intakes were possible, nutrient intakes were compared with the corresponding estimated average requirement (EAR) and adequate intake (AI), to determine the percentage of individuals falling below recommendations. The mean micronutrient, energy and macronutrient intakes of traditional food consumers were compared with those of non-consumers as recorded in the 24-hour recalls. A participant was defined as a traditional food consumer if she/he had consumed any traditional food (excluding bannock) on at least one recall day. Wilcoxon rank tests were performed to analyse the differences between consumers of traditional food and consumers who did not mention traditional food in dietary recalls. The Wilcoxon test was used because it is non-parametric and does not require data to be normally distributed, and because there were small sample sizes in some groups. Food group servings were derived from 24-hour recalls recorded from individuals.

Women also completed a traditional food frequency questionnaire to assess the consumption of traditional foods over the previous three winter months of November, December and January, when the community's traditional food consumption is known to be at its lowest level. A total of 58 traditional food species, including fish and sea mammals, land animals, birds and plant species, and various animal

parts and organs, were included. The questionnaire asked participants to report the number of days each week that they had consumed the various traditional food items over the three months.

Different methods were used to assess the physical activity status of participating women and youth. Women's physical activity was measured with a modified version of the International Physical Activity Questionnaire (IPAQ, 2001; Craig *et al.*, 2003). Participants were asked to report the number of days in the last seven in which they had spent at least ten minutes being vigorously active, moderately active, walking and being sedentary, and how many minutes in one day they would spend on each of these activities. Based on these patterns, women were categorized into three levels of physical activity. Youth completed a physical activity questionnaire designed to capture their levels of activity and their television/video game/Internet habits (Adams *et al.*, 2005). Types of activity and frequencies were recorded.

Anthropometric and clinical measurements included height, weight, waist circumference, blood pressure and body composition. Appropriate cut-offs were determined for body mass index (BMI), waist circumference, percentage of body fat and blood pressure of women and youth. All measurements were conducted by a trained staff member. Height was measured using a portable height rod with a horizontal headboard attachment; participants removed their shoes and stood as tall and straight as possible, keeping their heads level and their shoulders and upper arms relaxed at their sides. Height was measured at the maximum point of inhalation, repeated three times to a precision of 0.1 cm.

Waist circumference was taken with a flexible tape measure after participants had removed loose and bulky clothing. Clothes pins secured their shirts for access to the abdominal area. Participants stood straight with their arms relaxed at their sides and their feet together. The measuring tape was looped around the participant's waist at the midpoint between the hip and the bottom of the rib cage. Three consecutive measures were taken at the end of normal exhalations, and recorded with a precision of 0.1 cm.

Both weight and body composition were measured with a Tanita Bioelectrical Impedance Scale. Bulky clothing, shoes and socks were removed and a clothing reference weight of 0.5 kg was entered for each subject and automatically subtracted to provide the body weight. Gender, age, height and a standard build reference were entered for subsequent body composition calculations.

Blood pressure was measured as mmHg with a mercury sphygmomanometer and stethoscope, after ensuring participants were relaxed. Outer and tight-fitting clothing around the arm was removed by the participant, and an appropriately sized cuff was wrapped around the upper arm. Three measurements were taken one minute apart, and recorded to the nearest 1 mmHg. As part of the clinical measures, a short (ten-item) questionnaire was used to create a five-point scale of women's self-perceived health status.

CINE researchers developed a socio-cultural questionnaire for gathering women's views on the general use, accessibility, advantages, preferences and health benefits of traditional and market foods. The food security status of participating women and their households was evaluated with the Food Security Survey Module designed by the United States Department of Agriculture (USDA) for the Food Mail Project (Bickel *et al.*, 2000; Lawn and Harvey, 2003). This 18-item questionnaire evaluates households' food security situation for the previous 12 months. By combining a ten-item scale to measure the experiences of adults in the household and an eight-item scale for children under 18 years of age, the questionnaire provides a single measurement of overall food security. Correlations between women's food security status and frequency of traditional food use and the access score derived from the socio-cultural questionnaires were evaluated.

Interviews on perceptions of the impacts of climate change on access to traditional and market foods were conducted with men and women from Dene First Nations communities attending the 38th Dene National Assembly held in Fort McPherson in July 2008, and in Yellowknife, NWT, the following month. The interviews used 15 open- and closed-ended questions

to explore whether individuals had enough traditional food, whether healthy foods could be purchased, and respondents' perceptions of how climate change and climate variation affected the use of traditional foods and people's health.

CANDAT (Godin London Inc., 2007) was used to assign nutrient values to all foods from the 24-hour recall data. Nutrient values for traditional foods were derived from a traditional Arctic food database created from laboratory analyses conducted over several years at CINE (Appavoo, Kubow and Kuhnlein, 1991; Kuhnlein *et al.*, 1994; 2002; 2006; Kuhnlein, 2001; Morrison and Kuhnlein, 1993).

There were no missing nutrient values in the foods included in the analyses. Anthropometric, clinical and interview data were analysed using SAS version 9.0 (SAS Institute Inc., 2003). A p-value of ≤ 0.05 was considered significant. Interview responses on traditional food access and climate change were summarized and tabulated.

Table 7.1 Characteristics of participating youth and women in a Gwich'in community

Age group	*Youth (n = 65)*		*Women (n = 53)*	
Characteristic	**n[a]**	**Value**	**n[a]**	**Value**
Age years (mean ± SD)	63	12.7 ± 1.7	53	30.2 ± 5.9
Height m (mean ± SD)	65	154.2 ± 10.1	48	1.6 ± 0.0
Weight kg (mean ± SD)	64	48.4 ± 13.5	46	74.9 ± 13.7
Body mass index				
kg/m^2 (mean ± SD)	62	20.0 ± 3.5		
BMI (> 85th percentile) kg/m^2	15/62	24.2		
Normal (18.5–24.9 kg/m^2) % of n			46	23.9
Overweight (25.0–29.9 kg/m^2) % of n				30.4
Obese (≥ 30.0 kg/m^2) % of n				45.7
Blood pressure				
mmHg (mean ± SD)	64	108 ± 9/69 ± 8		
Blood pressure (> 90th percentile) mmHg	14/62	22.6		
Normal (≤ 120/≤ 80 mmHg) % of n			47	85.1
Pre-hypertension (120–139/80–89 mmHg) % of n				14.9
Hypertension (≥ 140/≥ 90 mmHg) % of n				0.0
Waist circumference				
cm (mean ± SD)	56	73.6 ± 10.8		
Waist circumference (> 85th percentile) cm	11/54	20.4		
Not at risk (< 80.0 cm) % of n			41	4.9
Increased risk (≥ 80.0 cm) % of n				7.3
Substantially increased risk (≥ 88.0 cm) % of n				87.8
Body fat[b]				
% (mean ± SD)	57	19.7 ± 7.5		
Body fat (> 85th percentile) %	10/56	17.9		
Normal (21.0–32.0%) % of n			42	14.3
Overweight (33.0–38.0%) % of n				28.6
Obese (≥ 39.0%) % of n				57.1

[a] Not all participants completed all aspects of the study.
[b] From Gallagher *et al.*, 2000.

Findings

Description of participants

Table 7.1 describes the youth and women participating in the study. Households ranged in size from one to eight people, with an average of four. On average, only one person in each household was employed, either full- or part-time (data not shown). The mean ages were 13 years for youth and 30 years for women. Of the youth measured, 23 percent had systolic or diastolic pressure at or above the 90th percentile, according to the blood pressure reference percentiles for children based on height-for-gender and -age (National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents, 2004). According to the five-point self-perceived health status score, the majority of women (68 percent) described their general health as very good or good, and 26 percent as fair or poor. Eighty-five percent of women were found to have normal blood pressure, defined as systolic pressure ≤ 120 mmHg and diastolic pressure ≤ 80 mmHg (Heart and Stroke Foundation of Canada, 2008).

Anthropometry

According to BMI-for-age growth charts, 24 percent of youth were above the 85th percentile, the cut-off for overweight or obesity according to the Centers for Disease Control and Prevention (CDC, 2000; Ogden *et al.*, 2002): 20 and 18 percent of youth were above the 85th percentile for waist circumference and body fat, respectively (Fernandez *et al.*, 2004; McCarthy *et al.*, 2006). Based on BMI and percentage body fat, 46 and 57 percent of women, respectively, were considered obese; according to measures of waist circumference, 88 percent were at a substantially increased risk of obesity-related health complications (Gallagher *et al.*, 2000; WHO, 2000). In 2002/2003, BMI data for Canada showed that 32 percent of First Nations women were overweight and 40 percent obese (First Nations Regional Longitudinal Health Survey, First Nations Centre, 2005), compared with data for the overall population in 2005, which showed 29 percent of adult women overweight and 23 percent obese (Statistics Canada, 2006). In the Canadian Community Health Survey, 41 percent of aboriginal youth aged two to 17 years were overweight (21 percent) or obese (20 percent) (Shields, 2005), compared with 29 percent of overall Canadian youth aged 12 to 17 years in 2004 (Shields, 2006).

Physical activity

Youth's physical activity and use of television, Internet and video games were assessed. Thirty-nine percent reported watching two to three television programmes on schooldays. On Saturdays, watching television or movies for part of the morning (43 percent) or afternoon (52 percent) (two hours or less) was the most common activity. Playing video/computer games or surfing the Internet were less popular, with 68 and 49 percent of youth reporting that they would not do these on Saturday morning or afternoon, respectively. For comparison, young people aged 12 to 17 years in Canada in 2004 spent an average of ten hours each week watching TV. Adding the time spent on computers or playing video games increased the total to 20 hours a week in front of a screen (Statistics Canada, 2008).

A wide range of physical activities were reported by youth in Tetlit Zheh. The most popular in summer were bicycling (reported by 98 percent), swimming (90 percent) and soccer (80 percent). During the snow-covered school year, youth reported skidooing (97 percent), sledding (84 percent), hockey (70 percent), soccer (87 percent), basketball (81 percent) and hunting (70 percent). According to the seven-day physical activity recall, walking outside was the most frequent activity, with an average of six days per week. Not including activities in gym class, walking and jogging were the most frequent activities, with an average frequency of four days per week. In comparison, in 1994, 71 percent of children (aged eight to 12 years) in the Mohawk community of Kahnawake, Quebec, Canada, took part in physical activity for at least 30 minutes a day (Adams *et al.*, 2005), and 36 percent watched less than two hours of television a day.

Table 7.2 Average daily intakes of traditional food (TF) in 24-hour recalls among Gwich'in youth (ten to 15 years) and women (20 to 40 years)

Traditional food item	*Average daily intake for all individuals (g ± SD)*	*Average daily intake for individuals reporting food item (g ± SD)*	*Individuals reporting food item (number and % of TF consumers/% of total)*
Youth TF consumers *(n = 53)* Total *(n = 64)*			
Caribou meat – cooked	113 ± 85	125 ± 80	48 (91/75)
Caribou meat – dried	12 ± 38	92 ± 60	7 (13/11)
Caribou stomach – cooked	1 ± 10	74	1 (2/2)
Moose meat – cooked	17 ± 47	113 ± 62	8 (15/13)
Moose kidney – cooked	1 ± 10	74	1 (2/2)
Whitefish – cooked	7 ± 35	180 ± 51	2 (4/3)
Women TF consumers *(n = 37)* Total *(n = 52)*			
Caribou meat – cooked	114 ± 124	185 ± 108	32 (86/62)
Caribou meat – dried	8 ± 27	68 ± 48	6 (16/12)
Caribou kidney – cooked	9 ± 56	237 ± 231	2 (5/4)
Caribou fat – cooked	0.1 ± 1	3 ± 0	2 (5/4)
Caribou stomach – cooked	3 ± 21	148	1 (3/2)
Caribou marrow – cooked	1 ± 6	45	1 (3/2)
Caribou heart – cooked	1 ± 10	74	1 (3/2)
Caribou tongue – cooked	1 ± 10	74	1 (3/2)
Moose meat – cooked	9 ± 41	164 ± 68	3 (8/6)
Moose liver – cooked	2 ± 14	99	1 (3/2)
Whitefish – cooked	9 ± 38	161 ± 15	3 (8/6)

Research has shown that the recalls of youth as young as grade 5 can be sufficiently reliable and valid for the assessment of physical activity (Sallis *et al.*, 1993). Physical activity of the youth in Tetlit Zheh was considered as falling within recommendations, as television viewing of two hours or less per day is within recommended levels for youth (American Academy of Pediatrics, 2001), and physical activity of at least 30 minutes a day is considered adequate (CDC, 2004).

Women's physical activity was assessed using the standardized IPAQ. Walking is an important physical activity for Gwich'in women, and therefore influences how comparison standards are used. If Gwich'in data include walking, the majority of women aged 20 to 40 years (60 percent) were considered moderately active, with 25 percent having low physical activity and 15 percent being very physically active. This is compared with data from the 2004/2005 Canadian Community Health Survey, which estimated that 52 percent of Canadian women (20 years and older) were inactive during their leisure time and 48 percent were moderately active (including walking) or more active (Canadian Fitness and Lifestyle Research Institute, 2005). When walking is not considered in the calculation, 33 percent of women in Tetlit Zheh met the United States recommendations of 30 to 60 minutes of moderate to vigorous activity on five days a week (Physical Activity Guidelines Advisory Committee, 2008).

Dietary intake

Dietary nutrients were examined using 24-hour recalls with youth and women, and the frequency of traditional food consumption was captured in a food frequency questionnaire with women. To identify

Table 7.3 Total energy and percentages of energy from macronutrients (mean ± SD) measured by 24-hour recalls in winter among Gwich'in boys and girls (ten to 15 years) and women (20 to 40 years): traditional food (TF) consumers versus non-consumers

	Youth						*Women*	
	Boys *(n = 30)*		***Girls*** *(n = 34)*		***Total*** *(n = 64)*		*(n = 52)*	
Energy/ macronutrient	***TF consumers*** *(n = 24)*	***TF non-consumers*** *(n = 6)*	***TF consumers*** *(n = 29)*	***TF non-consumers*** *(n = 5)*	***TF consumers*** *(n = 53)*	***TF non-consumers*** *(n = 11)*	***TF consumers*** *(n = 37)*	***TF non-consumers*** *(n = 15)*
Total energy (kJ)	6 721 ± 1 711	6 046 ± 2 014	6 577 ± 2 160	8 808 ± 6 482	7 003 ± 2 330	7 301 ± 4 573	7 472 ± 3 490	7 052 ± 4 385
% protein	19.9 ± 6.3*	13.3 ± 4.3	20.4 ± 6.4	13.2 ± 4.1	20.5 ± 6.2**	13.3 ± 4.1	24.4 ± 7.5***	11.9 ± 4.6
% carbohydrate	53.1 ± 10.4	63.0 ± 12.9	57.2 ± 9.5	61.0 ± 11.0	55.2 ± 10.0	62.1 ± 11.5	48.0 ± 10.9	58.7 ± 16.9*
% fat	28.1 ± 7.0	24.8 ± 9.2	23.2 ± 7.0	27.2 ± 8.3	25.2 ± 7.2	25.9 ± 8.4	27.3 ± 7.6	29.8 ± 12.9
% saturated	10.1 ± 2.8	8.1 ± 4.2	8.2 ± 2.8	9.7 ± 3.5	8.9 ± 2.9	8.9 ± 3.8	9.0 ± 2.8	8.5 ± 5.2
% MUFA	11.3 ± 2.6	9.9 ± 4.4	8.9 ± 3.0	9.9 ± 3.3	9.7 ± 3.0	9.9 ± 3.8	10.6 ± 3.4	11.2 ± 5.4
% PUFA	5.1 ± 2.6	4.2 ± 2.4	4.4 ± 2.2	4.9 ± 2.7	4.8 ± 2.3	4.5 ± 2.4	6.2 ± 2.8	5.8 ± 4.1

Wilcoxon rank test used to examine differences among groups.
* $p \leq 0.05$.
** $p \leq 0.001$.
*** $p \leq 0.0001$.
MUFA = monounsaturated fatty acid.
PUFA = polyunsaturated fatty acid.

potential underreporting, each participant's total energy, weight (kg) and height (m) were used in the Goldberg cut-off method, which compares participants' daily mean reported energy intakes with the intakes for a sedentary lifestyle recommended by FAO, the World Health Organization (WHO) and the United Nations Organization (UNO). The energy intake (EI)-to-basal metabolic rate (BMR) ratio x 1.5 was used as a cut-off for determining inadequate estimation of energy intake based on existing methodology (Goldberg *et al.*, 1991; Gibson, 2005). Energy intakes as recorded by 24-hour recalls for women were below the levels representative of habitual intake (means of 7 472 ± 3 490 kJ and 7 052 ± 4 385 kJ). As portion sizes of traditional food were substantial, often in excess of 100 g/day, it was estimated that underreporting was most likely due to beverage additives and purchased sweets and snacks. Research suggests that Goldberg cut-off values based on adults may overestimate the extent of dietary misreporting when applied to youth (Kersting *et al.*, 1998). Therefore, estimation of intakes was assessed for youth (using median intakes), and mean intakes for both youth and women were used for comparison of consumers and non-consumers of traditional food.

Traditional food consumption

Table 7.2 shows the average daily intakes (g) of traditional foods consumed by youth and women as reported in 24-hour recalls. Of the 64 youth with recalls, 53 reported at least one traditional food item, and of the 52 women, 37 did. The most important traditional species consumed by youth during the winter season assessed were caribou, moose and whitefish. Traditional food frequencies reported by women also emphasized the importance of traditional meats (caribou and moose) and fish. There were no significant differences in traditional food intakes between boys and girls (not shown). Table 7.2 gives the percentages of individuals reporting a specific item among traditional food consumers and among all respondents with recalls.

Macronutrients

Total energy and percentages of energy from macronutrients reported by youth and women are shown in Table 7.3. Among both youth and women, more individuals consumed traditional food than did not, and energy intakes were not significantly different

Table 7.4 Median intakes of micronutrients in winter diets compared with EAR and AI of boys and girls (ten to 15 years) in a Gwich'in community

	Boys *(n = 30)*		***Girls*** *(n = 34)*	
Micronutrient	***10–13 years*** *(n = 21)*	***14–15 years*** *(n = 9)*	***10–13 years*** *(n = 24)*	***14–15 years*** *(n = 10)*
Vitamin A (µg)[a]	301.0*/445.0	425.0/630.0	346.5/420.0	*294.5/485.0*
Thiamin (mg)	1.2/0.7	1.7/1.0	1.4/0.7	*1.1*/0.0*
Riboflavin (mg)	1.6*/0.8	1.8/1.1	1.8/0.8	*1.8/0.9*
Niacin (mg)	16.4*/9.0	18.0*/12.0	16.2/9.0	18.7*/12.0
Vitamin B_6 (mg)	1.2/0.8	1.3/1.0	1.2/0.8	*1.4/1.0*
Vitamin B_{12} (µg)	6.1*/1.5	6.6/2.0	6.7*/1.5	*7.1/2.0*
Folate (µg)[b]	241.0/250.0	456.0*/330.0	279.5/250.0	262.5*/330.0
Vitamin C (mg)	94.5*/39.0	117.1/63.0	161.6*/39.0	80.3/56.0
Vitamin E (mg)[c]	3.0/9.0	5.0*/12.0	4.0/9.0	4.0/12.0
Iron (mg)	16.4/5.9	19.2/7.7	14.7/5.7	15.0*/7.9
Phosphorous (mg)	1 099.0/1 055.0	1 551.0*/1 055.0	1 008.5/1 055.0	1 081.0/1 055.00
Selenium (µg)	58.8/35.0	75.8*/45.0	50.4/35.0	48.7*/45.0
Zinc (mg)	11.8/7.0	15.5*/8.5	10.5*/7.0	11.9*/7.3
Calcium (mg)	511.0/1 300.0	688.0/1 300.0	543.0*/1 300.0	509.5/1 300.0
Vitamin D (µg)	2.6/5.0	3.0/5.0	2.3*/5.0	2.5*/5.0
Total fibre (g)	8.1*/31.0	13.4/38.0	8.5/26.0	10.2/26.0

[a] Measured as retinol active equivalent (RAE).
[b] Measured as dietary folate equivalent.
[c] Measured as α-tocopherol.
* Not adjusted to usual intakes.

across categories. More protein, as a percentage of total diet, was consumed by the traditional food consumers among both youth (boys and total youth) and women. Similar amounts of total fat and carbohydrate were consumed by youth who consumed traditional food and those who did not, but among women the percentage of energy from carbohydrate appears higher among non-consumers. These data corroborate similar findings reported earlier, although the ages of participants differed and the sample sizes were larger for adults (Kuhnlein and Receveur, 2007).

Micronutrients

Youth were divided into DRI categories based on gender and age categories, and the EAR and AI of selected micronutrients were used as references because it was not possible to determine population-level adequacy for nutrients (Institute of Medicine of the National Academies, 2006). Table 7.4 shows the median intakes of boys and girls compared with the EARs and AIs. Among boys aged ten to 13 years (n = 21), 52 percent fell below the DRI for folate and 48 percent below that for phosphorus, but only 14 percent and 19 percent were below recommendations for selenium and zinc, respectively. Vitamin A, riboflavin, niacin, vitamin B_{12}, vitamin C, vitamin E, calcium, vitamin D and fibre could not be calculated for this age group because variation among individuals was less than within-person variation. Among boys aged 14 to 15 years (n = 9), percentages falling below the recommendations were 89 percent for vitamin A, 11 percent for vitamin B_6, 22 percent for B_{12} and 11 percent for iron. Boys in this age category also fell below the AIs for calcium (100 percent), vitamin D (67 percent) and fibre (100 percent).

Among girls aged ten to 13 (n = 24), none fell below the recommended intake for iron, but 13 percent fell below that for thiamine, 13 percent for riboflavin, 13

Table 7.5 Intakes of micronutrients (mean ± SD) in winter 24-hour recalls from boys and girls (ten to 15 years) and women (20 to 40 years) in a Gwich'in community: traditional food (TF) consumers versus non-consumers

	Youth						*Women*	
	Boys *(n = 30)*		***Girls*** *(n = 34)*		***Total*** *(n = 64)*		*(n = 52)*	
Energy/ macronutrient	***TF consumers*** *(n = 24)*	***TF non-consumers*** *(n = 6)*	***TF consumers*** *(n = 29)*	***TF non-consumers*** *(n = 5)*	***TF consumers*** *(n = 53)*	***TF non-consumers*** *(n = 11)*	***TF consumers*** *(n = 37)*	***TF non-consumers*** *(n = 15)*
Vitamin A (µg)[a]	398.2 ± 202.0	227.7 ± 128.2	400.6 ± 258.1	377.8 ± 416.1	399.5 ± 232.2	295.9 ± 289.1	660.9 ± 1916.7	222.6 ± 127.1
Thiamin (mg)	1.6 ± 0.7	1.3 ± 0.6	1.4 ± 0.6	1.4 ± 0.9	1.5 ± 0.6	1.3 ± 0.7	1.3 ± 0.5	1.2 ± 0.8
Riboflavin (mg)	2.2 ± 0.9**	1.2 ± 0.4	2.0 ± 0.9	1.4 ± 1.1	2.1 ± 0.9***	1.3 ± 0.8	2.6 ± 1.2***	1.5 ± 0.8
Niacin (mg)	18.4 ± 6.5	13.5 ± 6.5	17.5 ± 7.9	18.6 ± 12.5	17.9 ± 7.2	15.8 ± 9.5	23.9 ± 20.2*	15.3 ± 9.8
Vitamin B_6 (mg)	1.3 ± 0.5	0.9 ± 0.4	1.3 ± 0.5	1.1 ± 0.8	1.3 ± 0.5	1.0 ± 0.6	1.5 ± 1.0*	0.9 ± 0.5
Vitamin B_{12} (µg)	9.6 ± 5.9***	2.3 ± 1.3	8.7 ± 4.8**	2.3 ± 1.4	9.1 ± 5.3****	2.3 ± 1.3	11.2 ± 7.1****	1.6 ± 1.3
Folate (µg)[b]	332.3 ± 197.3	313.5 ± 139.7	300.0 ± 161.4	336.4 ± 266.2	314.6 ± 177.5	323.9 ± 195.6	309.6 ± 191.5	367.1 ± 311.2
Vitamin C (mg)	112.5 ± 65.6	87.7 ± 87.8	126.4 ± 85.4	141.4 ± 76.3	120.1 ± 76.7	112.1 ± 83.5	98.9 ± 97.0	122.3 ± 140.1
Vitamin E (mg)[c]	4.5 ± 2.7*	2.2 ± 1.0	3.6 ± 2.1	3.6 ± 3.0	4.0 ± 2.4	2.8 ± 2.1	4.3 ± 2.9	2.9 ± 2.9
Iron (mg)	18.9 ± 7.4*	12.0 ± 5.5	15.3 ± 4.7	13.3 ± 8.6	16.9 ± 6.3*	12.6 ± 6.7	19.0 ± 8.3****	9.2 ± 6.1
Phosphorous (mg)	1 196.0 ± 403.1	960.7 ± 437.1	1 143.0 ± 404.7	1 020.8 ± 573.6	1 167.0 ± 401.0	988.0 ± 477.6	1 171.5 ± 539.0*	778.7 ± 527.2
Selenium (µg)	69.2 ± 32.6	65.8 ± 28.9	56.8 ± 26.8	56.0 ± 42.7	62.4 ± 30.0	61.4 ± 34.3	99.2 ± 80.6*	53.7 ± 35.8
Zinc (mg)	14.2 ± 6.2*	7.1 ± 4.3	11.9 ± 4.8	8.4 ± 5.0	13.0 ± 5.5**	7.7 ± 4.4	15.7 ± 7.8****	5.7 ± 3.2
Calcium (mg)	610.5 ± 268.0	476.5 ± 222.8	628.0 ± 301.7	591.6 ± 444.1	620.1 ± 284.4	528.8 ± 327.6	425.8 ± 240.1	499.5 ± 417.4
Vitamin D (µg)	3.6 ± 3.4	2.3 ± 1.7	3.4 ± 3.1	2.2 ± 1.9	3.5 ± 3.2	2.3 ± 1.7	3.7 ± 5.5	2.6 ± 3.1
Total Fibre (g)	9.3 ± 4.9	10.0 ± 3.0	8.4 ± 3.4	10.6 ± 8.9	8.8 ± 4.1	10.2 ± 6.0	7.8 ± 4.7	8.6 ± 4.7

a Measured as RAE.
b Measured as dietary folate equivalent.
c Measured as alpha tocopherol.
Wilcoxon rank test used to examine differences among groups.
*p ≤ 0.05.
**p ≤ 0.01.
***p ≤ 0.001.
**** p ≤ 0.0001.

percent for niacin, 21 percent for vitamin B_6, 46 percent for folate, 96 percent for vitamin E, 58 percent for phosphorus, 17 percent for selenium and 100 percent for fibre. Among girls aged 14 to 15 years (n = 10), 80 percent fell below the EAR for vitamin A, 20 percent for riboflavin, 20 percent for vitamin B_{12}, 40 percent for vitamin C and 50 percent for phosphorus. Girls also fell below the AIs for calcium (90 percent) and fibre (100 percent).

Despite apparent underreporting by women, most women in the sample were obviously consuming adequate amounts of thiamin, vitamin B_{12}, iron, phosphorus, selenium and zinc, undoubtedly owing to the large portions of traditional food animal protein reported (not shown).

Table 7.5 shows the mean micronutrient intakes of youth and women who consumed traditional food and those who did not report any traditional food in the 24-hour recalls. Boys who consumed traditional food were found to have significantly higher intakes of riboflavin, vitamin B_{12}, vitamin E, iron and zinc. Vitamin B_{12} was also found to be significantly higher among girls who reported consuming traditional food. Overall, the youth who consumed traditional food had higher intakes of riboflavin, vitamin B_{12}, iron and zinc. Similar findings for women demonstrated that traditional food consumers had significantly higher riboflavin, niacin, vitamin B_6, vitamin B_{12}, iron, phosphorus, selenium and zinc intakes. These findings are important even though some nutrients are

Table 7.6 Food group servings (mean ± SD) in winter 24-hour recalls of youth (ten to 15 years) and women (20 to 40 years) in a Gwich'in community compared with recommendations

Food group	*Recommended servings*	*TF consumers*	*TF non-consumers*	*Total*
Youth		*(n = 53)*	*(n = 11)*	*(n = 64)*
Fruits and vegetables	5–8	2.6 ± 1.9	2.6 ± 1.6	2.6 ± 1.8
Grain products	4–7	4.7 ± 2.7	4.7 ± 3.0	4.7 ± 2.7
Milk and alternatives	2–4	0.9 ± 0.7	0.7 ± 0.5	0.9 ± 0.7
Meat and alternatives	1–2	3.6 ± 1.8*	1.8 ± 1.5*	3.3 ± 1.9
Women		*(n = 37)*	*(n = 15)*	*(n = 53)*
Fruits and vegetables	7–8	1.7 ± 1.8	2.2 ± 2.5	1.8 ± 2.0
Grain products	6–7	4.4 ± 3.1	4.7 ± 4.7	4.4 ± 3.6
Milk and alternatives	2	0.5 ± 0.5	0.5 ± 0.5	0.5 ± 0.5
Meat and alternatives	2	5.4 ± 4.1*	2.2 ± 2.0*	4.4 ± 3.9

Recommendations from Canada's Food Guide to Healthy Eating for First Nations, Inuit and Métis.
Wilcoxon rank test used to examine differences among groups.
* $p \leq 0.01$.
TF = traditional food.

not being consumed in sufficient amounts. The animal food portion of the diet, primarily as traditional food, is the major contributor of many of these nutrients. Earlier results with Dene/Métis and Yukon youth aged ten to 12 years (n = 98) showed similar patterns of nutrient intake among consumers and non-consumers of traditional food (Nakano *et al.*, 2005b). Dene/Métis adults (n = 1 007) from all regions also showed similar patterns, except that non-consumers had higher intakes of energy, carbohydrate, total fat, saturated fat, vitamins D and E and several minerals (Kuhnlein *et al.*, 2004).

Food group servings

Table 7.6 shows the mean numbers of food group servings derived from the 24-hour recalls reported by youth and women, and compares these with Canadian Food Guide recommendations. Youth had fewer than the recommended number of servings of both fruits and vegetables, and milk and alternatives. When youth and women who consume traditional food were compared with those who do not the only significant difference was that non-consumers were found to consume fewer servings of meat and alternatives.

As noted in Table 7.2, 82 percent of youth reported consuming a minimum of one item of traditional food in the 24-hour recalls. Caribou was the most frequent food item consumed, with moose and whitefish also being popular. Traditional food consumers consumed an average of 154 g of traditional food daily, or 2.1 servings according to Canada's Food Guide for First Nations, Inuit and Métis (Health Canada, 2007). Results from the traditional food frequency questionnaire showed that women consumed a total of 30 different traditional food species and 81 different traditional food parts during the three-month reporting period. Caribou (*Rangifer tarandus*), whitefish (*Coregonus* sp., *Prosopium* sp.), Labrador tea (*Ledum groenlandicum*), loche (*Lota lota*) and cranberries (*Vaccinium* sp.) were particularly prominent in the diet, being consumed by the largest percentages of women.

Selected sweet, salty and fat-rich dessert market foods consumed by youth and women accounted for a large amount of energy in the recalls; Table 7.7 shows the average numbers of mentions per person and the average serving sizes. For example, women consumed up to 36 oz of sweetened drinks, 48 oz of pop and four servings of sweet desserts within the recall period. Similar findings for Dene youth were demonstrated earlier, with more than 50 percent of market food energy coming from these kinds of food (Nakano *et al.*, 2005b).

Table 7.7 Frequencies of daily consumption of selected market foods by youth (ten to 15 years) and women (20 to 40 years) in a Gwich'in community: data from one 24-hour recall per person

Food item		*Youth (n = 64)*	*Women (n = 52)*
Juice/powdered drinks/hot chocolate[a]	No. of mentions/person	1.75	0.58
	SD	1.17	0.75
	Range	0–4	0–3
Pop/sports drinks/ sweetened iced tea[b]	No. of mentions/person	0.44	0.75
	SD	0.59	0.88
	Range	0–2	0–3
Salty snacks[c]	No. of mentions/person	0.39	0.38
	SD	0.68	0.60
	Range	0-3	0–2
Sweetened desserts and flour products (cookies, cake, doughnut, pie, ice cream, gelatine)[d]	No. of mentions/person	0.52	0.50
	SD	1.13	0.83
	Range	0–6	0-4
Candy (hard, chocolate)[e]	No. of mentions/person	0.30	0.10
	SD	0.58	0.36
	Range	0–2	0–2
Free sugar, jam/jelly, syrup[f]	No. of mentions/person	0.45	1.73
	SD	0.71	1.07
	Range	0–3	0–4

[a] Average servings: 1 cup or 8 oz/235 ml (youth); 1.5 cups or 12 oz/355 ml (women).
[b] Average servings: 1.5 cups or 12 oz/355 ml (youth); 2 cups or 16 oz/473 ml (women).
[c] Average servings: 50 g (youth); 60 g (women).
[d] Average servings: cookies = 40 g (youth), 20 g (women); cake = 75 g (youth), 80 g (women); doughnut = 80 g (youth), 115 g (women); pie = 200 g (youth), 100 g (women); ice cream = 330 g (youth), 145 g (women); gelatine = 320 g (youth), 285 g (women).
[e] Average servings: hard candy = 4 g (youth and women); chocolate bar = 65 g (youth), 45 g (women).
[f] Average servings: added sugar = 1.5 teaspoons (youth), 2.5 teaspoons (women); jam/jelly = 1 tablespoon (youth), 2.5 tablespoons (women); syrup = 5 teaspoons (youth), 4 teaspoons (women).

Table 7.8 Food security status among participating women's households in a Gwich'in community

Variable	*Number*	*%*
All households[a]	**53**	
Food-secure	24	45.3
Moderately food-insecure	26	49.1
Severely food-insecure	3	5.7
Children only[b]	**43**	
Food-secure	34	79.1
Moderately food-insecure	9	20.9
Severely food-insecure	0	0.0
Adults only[a, c]	**10**	
Food-secure	5	50.0
Moderately food-insecure	4	40.0
Severely food-insecure	1	10.0

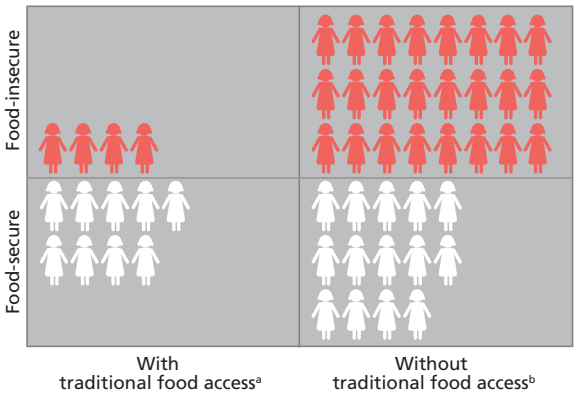
[a] Based on ten-item USDA Food Security Scale for adults/households.
[b] Includes only respondents with children in the household; based on eight-item USDA Food Security Scale for children.
[c] Includes only respondents without children in the household.
Source: Goodman, 2008.

Food security

In January 2006, household food security was assessed from young women's responses to a survey using a modified version of the USDA Food Security Survey Module questionnaire. Table 7.8 shows that 55 percent of households (29 households) were found to be food-insecure, with 6 percent (three households) reporting severe food insecurity. Among households with children, 21 percent (nine households) had experienced food insecurity to the extent that children within the household were affected. However, in all households, children were affected moderately, with no cases of severe food insecurity being found. Only ten households reported no children in the home, and half of these reported food insecurity.

To explore the issue of food access, women were asked questions relating to their access to both market and traditional foods. Twenty-eight percent of respondents reported difficult access to their favourite traditional foods, due to lack of transportation, equipment and/or storage, lack of a hunter in the household, reliance on others to provide traditional food, and time constraints. A greater number (43 percent) reported difficult access to their favourite market foods, with lack of affordability and availability being among the main barriers. When traditional food was not available, 45 percent of women indicated that their households would not be able to buy all the food they needed from the store. Only 40 to 45 percent of women's households had access to hunting and fishing equipment, with 11 and 29 percent of women reporting that hunting and fishing, respectively, were too expensive for their families. Food security was

Figure 7.2 Relationship between food security status and traditional food access score among women in a Gwich'in community (n = 51)



p ($\chi 2$) < 0.05.
Food security status based on ten-item adult/household scale from the USDA Food Security Survey Module.
[a] Positive responses to all traditional food access items included in the traditional food access score.
[b] Minimum of one negative response to a traditional food access item included in the traditional food access score.
Source: Goodman, 2008.

also found to be positively correlated with full-time employment (Goodman, 2008).

Traditional food access scores were developed from questions on the availability of hunting and fishing equipment, the affordability of hunting and fishing excursions, and access to traditional food in general. The food access scores were correlated positively with the frequency of traditional food use, and households with reduced traditional food access consumed less traditional land animal meats and total traditional food, quantified by serving sizes (Goodman, 2008). Figure 7.2 shows how the traditional food access score significantly predicted food security among those interviewed.

Climate change impacts on access to food and health

Because the impacts of climate change are thought to affect food availability negatively, key informants were interviewed to assess their perceptions of the impacts of climate change on access to traditional food species, market food and health. A total of 22 Dene First Nations adults were interviewed, representing the five regions of the Dene Nation and all age categories; of these 13 men and eight women, eight were elders aged 60 years or more. Nine participants were from Gwich'in communities in NWT. Responses were categorized into three themes: perceived impact on the harvesting of traditional food; access to traditional foods and changes in health; and access to healthy market foods.

Theme 1 – impact on the harvesting of traditional foods

Sixty-eight percent (15/22) of the participants, including all Gwich'in participants, felt that climate change has affected their intake of traditional foods. Participants from northern (e.g., Gwich'in) and central (e.g., Akaitcho) regions observed changes in the species of fish and in the water. Changes in the temperature and cleanliness of the water were perceived as contributing to fish migration and health. Responses on changes in the fish included "discolouration", "smaller in size", "change in flesh texture", "unhealthy" and "less fish available to harvest". Comments included the following:

> The water is not clean. I know there is something wrong with the water but I eat the fish anyway.
> I see worms, parasites and bumps on the fish, but I still consume fish because it is traditional food.

Participants from all regions perceived a decline in numbers of caribou and moose, and attributed this to climate-related changes in migration patterns caused by warming temperatures, increased forest fires and reduced access to food sources. For example, caribou's access to food sources was reported to be limited by ice formation under the snow preventing them from breaking through the ice with their hooves to reach the lichen; as a result, caribou were reported as being thinner than previously. In addition, biting insects (mosquitoes, warble flies and bot flies) that harass caribou make it difficult for the animals to feed.

Changes in weather conditions were reported as affecting travel for hunting or fishing. An elder reported "it is difficult to read snow patterns". Participants observed changes in the snow and ice, with rivers and lakes freezing more slowly, which prevents hunters from moving across the land. Water under the snow

also makes travelling dangerous for hunters. A hunter commented, "When on the land, I don't know if I will end up in open water where there wasn't any before."

Participants reported that there were fewer ducks to harvest; possible explanations included changes in flight patterns, with birds no longer stopping where they historically did so, and early migration from the north. Another perspective was "ducks do not lay as many eggs, and do not protect their young as well … decrease is seen in cranes and geese". New bird species entering the habitat were reported across all five regions.

Participants also noted that the rising cost of fuel is limiting their ability to go out on the land to harvest traditional food. The increased cost of fuel for heating homes was reported as reducing the funds available to go harvesting. The costs of supplies and equipment for hunting and fishing were reported to have increased, thus limiting harvesting. One respondent stated "In the past it would cost approximately CAD 700 to go out on the land and harvest (camp), but today it costs approximately CAD 1 200". Other factors affecting the harvesting of traditional foods included increased predators, outfitters and the tourist trade, and industries that interrupt migration patterns.

Theme 2 – access to traditional foods

Thirty-six percent (8/22) of key informants felt that they did not eat as much traditional food as they would like to, and that access to these foods was more difficult. Those who reported eating less traditional food than they would like stated that the costs of fuel and the time available for hunting were impediments, as well as reduced animal numbers in nearby hunting locations. Being able to purchase traditional foods from a store would improve their access to these foods.

Although participants reported that access to traditional foods had become more difficult recently, many also reported the cultural practice of sharing meat. Meat was noted as being given to single mothers and the elderly who cannot get to the land themselves. "Through harvesting traditional foods you practise your culture and live your heritage" was a comment that summarized the value participants placed on traditional foods. Participants viewed the changes in traditional foods over the last two years as having had an impact on their families' health, by increasing diabetes and blood cholesterol in adults and dental caries in youth. Youth were reported as replacing traditional foods with high-sugar, high-fat foods. Trends in increasing intakes of high-sugar/-fat foods were also reported in adults, and were perceived to be a contributing factor in the rise in body weight, diabetes and cholesterol problems.

Changes in traditional foods were also perceived as affecting family members' behaviour and mood. One father stated "When there is no caribou, I feed my family hamburger, hotdog and pizza," and that he could see a difference in his family's behaviour. Another participant reported "A decrease in caribou affects their mood. Traditional foods strengthen their mood, self-esteem and attitudes, and increase their energy." Participants also consistently stated that traditional foods are healthy, and that they feel healthier when they consume them.

Theme 3 – access to healthy market foods

Participants observed that healthy foods cost too much in communities in northern regions. Seven of the nine Gwich'in participants stated that the healthy foods in stores are too expensive to buy, although the stores keep them in stock. Other factors reported as affecting access to healthy foods were lack of variety, the poor condition of fresh foods, and stores' inadequate supplies of healthy foods. Participants in remote communities stated that they travelled to the closest towns, often several hours' drive away, for their food shopping. Participants also noted that food costs are too high in the North: "for example, a litre of milk costs CAD 8 in the North, but only CAD 3 in the south". Participants stated that a reduction in the price of healthy foods, and timely deliveries of perishable foods to stores would make it easier to purchase healthy foods.

Project activities in Tetlit Zheh

In the context of activities being conducted by other agencies in the community, project assistants in Tetlit Zheh considered community activities for improving

knowledge of and access to healthy traditional and market foods. After consultations, local personnel developed and delivered several activities over an 18-month period. One or two community health promoters based in local healing centres were supported throughout the project. The activities implemented included:

- food teaching events for community groups (youth, schools, young mothers, etc.), usually led by elders and Tl'oondih Healing Society staff;
- regular local radio announcements about project activities, recipes and traditional food availability and quality (in liaison with the Natural Resource Department);
- nutrition classes in schools;
- fitness events for women;
- classes and meals for pregnant women and young mothers;
- teaching schoolchildren about food labels (market food);
- classes on nutrition, the risk of diabetes, and traditional values from traditional food, at youth camps (grades 4 to 7) about 30 km up-river;
- regular updates to the Band Council;
- nutrition activities for the Moms and Tots programme;
- production of a DVD describing the current food situation and challenges, and emphasizing the importance of traditional food and healthy market food;[2]
- publication and distribution of a book about traditional Gwich'in food and health;
- Drop the Pop NWT.[3]

Future considerations

This chapter has provided a systematic evaluation of the food and health circumstances of youth and young women in the Gwich'in community of Tetlit Zheh, and has described awareness raising activities to improve health through the increased use of traditional Gwich'in food and healthy market food. The Tetlit Gwich'in are similar to many indigenous communities in northern Canada, which have excellent traditional food resources but reduced access to them, while the resulting nutrition transition raises growing concerns about changing dietary patterns, reduced physical activity and increasing obesity and chronic diseases.

The focus of the research was on youth and young women during the deep winter, when traditional food use is at its lowest. This strategy was based on the belief that improving the dietary and activity behaviours of these two population segments in the lean season could lead to year-round change in the entire community, through activities planned and delivered to the community as a whole.

The researchers found that dietary patterns were short of several nutrients, despite important intakes of traditional food by both youth and young women. Those consuming traditional foods had better diets in several respects. Replacing market foods of low nutrient density with traditional food of higher nutrient density would improve nutrient intakes, even though food group analysis showed that servings of meat and alternatives exceeded Canadian Aboriginal Food Guide recommendations, while milk, and fruit and vegetable servings fell seriously short. In general, the traditional animal foods available to and consumed by youth and women were the best foods presented in the dietary recalls. If all parts of animals/fish and berries had been consumed more frequently, intakes of nutrients such as vitamins A, C, E and D would likely have met requirements among more youth and women (Kuhnlein *et al.*, 2006).

Physical activity patterns were modest, and overweight and obesity affected both youth and young women, with BMI and body fat being higher among women. Fortunately, hypertension was non-existent, and pre-hypertension was present for only a small proportion of youth and young women. Youth expressed interest in and enthusiasm for several culturally relevant physical fitness activities, and did not spend excessive time with in-home entertainment media (television, video and video games), as has been reported in other aboriginal communities (Bernard *et al.*, 1995). The

[2] www.indigenousnutrition.org
[3] www.dropthepopnwt.ca

extent of obesity among young women is especially concerning, as changing dietary patterns, reduced use of traditional food and increased use of food of lower nutrient density, coupled with a physical activity expenditure that is below the energy intake is the classic pattern of the nutrition transition and the root cause of increasing obesity and the onset of chronic disease (Kuhnlein *et al.*, 2004).

The food security of Tetlit Gwich'in women and households was associated with access to traditional food resources. Qualitative research showed that the impact of climate change and increased food and fuel prices had affected households' ability to hunt and fish for family subsistence. This led to perceptions of poorer health having resulted from a diet composed of less traditional and quality market food than people would prefer. It is telling that full-time employment was also correlated with food security, and that people with higher incomes would like to be able to buy traditional foods, which they cannot do locally owing to government controls on the sale of wildlife. From the extensive interviews reported here, it is obvious that Gwich'in adults are well aware of the nutritional and health qualities of their traditional foods, and that they must be proactive in improving their access to these foods. This was demonstrated in the response to creating a food and health book for this project, and in other recent ethnographic research on traditional Gwich'in food resources (Andre and Fehr, 2001; Parlee, Berkes and Teetl'it Gwich'in, 2005).

Project assistants presented diverse intervention strategies to the Tetlit Zheh community. These were primarily experiential activities focusing on traditional food preparation and the recording of recipes for a community food and health book, physical activities for youth and women, radio and Internet communications, and learning activities for schools and women's groups. The most successful activities tended to be those within the school structure, while the scheduling of activities targeting young women was more challenging, owing to the women's time commitments (child care, community responsibilities, etc.) and limited free time. The DVD and food book have been circulated in the community and have been very well received. In a small, informal survey, community members rated the food book as very useful. Individuals found the book useful for passing on traditional food knowledge to youth, and one school teacher was using the book in the classroom. Many of the people surveyed said that they had already learned a great deal regarding nutrition and the variety of ways of preparing traditional food.

A continuous flow of resources is needed to support sustained behaviour change strategies for all segments of the population. Of particular importance are mutually supportive activities that are coordinated from community offices and other settings – such as those sponsored from schools, the health centre, the Head Start centre for toddlers and their mothers, elders' committees, the Hunters' and Trappers' Association and the Band administration, and those promoted by researchers present in the community. If they are to be successful, interventions for preventing chronic disease by focusing on nutrition and physical activity in low-income settings must be interactive, culturally grounded and coordinated through primary care settings, with incentives for participation (Chaudhary and Kreiger, 2007).

Community food stores, of which two were operating during the project period, also offer potential for promoting better food environments. It has been shown that disparities in obesity prevalence depend on the quality of retail food environments in disadvantaged areas, especially when income is limited, and particularly among women (Ford and Dzewaltowski, 2008). Two examples of attempts to improve retail food outlets in the Canadian Arctic are the Government of Canada's Food Mail programme, which has worked to increase the availability of purchased foods in selected communities in the north (Lawn and Harvey, 2001), and Healthy Foods North. Neither of these programmes has been active in Tetlit Zheh, and Healthy Foods North had to close in 2010 owing to funding problems.

The objectives of the Gwich'in Traditional Food and Health Project in Tetlit Zheh were undermined by the impact of climate change and other forces that reduced the availability and presence of traditional animal food resources at a reasonable distance from the community, and by rapidly escalating food and fuel

prices. The project could therefore not demonstrate that an intervention based on traditional food and healthy market food had improved the health of youth and young women. A post-intervention evaluation at the close of the project budget period was deemed unfeasible because of the constraints people faced with reduced access to both traditional and healthy market foods, despite popular and broad-based community education activities.

Indigenous Peoples throughout the world face circumstances that compromise their cultural food systems. In the case of the Tetlit Gwich'in, the need and wish of the community is to maintain traditional foods for their health and cultural benefits, and to be able to buy quality market foods that they prefer and can afford. Interventions that mitigate climate change and contribute to protecting the habitat of diverse food species will help meet this goal. It is also important to build on other social justice initiatives that protect the cultural food system and livelihoods, to assuage poverty in all its dimensions, and to continue to provide resources and tools for health promotion that develops and maintains a healthy community in the contemporary world

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Chapter 8

Inga food and medicine systems to promote community health

SONIA CAICEDO[1] ANA MARÍA CHAPARRO[1]

Figure 8.1
PARTICIPATING INGA COMMUNITIES
Department of Caquetá, Colombia

Data from ESRI Global GIS, 2006.
Walter Hitschfield
Geographic Information Centre,
McGill University Library
**www.maplandia.com/columbia/caqueta*

1
Amazon Conservation
Team Colombia,
Bogota, Colombia

Key words > Inga community, Indigenous Peoples, traditional foods, Andean piedmont, biocultural diversity, nutrition, health, food security

Photographic section >> XIII

"I am a nutrition promoter, which we call *Kawadurkuna Nucanchipa Micuy*, or keeper of our nutrition and health. I am the person in charge of promoting food security in the framework of the Life Plan Recovery of Inga Life and Culture. I conduct the health and nutrition diagnoses of the communities and promote traditional foods and crops so that families are able to recover traditional foods, recipes and drinks, seeking to make them less dependent on markets when it comes to health and food."

Libia Diaz, Inga local promoter, San Miguel Indigenous Reserve

Abstract

This chapter describes the activities and results of a project developed in five indigenous reserves of the Inga indigenous group from the Department of Caquetá in Colombia. The project's objective was to promote indigenous traditional foods and medicine as a strategy for ensuring community health.

Support to family and school vegetable gardens (*chagras*), and the establishment of farming projects and medicinal gardens – in addition to family visits, workshops and courses on nutrition and health, culinary festivals, seed exchanges, traditional recipe collection and health brigades – were essential elements of a process whose general purpose was to strengthen the health component of the Inga community's Life Plan (see text).

The participation of community elders and traditional healers strengthened the project's results by triggering and encouraging broad consensus on its benefits. Health recommendations were promoted through pamphlets and booklets on nutrition, health and traditional recipes and through radio programmes in the Inga language, as part of a communications strategy that aimed to build community awareness regarding the importance of nutrition and health.

The Inga ethnic group of the Caquetá region

Located in the eastern Andean piedmont (westernmost Amazon) in the Department of Caquetá (Figure 8.1), the project area, which is inhabited by numerous indigenous tribes, is known as one of the most species-rich sites in Amazonia and is considered a global conservation priority. Today, the piedmont is perceived as linking the mountains of the Andes to the plains of the great Amazon, "a staircase of earth that serves as a land bridge so that flora, fauna and people form a single landscape" (Ramírez, 2005). Characterized by flora and fauna that are globally diverse, the region displays unusual adaptations to dynamic environments, and has a high degree of local endemism. Located near the equator, it has

no significant seasonal differences and only minor variations in average monthly temperatures.

The region's biological and cultural evolutions have taken place largely in parallel. Among its biodiversity, the botanical species *Banisteriopsis caapi* (Spruce ex Griseb.) C.V. Morton is important as a sacred plant for the region's original inhabitants, who call it *yagé* or *ayahuasca*. Some local tribes[1] use this "vision vine" as a sacrament in rituals, and are therefore sometimes referred to collectively as the "*yagé* culture".

The Inga ethnic group of Caquetá is part of this *yagé* culture, and its cultural practices include ceremonies in which *yagé* is consumed. Considered a gift from God, *yagé* is believed to provide not only the capacity to manage and understand the Inga culture, but also powers of healing. "These practices include a special relationship with nature, in which [the Inga] invoke the strength of their mythical animals such as jaguars, parrots, and snakes, and also achieve knowledge on the use of medicinal, food, psychotropic, stimulant, timber, and craft plants" (Ramírez, 2005).

The Inga's relative isolation from Western society has allowed them to conserve linguistic and cultural knowledge and to continue practising their indigenous traditions, including specific dietary habits. For the Inga, nature gives life by providing animals, plants and seeds that are used for family and community support. During the project's first phase, groups of these traditional foods were collected and characterized: vegetables, tubers and trees or palms such as *chontaduro* (*Bactris gasipaes* Kunth), *milpés* palm (*Oenocarpus bataua* Mart.) and yam (*Dioscorea* spp.); fruits such as *zapote* (*Matisia cordata* Bonpl.), papaya (*Carica papaya* L.), pineapple (*Ananas cosmosus* L.), banana (*Musa* spp.) and *arazá* (*Eugenia stipitata* McVaugh); small animals such as ants (*Atta* spp.), *churo* (a snail, *Pomacea maculata* Perry) and *mojojoy* (a grub, *Coleoptera* spp.); and larger animals such as *boruga* (an agouti, *Cuniculus paca* L.), *morrocoy* (a turtle, *Geochelone carbonaria* Spix), *churuco* (a monkey, *Lagothrix lagothricha* Lugens), deer (*Mazama* spp.), *cucha* (a fish, *Hypostomus* sp.), shad (*Brycon* spp.) and *bocachico* (a fish, *Prochilodus nigricans* Spix & Agassiz). Correal *et al.* (2009) provide a fuller list of Inga traditional foods.

Inga leaders have stated their determination to defend their unique traditional lifestyle by asserting and implementing the five fundamental rights of Indigenous Peoples defined by the International Labour Organization's (ILO's) Convention 169: identity, participation, territory, autonomy, and autonomous development (ILO, 1989). These rights are exercised through the Inga Life Plan, an indigenous development plan designed in a participatory fashion by the Tandachiridu Inganokuna Association, supported by the Colombian Constitution – one of the most progressive in Latin America. The Inga Life Plan establishes the theoretical basis for future actions, the community's objectives, and the practical means of fulfilling these. Briefly, the plan seeks to achieve the holistic integration of all aspects of daily life, including education, health, agriculture, land tenure, nature and culture.

Organization of this Inga community started in 1988, when the Organization of Inganos of Southern Colombia (ORINSUC) was formed. In 2000, ORINSUC was transformed into the Tandachiridu Inganokuna Association of Senior Councils (Inga from the Caquetá), which has restored indigenous judicial and governmental structures, initiated a process for legalizing collective traditional lands in indigenous reserves, and established activities to improve communities' general health through primary health care programmes.

In February 2002, the Amazon Conservation Team and the Inga community, in partnership with the Colombian National Park Service, established the 77 380 ha Alto Fragua Indi Wasi National Park, located along the eastern Andean foothills of the Colombian Amazon at the headwaters of the Fragua River. The park was created to protect one of the world's greatest regions of biodiversity, as confirmed through inventories conducted by the *Instituto de Investigación de Recursos Biológicos Alexander Von Humboldt*. In addition to protecting several tropical Andean ecosystems, including highly endangered

[1] These include the Kametza in Sibundoy Valley; the Siona and Kofan along the Putumayo River; the Inga in Sibundoy Valley and the regions around Mocoa, Florencia and the Bota Caucana; and the Coreguaje in the vicinity of the Orteguaza River.

humid sub-Andean forests, the park also conserves endangered fauna, such as the spectacled bear, and sacred cultural sites designated by local Indigenous Peoples. Indi Wasi protects biological diversity in a vital area that links Andean and Amazonian biota and contains sites of high cultural significance for the Inga people.

The Inga community has also determined that younger generations must be educated under the guidance of traditional Inga authorities, many of whom have expert knowledge of the surrounding forests and their diversity. In response to the lack of suitable education for their youth, the Inga have developed a curriculum that embraces traditional knowledge areas such as botanical medicine and forest stewardship, as well as standard "Western" subjects at the innovative Yachaicurí Ethnoeducation School of Yurayaco, Caquetá.

At the school, approximately 90 Inga students aged five to 18 years are being trained to become conservation leaders. They participate in courses that emphasize sustainable agriculture, and record ancestral knowledge in their native language. Located on 55 ha, the school grounds include a natural science laboratory and an agro-ecological farm, where students learn first-hand the sustainable farming techniques that allow them to grow their own food, contribute to the food resources of surrounding communities, and provide an economic base for their school.

The Inga group that participated in the project is located in eastern Caquetá, 60 km south of Florencia, the capital of the region. Its territories cover approximately 19 778 962 ha, at 297 to 540 m above sea level, with an average temperature of 27 °C and relative humidity of 87 percent. In this region, the most readily available agricultural products, both cultivated and harvested from the wild, are banana, sugar cane, pineapple and maize. Other significant products are rubber, cocoa, *arazá* (*Eugenia stipitata* McVaugh), *cocona* (*Solanum sessiliflorum* Dunal), *copoazu* (*Theobroma grandiflorum* Schumann), *chontaduro* (*Bactris gasipaes* Kunth), *caimarona* (*Pourouma cecropiifolia* Mart), coffee and *borojo* (*Borojoa patinoi* Cuatrec) (Parra, 2004).

Cultural and environmental challenges

The eastern Andean piedmont of Colombia is characterized by uncontrolled land occupancy and immigration resulting from the advance of colonization. In recent decades, government development planning for these territories has focused on extensive cultivation through the use of credit and subsidies, placing a strain on sustainable use of the local environment. There is considerable logging activity in the region, and this is extremely difficult to monitor. Seismic exploration and exploratory oil drilling have also taken place. The available hydrocarbons appear to be of insufficient quantity and quality to merit further exploitation, but petroleum extraction may still represent a threat for conservation of the region's ecosystems and Indigenous Peoples. Mining is another potential threat.

These territories have been a refuge for paramilitary groups and armed militias such as the Revolutionary Armed Forces of Colombia–People's Army (FARC–EP) and the National Liberation Army (ELN). Local people face constant uncertainty in the face of external efforts to control the territory. Conflict has directly affected the Inga ethnic group and has increased economic, social and environmental instability. Violence against citizens, including abductions and assassinations, is increasing. Among adult men and women (between 15 and 64 years of age), violent conflict appears to be an important cause of death, although there are no differentiated data for the region's indigenous population, which represents 2 percent of the total (Departmental Health Institute of Caquetá, 2006). The cultivation of coca for cocaine production and the resulting activities of the narcotics industry have triggered fragmentation of the social infrastructure and devastation of local ecosystems. All of this has serious environmental and cultural implications for the region's indigenous communities.

Health and nutrition challenges

Through the partial loss of traditional lands and severe deforestation, access to the Inga's traditional cultivated and wild plants for food and medicine has

decreased significantly. This has had significant negative consequences on local economies and indigenous food and medical systems. In addition, the shrinking of the area available for traditional rotation crop production has reduced the Inga's capacity for self-subsistence. Difficult access to health services and the scarcity of these services in ethnic territories, as well as poverty and social and geographical marginalization add to the challenges.

The United Nations Millennium Development Goals[2] provide the foundation for the Colombian Government's social policies for overcoming these challenges. With the goal of upgrading the coverage and quality of the general health and social security system, two legislative reform initiatives have been brought before the Colombian Congress, "seeking to promote the inclusion of currently uninsured low-income population sectors; improve efficiency in the provision of public services, including health; and increase capacity building and accountability at the regional (territorial) levels" (PAHO, 2007).

The 2005 Colombian National Survey on Health and Nutrition indicates slight improvements in the department's indicators, including those for nutrition (PAHO, 2007). For example, in 2005, chronic malnutrition in children under five years of age had diminished slightly (to 12 percent) since 2000 (13.5 percent); acute malnutrition was observed in only 1 percent of children under five years of age; and among those aged five to nine years, 13 percent showed stunting and 5 percent low weight-for-height.

Nevertheless, problems persist, and the health statistics for the country as a whole obscure large differences among regions, between urban and rural areas and across social levels. Minority groups are characterized by high poverty rates, markedly inadequate basic sanitation services and a higher degree of health problems than other population groups. In the Department of Caquetá where this research took place, the predominant health concerns are acute diarrhoeal diseases, acute respiratory infections, malnutrition and nutritional deficiencies, tuberculosis (TB), periodontal diseases and skin disorders (PAHO, 2007).

[2] www.un.org/millenniumgoals/

In 2006, the year of the most recent government study, the Department of Caquetá's infant mortality rate was 32 per 1 000 (compared with a national rate of 20). For children under five years of age, mortality was 41 per 1 000 (compared with the national 26). The department therefore has one of the highest infant and early childhood mortality rates in the country (Departmental Health Institute of Caquetá, 2006). Prevalent childhood diseases are the main cause of death among children under five, with acute diarrhoea and respiratory infections being the most prominent. Figures for maternal and perinatal mortality are also above average: a maternal mortality rate of 98 per 100 000 live births compares with a national rate of 79, and a neonatal mortality rate of 18 per 1 000 live births with one of 7.4.

Participatory research

Research for the project was developed in a participatory fashion using the Centre for Indigenous Peoples' Nutrition and Environment (CINE) methodology (Kuhnlein *et al.*, 2006). Working with the research team, the community determined the methods for collecting, recording and presenting the data. The data collection process also triggered and enabled community awareness building about the factors that influence nutritional and general health.

A multicultural team established at the beginning of the project was responsible for developing project objectives and recommendations. In addition to the project coordinator and support team, four indigenous local promoters collected and recorded key nutrition information and sensitized the communities to the importance of nutrition and health, using terminology and imagery common to the Inga. (Hereafter, the promoters will be referred to as "the team".)

The team participated in several meetings with leaders of the Tandachiridu Inganokuna Association to draft a cooperation agreement in which the role of each member was discussed, described and established. The signed agreement reflected the communities' expectations, guaranteeing a participatory decision-making process and protecting the rights of indigenous communities.

Project objectives and participants

The project's general objective was to contribute to protecting the health and food security of the Inga people by promoting the maintenance and recovery of their traditional agricultural production systems, as part of their Life Plan. Specific project objectives were to:

- improve and increase the availability of traditional foods that are important for the Inga's health and nutrition;
- promote the maintenance and application of the Inga's ethical beliefs, knowledge and cultural practices related to nutrition and health;
- offer students of the Inga Yachaicuri School a primary health care programme;
- carry out an anthropometric assessment of the Inga ethnic group;
- develop and assess a programme for improving the health and nutrition status of the community sustainably.

Intervention activities

The project lasted from 2005 to 2008. During the first year, meetings were held with the Senior Council of the Inga indigenous group of Caquetá, to establish a research framework and obtain permissions. Local health and nutrition promoters and traditional agriculture promoters were selected, and training workshops held for them. The project's team of four promoters conducted the fieldwork with participating families. The promoters were trained in and informed about health promotion issues. Among the subjects discussed were the definitions of health and illness; child care; health care for pregnant women, adults and elders; prevention of the most frequent illnesses within the community, including colds, diarrhoea, fever, malnutrition and anaemia; promotion of healthy foods; and the cultivation and use of medicinal plants.

In the project's first phase, research was conducted to define the sources and nutritional composition of key traditional foods. Nineteen traditional foods were selected for promotion, based on their cultural and nutritional values, ease of retrieval in the *chagras*[3] and daily use for family nourishment (Table 8.1) (Correal *et al.* 2009).

During development of the project's information and educational strategy, the promoters visited families on each of the indigenous reserves. These visits were to collect information on the composition of Inga families and their health status and environment; the Inga's beliefs and knowledge regarding traditional plants and medicine; the availability of traditional foods; Inga food use frequencies; environmental, social and economic indicators; the distribution of traditional seeds and knowledge; breastfeeding practices; and recipes.

The promoters worked closely with family members, highlighting the positive aspects of their health status as well as those that needed improvement. Areas of emphasis included: i) promoting the development of *chagras* for cultivating traditional foods; ii) exchanging traditional seeds among families; iii) maintaining the cleanliness of housing and local environments; iv) using plants from medicinal gardens to help treat diseases; v) implementing recommendations for the improvement of health care; vi) implementing recommendations on nutrition and health care for senior groups; vii) promoting breastfeeding; and viii) discouraging the use of powdered milk for babies.

Each family was visited at least three times during each year of the project. The first visit was used to obtain information on the Inga's knowledge of health and their commitment to making specific improvements, especially by implementing recommendations for improving health care. The second and third visits assessed families' implementation of these recommendations. During the visits, promoters observed that the communities and families showed the most interest in improving their *chagras* and in seed exchanges, culinary festivals, and *yoco* and *yagé* ceremonies.

[3] A *chagra* is a family and/or communally managed plot based on a diversified and sustainable production system that imitates the forest ecosystem's dynamics by combining agricultural and forestry technologies. Its fauna and flora components are closely interrelated and selected to ensure the protection and sustainable use of the soil and other forest resources. The project's indigenous partners perceived the *chagra* as being like a market store that provides indigenous people with a supply of daily nutritional needs near their homes. The *chagra* is an example of the application of accumulated, inter-generationally transmitted indigenous knowledge about the harvesting and use of plants.

Table 8.1 Traditional foods promoted

Common name (scientific name)	*Nutrients provided*	*Importance to health according to female and male indigenous healers*
Chontaduro (*Bactris gasipaes* Kunth)	Protein, fat, fibre, vitamin A	Promotes proper growth of children; prevents malnutrition; protects against lung disease; helps maintain healthy skin and good vision
Milpés (*Oenocarpus bataua* Mart)	Fat, protein, fibre	Promotes proper growth of children and proper foetal development; provides energy for daily activities; prevents malnutrition; protects against heart disease; aids the digestive process
Mojojoy (*Coleoptera* spp.)	Protein, fat	Promotes proper growth of children and proper foetal development; provides energy for daily activities; facilitates weight gain; prevents malnutrition; protects against lung disease
Zapote (*Matisia cordata* Bonpl.)	Vitamin A, vitamin C	Protects against lung disease; helps maintain healthy skin and good vision; protects against colds; helps to heal wounds; protects against heart disease
Yoco (*Paullinia yoco* Schultes & Killip)	Not available	Mild stimulant and general health tonic
Cayamba (*Auricularia auricular-judae* (Bull.) Quel.)	Protein, fibre, minerals	Facilitates immune response; improves the digestive process; helps prevent the body from absorbing fats from foods, thereby protecting the heart and circulatory system
Ant (*Atta* spp.)	Fat, protein, niacin	Supports the functioning of the digestive system; protects the skin from infections; promotes a healthy nervous system; helps the body to produce energy
Snail (*Pomacea maculate* Perry)	Protein, phosphorus	Promotes proper growth of children and proper foetal development; prevents malnutrition; improves the body's defences against diseases
Cucha (*Hypostomus* sp.)	Protein, phosphorus	Promotes proper growth of children and proper foetal development; prevents malnutrition; improves the body's defences; facilitates the formation of bone and teeth
Cimarrón (*Eryngium foetidum* L.)	Iron	Prevents and treats anaemia; aids treatment of hepatitis
Ají (*Capsicum* L.)	Vitamin A, vitamin C, minerals, capsaicin, potassium	Protects against cancer; helps the digestive process; prevents bronchitis
Yam (*Dioscorea* spp.)	Carbohydrates	Prevents malnutrition; increases energy
Pineapple (*Ananas cosmosus* L.)	Vitamins, minerals, bromelain	Improves digestion and circulatory process; cleanses the intestines
Banana (*Musa* spp.)	Carbohydrates	Prevents low weight; increases energy
Sour cane (*Begonia plebeja* Liebm.)	Not available	Purgative and antipyretic
Nina Waska (not available)	Not available	Purgative; promotes internal cleansing
Papaya (*Carica papaya* L.)	Vitamin C, minerals, fibre, papain	Improves the digestive process; cleanses the intestines
Arazá (*Eugenia stipitata* McVaugh)	Vitamin C, fibre	Protects against colds; helps to heal wounds; protects against heart disease

The following were the recommendations for family and community health care:

- Drink something bitter once a week.
- Apply nettle.
- Do not eat sweets from the town.
- Eat abundant fruits.
- Women should take care during their menstrual period.
- Purge three times a year.
- People should take care when they have a cold.
- Consume aromatic plants in teas and juices, to avoid diseases.
- Eat only traditional foods and meals made from traditional recipes.

The following recommendations for different age groups are based on traditional Inga knowledge, which is shared by Inga shamans and elders during family visits.

Health care and nutritional support for children under two years of age

- Young children should be swathed in cloth diapers.
- To prevent skin ailments, bathe children with plants such as cane and maize leaves, *yarumo* (*Cecropia peltata* L.) and *balso* (*Ochroma pyramidale* Urban).
- Bathe children with herbs such as mint (*Mentha pulegium* L.) or wormwood (*Artemisia absinthium* L.), without rinsing.
- Leave children's clothes to dry in the air.
- Breastfeeding is recommended for at least the first three months. Bottle-feeding should be avoided.
- Remove parasites with mint (*Mentha pulegium* L.), purslane (*Portulaca oleracea* L.) and *paico* (*Chenopodium ambrosioides* L.).
- From one year of age, children should eat all categories of traditional nourishment. The only food that is not recommended for children under two years of age is chilli (*ají*).
- Animal heads should not be consumed by children under two years of age.
- Children can drink all kinds of *chicha*, as long as it is not too fermented.
- During teething, children should be given food with sufficient texture for biting and tearing.

Health care and nutrition for children aged two to 12 years

- Parasites should be removed by using purgatives such as *yoco* (*Paullinia yoco* Schultes & Killip).
- Lice should be prevented by applying *achapo* husk juice (*Prochilodus nigricans* Agassiz).
- All children should be taught respect for family and traditions, and to accept advice from their grandparents and elders.
- Children should be taught to honour the indigenous culture, customs, language, clothing, myths and legends, games and food.
- Children should be fed with all types of traditional food.
- Children should not be breastfed or bottle-fed.
- Give children traditional drinks such as *chicha*, *anduche* and *guarapo* that are sweet but not strongly fermented.

Health care and nutrition for adolescents, adults and the elderly

- Adolescents and adults can consume all types of animal.
- Traditional healers and apprentices should not consume pregnant animals or fish with teeth.
- Purgatives should be taken during a new moon.
- *Yagé* or *ambiwaska* (*Banisteriopsis caapi* [Spruce ex Griseb.] C.V. Morton) should be taken every two weeks.

Health care for women during their menstrual period

- Do not bathe in cold water, unless special plants such as lemongrass (*Cymbopogon citrates* Stapf.) or other herbs are added.
- Do not swim in the river: "coldness" may be passed to the uterus and the woman will suffer during labour.
- Do not lift heavy things.
- Do not drink milk or eat cassava or fruits, to avoid cystitis or burning urination.
- Women should avoid eating *danta* (*Tapirus terrestris* L.), *gurre* (*Cabassous unicintus* L.), *cerrillo* (*Tayassu tajacu* L.) and deer (which are irritating meats) and chilli (*ají*) (*Capsicum* L.).

Health care during pregnancy and breastfeeding

- Do not lift heavy things.
- Bathe in herbs such as basil (*Ocimum basilicum* L.), *altamiza* (*Artemisia vulgaris* L.), *ajenjo* (*Artemisia absinthium* L.) and orange leaf; these plants can be mixed.
- During pregnancy women should receive palpations from midwives or women healers to determine whether the baby is healthy.

The interviews conducted during visits were based on the individual physical health questionnaire (Annex

Table 8.2 Activity indicators with projected and final numbers achieved

Indicator	*Projected number*	*Actual number*
Families benefiting from the project	80	60
Hectares supported	N/A	81
Sustainable production projects for food security	N/A	19
Nutritional and health promoters trained and working with communities	4	4
People participating in *yoco* ingestion	100	140
Health brigades	5	5
People participating in health brigades	N/A	270
Information activities on health subjects (workshops on health and nutrition information)	5	7
People participating in health information activities	N/A	176
Traditional foods recovered	19	19
Schools using school *chagras*	4	4
Schools using traditional foods in their cafeterias	4	4
Radio programmes on health and food	N/A	50
Promotional literature products (flipchart and cookbook)	2	2

8.1), the dietary frequency questionnaire, a 24-hour recall, the infant food history survey (Annex 8.2) and the food security interview (Annex 8.3). The individual physical health questionnaire collected information on indicators including diminished visual perception at night, pallor, hair problems, oral lesions and bleeding of the gums. The dietary frequency questionnaire and 24-hour recalls were used to identify the main traditional and non-traditional foods and their frequencies of consumption in participants' families. The infant food history survey gathered data on breastfeeding practices and the health care status of indigenous children. The food security interview was used to assess families' perceptions regarding food availability. Among the questions asked and discussed were: Do you always have food? Do you buy food? Do you ever go hungry? Do you cook or provide food for others? Families' traditional food preferences were identified through analysis of the information collected through this tool. Anthropometric data were collected for youth ≤ 18 years of age; information was classified into the indicator categories weight-for-age, height-for-age, and weight-for-height.

In addition, workshops and courses were conducted to build awareness and understanding both in the communities and among the students of Yachaicuri School. Workshops and group activities on nutrition, nourishment and health were developed in each indigenous reserve. Traditional food recipes were collected and prepared during culinary festivals. Promotional literature and visual materials regarding the recommendations for improving community health were prepared by the local promoters using information collected from community elders, particularly traditional healers.

Community and school *chagras*, farming projects and medicinal plant gardens were established to increase the availability of traditional foods and medicine. Students helped to create school *chagras* where cilantro, *cimarrón* (*Eryngium foetidium* L.), onion (*Allium* sp.), cucumber (*Cucumis sativus* L.) and other vegetables were grown for the children, and medicinal plants were cultivated.

Culinary festivals, seed exchanges and recipe collections were organized to promote the use of traditional foods and to identify the plants used and encourage the cultivation of traditional food crops in *chagras* and family gardens.

Promoters visited the communities to evaluate the menus of school cafeterias. For each school, the project prepared menus that included at least one traditional food preparation. Ways of preparing foods harvested in the school's *chagra* were recommended. The Colombian Institute of Family Welfare's menus were revised to include traditional drinks such as *anduche*, *chicha* and *chucula* (banana whipped with water) and foods such as *tacacho* (cooked and mashed banana).

The local promoters visited schools on the indigenous reserves to develop educational activities and introduce traditional foods, especially the 19 foods identified during the preliminary research. The nutritional and cultural importance of these foods

Table 8.3 Numbers of people participating in project activities

Age range (years)	*Female*	*Male*	*Total*
< 1	6	3	9
1–4	7	13	20
5–10	20	17	37
11–15	28	19	47
16–20	11	12	23
21–25	6	11	17
26–30	6	3	9
31–35	4	6	10
36–40	3	5	8
41–45	5	6	11
46–50	2	0	2
51–55	2	2	4
56–60	4	8	12
61–65	4	1	5
66–69	1	0	1
≥ 70	2	2	4
Total			**219**

was highlighted, and recipes were prepared for the students to taste.

The Inga consider frequent invitations to drink *yoco* (*Paullinia yoco* Schultes & Killip) as being vital to their nutrition and health, along with the periodic drinking of cleansing plants. *Yoco* has traditionally been used as a stimulant, owing to the high caffeine content of its bark; it is also used as a laxative and in many other traditional indigenous treatments in the foothills. In each indigenous reservation, five health brigades provided services through a *taita* (traditional healer) and an apprentice.

Table 8.2 lists the project activities, with the anticipated and actual numbers reached.

Project results: improved health, nutrition and food availability

A total of 219 indigenous people from the five Inga indigenous reserves participated in project activities. Participants were from all age groups: 51 percent were women and 49 percent men. Children up to 15 years of age (51.6 percent) were the major population group participating in activities (Table 8.3).

Table 8.4 Observed and self-reported health conditions (percentages)

Condition	*Baseline 2006 (n = 108)*	*Final assessment 2008 (n = 98)*
Presence of oedemas	7.8	3.4
Pallor of the skin	48	44.8
Self-reported bleeding gums	13.9	11.5
Self-reported hair problems	13.1	13.8
Self-reported oral lesions	1.7	0
Self-reported night blindness	63	24.1

Individual physical health questionnaire

Answers to questions on the self-perception of health status revealed that 60 percent of participants considered their health to be average; 36.7 percent considered themselves to enjoy good health; and 3.3 percent considered themselves to be in poor health. For the final evaluation, health status was deemed average in the presence of "pain in the bones", a common complaint resulting from work in the fields and, according to indigenous beliefs, snakebites. Noteworthy was that 100 percent of participants used traditional medicinal practices to prevent or treat health problems. An important improvement in night blindness was reported (Table 8.4).

Food frequency and 24-hour recall

All Inga families used plants and animals from their *chagras* to prepare their daily meals. Foods such as plantain (*Musa* spp.), yucca (*Manihot esculenta* Crantz), *chontaduro* (*Bactris gasipaes* Nunth), *píldoro* (*Musa* sp.) and *yota* (*Xanthosoma* sp.) were regularly prepared. Eighty-two percent of families consumed fruits weekly. The types of fruit consumed depended on the harvest cycle, and the most frequently used were guayaba (*Psidium guajava* L.), orange (*Citrus sinensis*

Table 8.5 Contributions of kilocalories, protein, iron and vitamin A to daily intake, traditional food (TF) versus non-traditional food, using 24-hour recalls (n = 58) (percentages)

	kcal		*Protein*		*Iron*		*Vitamin A*	
	TF	*Non-TF*	*TF*	*Non-TF*	*TF*	*Non-TF*	*TF*	*Non-TF*
Baseline 2006	47	53	60	40	14	86	80	20
Final assessment 2008	57	43	70	30	50	50	100	0

Table 8.6 Anthropometric nutritional evaluation of youth ≤ 18 years of age

		2006 (n = 227)		*2008* (n = 127)	
Indicator	*Age range* (years)	*No. participants*	*Participants < -2SD* (%)	*No. participants*	*Participants < -2SD* (%)
Weight-for-height	< 5	41	0.8	29	0.6
Weight-for-age	< 5	41	3.6	29	3.5
	5–10	71	4.6	37	4.6
Height-for-age	< 5	41	14.5	29	14.4
	5–19	186	14.7	98	14.7

Osbeck), mandarin (*Citrus reticulata* Blanco), banana (*Mussa* sp.), *guama* (*Inga edulis* Mart), pineapple (*Ananas cosmosus* L.), *zapote* (*Matisia cordata* Bonpl.) and *arazá* (*Eugenia stipitata* McVaugh). Traditional drinks were prepared daily: maize *chicha*, *chontaduro chicha*, *anduche* (a banana drink) and cane *guarapo* were the most frequent. Fish was the most frequently consumed animal food (three or four times a week), while eggs were consumed daily among families with poultry farming facilities. Traditional foods that were not consumed frequently included beef, yam and hard-to-obtain foods such as snails and *milpes* (*Oenocarpus bataua* Mart).

The contributions to energy (kcal) and protein of traditional and non-traditional foods were calculated in the project's first phase and during the evaluation activities. Interviews based on 24-hour recalls were conducted with approximately 15 people from each community – the majority were students chosen randomly in schools – to observe variations between the percentage contributions of foods consumed and the nutrition recommendations provided by the Colombian Institute of Family Welfare (ICBF, 2005).

The contributions to kcal, protein, iron and vitamin A of indigenous traditional foods increased between the first and second phases of the project (Table 8.5). The kcal contribution of traditional foods was high because the traditional Inga diet is rich in carbohydrates and kcal, mainly from plantain, yucca and yam. Non-traditional foods in families' food baskets included rice, pasta and sugar. Traditional foods' contribution of protein increased by 10 percent among participating

Table 8.7 Duration of exclusive breastfeeding, mothers with children ≤ 2 years of age (n = 18)

Months from birth	*Exclusive breastfeeding* (%)
1	16.7
2	5.6
3	10.0
4	5.6
5	18.9
6	32.0
7	5.6
11	5.6

families, owing to increased consumption of the eggs and meat produced by families with poultry. This, combined with the use of *cilantro cimarrón* (*Eryngium foetidium* L.) in the preparation of foods also increased the amount of iron in participants' diets. Non-traditional foods such as beans and lentils were used three times a week at lunch and dinner, completing the families' nourishment. Traditional foods such as chilli (*Capsicum* L.) and fruits such as *zapote* (*Matisia cordata* Bonpl.) and papaya (*Carica papaya* L.) supplied vitamin A.

Anthropometric assessment

Despite improvements in health indicators and dietary assessments, there were minimal improvements in anthropometric indicators from 2006 to 2008. This was expected, because height indicators (stunting) are persistent. Few children had serious weight-for-age or weight-for-height deficiency (Table 8.6). This analysis emphasizes the need to generate specific parameters for comparisons of data from Colombia's indigenous communities, whose populations are on average shorter than those of the country as a whole.

Infant and child nutrition: infant food history survey

Inga people consult both traditional health agents, such as midwives and relatives, and Western doctors and nurses. During childbirth, 50 percent of the mothers surveyed used Western medicine, and the other 50 percent used midwives or relatives trained to help with childbirth. This is well known by the region's health entities: regional health action plans for improving mother-and-child health include the training of non-institutional midwives, indigenous health promoters, etc. to assist indigenous women during pregnancy and childbirth (Ministry of Social Protection, 2008).

Table 8.8 Reasons for stopping breastfeeding, mothers with children ≤ 2 years of age (n = 18)

Reason	*% mothers*
Child hungry	27.1
Work activities	20.0
Lack of milk production	19.5
Food support from government institutions	13.3
Introduced non-dairy beverages	13.4
Mother ill	6.7

As a rule, the indigenous women of the community breastfeed: 100 percent of survey participants stated that they started breastfeeding soon after the child's birth, with 78 percent starting one hour after delivery. This is significantly higher than the 47.2 percent of women who reported starting breastfeeding an hour after childbirth in the National Survey of the Nutritional Situation in Colombia in the Department of Caquetá (ICBF, 2005). For the current study, local promoters visited pregnant women and assisted with childbirth, teaching the proper position for breastfeeding and advocating against the use of traditional drinks and baby bottles during the baby's first month of life. Of the women interviewed, 57 percent stated that they breastfed exclusively for the child's first four to six months (Table 8.7). Twenty-seven percent stopped breastfeeding altogether at one year, and 18 percent stopped at two years; 64 percent of women breastfed for at least one year. The reasons for weaning are listed in Table 8.8.

In response to these findings, recommendations were developed to promote the "golden rule" of breastfeeding ("the greater the stimulus, the greater the production of milk"), the benefits for children's food security from breastfeeding, and the associated reduced food costs for the family. In indigenous families, complementary feeding begins between the third and sixth month of life, when mothers offer their children traditional foods such as fish, vegetables and plantain drinks. By ten months of age, children are ready to consume all the traditional and non-traditional foods eaten by the family. Table 8.9 summarizes the main foods used during the introduction of complementary foods.

During their visits, the local promoters worked closely with family members to collect information on

Table 8.9 Complementary foods offered

Food or preparation	Type: Traditional or homemade	Type: Non-traditional or purchased	Age at introduction (months)
Fish soup	√		3
Chicken soup		√	3
Meat soup	√		4
Plantain soup	√		4
Vegetable soup		√	4
Plantain drink	√		4
Pumpkin	√		4
Meat	√		6
Guava	√		7
Orange	√		7
Chucula[a] and *anduche*[b]	√		7
Pineapple	√		8
Yucca	√		8
Yam	√		9
Pomo[c]	√		9
Cherimoya	√		9
Grape	√		8
Yota[d]	√		9
Cucumber *archucha*	√		9
Eggs	√		11
Sweet *chichi*[e]	√		14

[a] Cooked ripe plantain.
[b] Traditional drink made from fermented ripe plantain.
[c] Mountain apple (*Eugenia malaccensis* L.).
[d] Tuber (*Xanthosoma* spp.).
[e] Sweet drink made of fermented maize.

traditional food preparation practices. Of note is that the pre-mastication practices used by female ancestors to prepare traditional drinks for young children are no longer in use. Local promoters remembered drinking cassava *chicha* prepared through pre-mastication by their grandmothers and aunts. Following Inga traditional practices and beliefs, the *chicha* was prepared without sugar; the drink's sweet flavour resulted from the women's saliva mixing with the tuber. Younger mothers now believe that this is not hygienic, and have no memory of having participated in this type of food preparation. Occasionally, indigenous women chew lightly on foods of hard consistency (such as meat) to facilitate infants' consumption of complementary foods (from zero to four months). Today, no pre-mastication practices are used to prepare traditional drinks such as *anduche*, *chicha* or *chucula*.

Food availability: food security interview

Twenty-four households participated in the food security interview. One of the programme's most important achievements was to increase the availability of traditional foods, especially the 19 that had been selected, through activities that included *mingas*[4] at the *chagras* (Correal *et al.*, 2009).

All of the families interviewed (100 percent) stated that they considered traditional foods to be healthy and nutritious: 64 percent stated that they had access to the quality and types of food they preferred, while 36 percent stated that their families still had insufficient traditional foods for consumption. The factors that prevented indigenous families from achieving their preferred food consumption – shortage of traditional foods, decreased hunting or fishing stocks, and/or lack of financial resources for purchasing other goods – were resolved by families working to improve the quantity and quality of the food they grow and through conservation strategies for preserving fauna species in nearby forests and rivers.

It is noteworthy that 100 percent of the families stated that both youth and adults had regular access to certain quantities and qualities of traditional foods, and that during the project period no family members lost weight because of a significant reduction in their food consumption or a lack of food for an entire day. All families interviewed stated that traditional farm and garden foods – including meat, fish, yucca, plantain, onions, tomatoes, fruits and foods derived from livestock, such as cheese and milk – were always shared in their immediate community.

Family food security among the Inga is based on plant cultivation and harvesting and animal breeding. Following the establishment and strengthening of

[4] A *minga* is a work project that engages many of the people in the community.

Table 8.10 Production from *chagras* and farming projects, 2007 to 2008

		Area farmed (ha)		*No.* chagras		*Area of* chagras (ha)		*Species in* chagras*		*Medicinal species**		*Food species**	*Species for other uses**
Indigenous reserve	***No. families***	***2007***	***2008***	***2007***	***2008***	***2007***	***2008***	***2007***	***2008***	***2007***	***2008***	***2008***	
San Miguel	15	16.25	29.88	18	25	11.5	13.75	42	61	0	24	34	3
Brisas	11	12	9.62	15	12	6.75	5	35	52	0	15	34	3
Yurayaco	9	0	11.44	9	12	7.25	7.5	28	47	0	7	38	2
Niñeras	14	33	29.5	21	30	11.75	12.51	70	106	0	27	63	16
Total	**49**	**61.25**	**80.44**	**63**	**79**	**37.25**	**38.76**						

* Some species were grown and used in more than one community.

family and school *chagras*, 71.4 percent of the families participating in project activities expressed decreased anxiety regarding food availability because food was always available in their *chagras*. Other goods (rice, pasta, butter, oil and salt) were purchased to complete the families' diet, but these products were not consumed daily. Seventy-two percent of the families had poultry farming facilities, and 37 percent produced milk and cheese for family consumption.

The families interviewed believed that the availability of traditional foods increased over the two-year project period. Families are now growing more species in larger *chagra* and garden areas. The diversity of species found in the average family chagra increased by 54 percent during the project. Each indigenous reserve now contains between 47 and 106 species, including the 19 traditional foods identified in the preliminary research (Table 8.10). There was also a marked increase in the harvesting of plants for medicinal use. Culinary festivals and seed exchanges were key to strengthening the use and cultivation of *chagras*.

The local promoters' activities to improve community nutrition and health care also supported the promotion, recovery, sowing and use of traditional seeds in accordance with traditional customs. Some traditional practices and knowledge resurfaced for the community's use. Families showed great motivation and willingness to continue recovering traditional foods and agricultural practices. Inga youth participated actively in educational activities such as tending school *chagras* and community plant nurseries. The strengthening

Table 8.11 Medicinal plants encouraged by local promoters

Plant	***Use***
Ambar (*Tetracera sessilliflora* Triana & Planch)	Infusion to calm nervous breakdowns and for fevers, headaches and kidney ailments
Chondur (*Cyperus* sp.)	For hair problems
Descancel (*Compositae* Bercht & J. Presl.)	For fevers and headaches, and to ease labour
Paico (*Chenopodium ambrosioides* L.)	For parasitic infection
Chiricaspi (*Bruntelsia grandiflora* Plum ex. L.)	For physical pain in general
Yawar chondur (*Cyperus* sp.)	For headaches
Ruda (*Ruta graveolens* L.)	For fevers
Limoncillo (*Cymbopogon cytratus* (DC) Stapf.)	For menstrual pain and colic
Hojas de naranja (*Citrus aurantium* C. *sinensis* Osbeck)	For menstrual pain and colic
Bitter cane (*Costus spicatus* L.)	For fevers
Tabardillo/oreja negra (*Calliandra califorica* Benth.)	For fevers
Kalambombo (*Averrhoea carambola* L.)	For cuts and skin irritations
Hoja Santa (not available)	For headaches and acne
Nettle (*Urtica* L.)	To calm nervous breakdowns and for coughing
Sauco (*Sambucus mexicana* L.)	For eye irritations and as a purgative
Toronjil (*Melissa officinalis* L.)	To calm nervous breakdowns
Flor de muerto (*Cistus albidus* L.)	For stomach pains
Malva (*Malva sylvestris* L.)	For fevers
Achiote (*Bixa orellana* L.)	For cuts and skin irritations
Cat's claw (*Ucaria* spp.)	For kidney ailments and to clean the blood

of family and school *chagras* through the recovery of traditional seeds provided an additional benefit beyond fresh, healthy and nutritious foods, by providing venues where Inga elders, adults and youth can come together to share their knowledge of ancestral agriculture techniques.

Ongoing project activities by promoters include assisting the expansion of *chagras* and the production of organic fertilizers for soil restoration; providing technical assistance and onsite advice; assisting the continued recovery of traditional seeds; and encouraging the consumption of traditional rather that purchased foods.

Traditional medicine

Supplies of traditional seeds and oversight were provided during the project, to strengthen the communities' medicinal plant gardens. Awareness and understanding of the use of traditional medicine were increased through health brigades of *taitas* (shamans) and *mamas* (women healers) from the unions UMIYAC (*Unión de Médicos Indígenas Yageceros de la Amazonía Colombiana*) and ASOMI (*Asociación de Mujeres Indígenas: La Chagra de la Vida*). Local promoters encouraged the use of some medicinal plants (Table 8.11).

Conclusion

Barriers to implementation and data collection

Data were collected through informal interviews and discussions. Generally, the Inga feel more comfortable when activities are conducted informally. They believe that projects should support their Life Plan, rather than merely diagnosing or documenting their lifestyle. Notably, the Inga do not approve of the collection of blood samples and subsequent medical laboratory analysis.

The group of participants changed during the project. Some of the people who participated in the first phase left the indigenous reserve, while new indigenous people arrived in the research area during the course of the project. It was therefore difficult to develop precisely comparable information for before-and-after analysis of the intervention.

Armed conflict in the project territories occasionally hindered access to the Inga region during the project period. In addition, the Inga indigenous reserves in Caquetá are difficult to reach: travel is mainly by foot, so it can require hours to reach a community.

Project achievements

Traditionally, the main staples of the Inga group were locally obtained foods such as manioc and wild game. Increased contact with the outside world and the associated increased consumption of processed foods caused deterioration in the health status of Inga communities. This project's goal was to emphasize the importance of forest resources in supporting the Inga's nutritional health.

The project's promotion of a sustainable economy based on indigenous communities' traditional values resulted in improved health and nutrition in Inga families. The support provided to family and school *chagras* and the establishment of farming projects and medicinal gardens – as well as family visits, workshops and courses in nutrition and health, culinary festivals, seed exchanges, the collection of traditional recipes and health brigades – were fundamental to strengthening the health component of the Inga community's Life Plan.

Support to indigenous families and the local indigenous association in developing and implementing the health component of their Life Plan strengthened communities' governance and facilitated their engagement with traditional authorities, health promoters and healers. The Inga youth population became involved in promoting and preserving both indigenous culture and indigenous knowledge regarding environmental conservation. The Inga's holistic integration of all aspects of daily life – including education, health care, agriculture, land tenure, interaction with the environment and cultural expression – allowed the project implementers to integrate health and nutrition activities into an overall health improvement plan. The project strengthened the conservation and application of traditional indigenous knowledge and traditional food consumption.

In the Inga group of the Department of Caquetá, nutritional, health care and environmental challenges persist, despite the significant increase in local awareness. Specific health care models have still to be defined with the community, and more work is needed to bridge the communication gap between community leaders and youth regarding health issues.

The project built capacity through training workshops, enabling the Inga indigenous association to implement the health component of its Life Plan effectively, and ensuring project sustainability. In addition, the expansion of ancestral territories – particularly links between the Alto Fragua Indi Wasi National Park and the Yurayaco and San Miguel indigenous reserves – allowed the development of conservation strategies for the sustainable use of the natural resources that nourish the Inga community.

The project results define a path for further community outreach. Three other Colombian indigenous communities have improved their health status through food security projects initiated by the project's implementing agency, the Amazon Conservation Team. These encompass 638 families from 38 indigenous reserves. As well as the Inga of the Caquetá, the beneficiaries are the Coreguaje ethnic group in the vicinity of the Orteguaza River; the Inga of the Baja Bota Caucana; and the Siona community along the Putumayo River. The traditional agricultural activities implemented include seed exchanges and training workshops on health, sustainable production and conservation. A total of 797 traditional *chagras* have been established and supported, covering a total of 440 ha. Agroforestry plots and poultry and cattle farms have also been installed. Future activities will include food security projects for the Inga and Kofán communities of the Department of Putumayo and the Uitoto community of the Amazonas Region

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Annex 8.1 Individual physical health questionnaire

Date:	**No.**
First name and last name:	
Gender:	**Age:**
Birth date:	
Height:	**Weight:**
Presence of oedemas:	
Self-perception of health:	
Do you have or have you had a disease?	
What was the disease's cause?	
Are you under treatment?	
Are you taking *pharmacy medicines*, and which ones?	
Are you taking *traditional medicines*, and which ones?	
Can you see properly in the dark?	
Do you have hair problems?	
Pallor:	
Do you have wounds or scars in your mouth?	
Do your gums bleed easily?	
Women	
Are you pregnant?	
How many pregnancies have you had?	
How many childbirths have you had?	
How many of your children are alive?	
Are you breastfeeding?	
Have you breastfed your children?	
Children	
Are they being breastfed?	
How long were they breastfed?	
Did they take different kinds of milk, which ones and when?	
How old were they when you started giving them complementary food?	
How was it given?	
Do they take nutritional supplements or vitamins, which ones?	
Family	
Do you use iodized salt?	
Do you drink alcohol?	

Annex 8.2 Infant food history survey

Date:	**No.**
Child's name and last name:	
Age:	
Mother's name and last name:	
Indigenous reserve:	
Local promoter's name:	
Who helped you with childbirth? *(midwife, local promoter, doctor, nurse, relative, other)*	
When did breastfeeding start? Hours after childbirth?	
For how long was the child breastfed?	
Did you offer the child other types of milk, and why?	
At what age and with what types of foods did you start complementary feeding? (*foods, age and preparation procedures)*	
At what age did you stop breastfeeding your child? *(months)*	
Why did you stop breastfeeding?	

Annex 8.3 Food security interview *(English translation)*

Respondent's name:

Date:

Indigenous reserve:

These questions make it possible to know your family's food security status over the past year.

Which of the following statements best describes what your family has eaten over the last 12 months?
1. In your family there is always the amount and type of food you want to eat.
2. Your family has the amount of food you want but not the kind of food you want to eat
3. Sometimes your family does not have enough food to eat.
4. Almost always your family does not have enough food to eat

If your family does not produce food, are you concerned that foods are gone before you have money to buy them?
a. Almost always
b. Rarely
c. Never

Are the foods that your family eats gone before you can obtain or produce more?
a. Almost always
b. Rarely
c. Never

If you do not produce food can you give the children in your family a balanced diet?
a. Almost always
b. Rarely
c. Never

Do you or another adult in your family eat less or skip a meal because there is not enough food for all the family?
a. Yes
b. No

If you answered "Yes" to the last question, how often does this happen in a year?
a. Almost every month
b. Some months but not all
c. Only one or two months

Have members of your family lost weight because they do not have enough food to eat?
a. Yes
b. No

Have you or another adult in your family not eaten all day because there is no food in the family?
a. Yes
b. No

If you answered "Yes" to the last question, how often does this happen in a year?
a. Almost every month
b. Some months but not all
c. Only one or two months

Has a child in your family had to skip a meal because there was no food in the house?
a. Yes
b. No

If you answered "Yes" to the last question, how often does this happen in a year?
a. Almost every month
b. Some months but not all
c. Only one or two months

Has a child in your family been hungry because there is not enough food in the house?
a. Yes
b. No

Has a child in your family not eaten all day because there is not enough food in the house?
a. Yes
b. No

Which of these factors or items prevents you from eating enough food or food that you would prefer to eat?
a. Age
b. Health problems
c. Lack of money
d. Lack of food in the area, or a place to buy it
e. Food markets are too far away
f. There are no traditional foods in the area
g. Do not know how to or cannot hunt or fish

Comments:

Do you and your neighbours share food?
a. Yes
b. No

If you answered "Yes" to the last question, which foods are shared?

List five foods that you buy for everyday use in feeding your family.

What foods do you produce for daily use in family meals?

What is good traditional food?

What are the problems with traditional foods?

In the last two years have you noticed changes in the amount of traditional food species? Please explain your answer.

In the last two years have you noticed changes in the quality of traditional food sources? Please explain your answer.

What are your favourite foods?

Chapter 9

The value of Inuit elders' storytelling to health promotion during times of rapid climate change and uncertain food security

GRACE M. EGELAND[1] SENNAIT YOHANNES[1] LOOEE OKALIK[2] JONAH KILABUK[3]
CASSANDRA RACICOT[1] MARCUS WILCKE[4] JOHNNY KULUGUQTUQ[5] SELINA KISA[4]

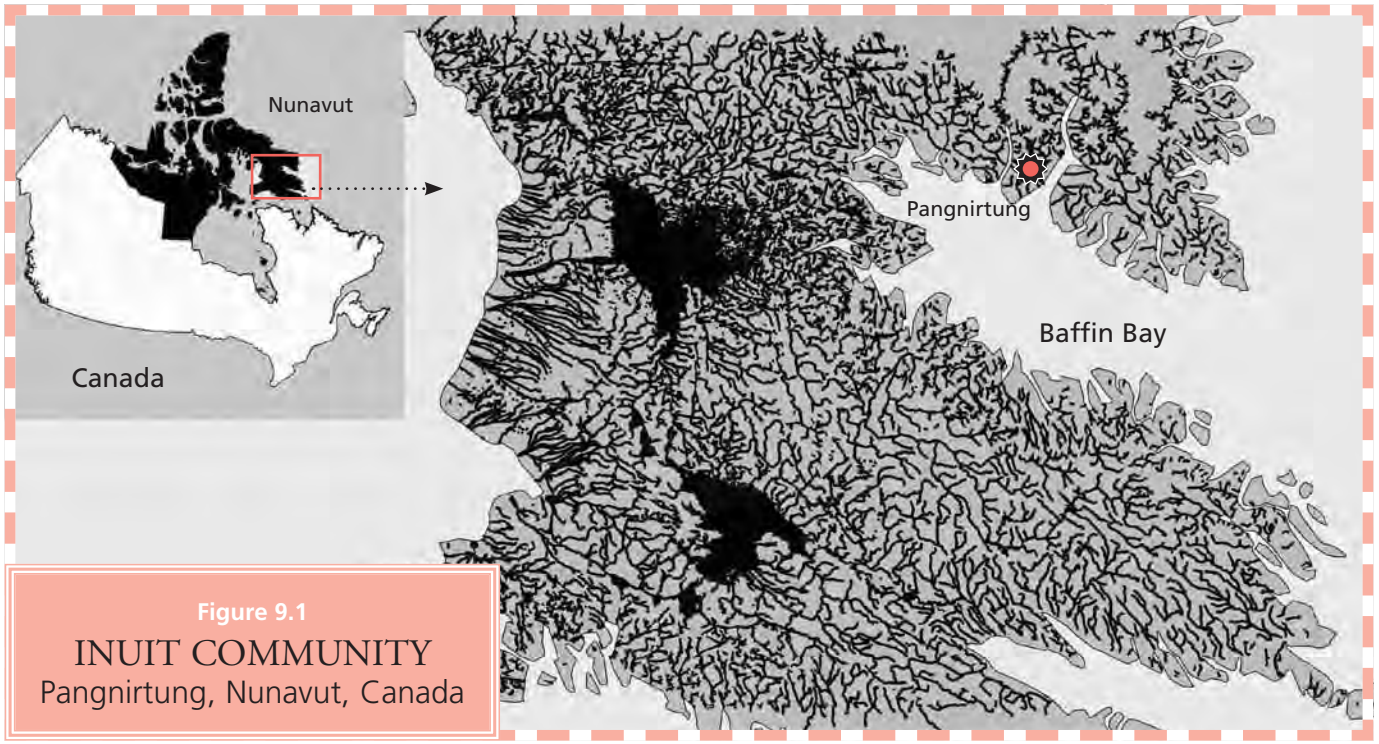

Figure 9.1
INUIT COMMUNITY
Pangnirtung, Nunavut, Canada

Data from ESRI Global GIS, 2006. Walter Hitschfield Geographic Information Centre, McGill University Library.

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Key words > diet, health promotion, storytelling, food security, climate change, aboriginal health, Inuit, Indigenous Peoples

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