

Culture, Environment, and Food to Prevent Vitamin A Deficiency



Harriet V. Kuhnlein and Gretel H. Pelto, Editors

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This work was carried out with the aid of a grant from the
International Development Research Centre, Ottawa, Canada



INFDC



CANADA

Published jointly by the

International Nutrition Foundation for Developing Countries
P.O. Box 500, Charles Street Station
Boston, MA 02114-0500 USA

and the

International Development Research Centre
P.O. Box 8500
Ottawa, ON, Canada K1G 3H0

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INFDC ISBN 0-9635522-7-9

IDRC ISBN 0-88936-768-X

U.S. Library of Congress Cataloging-in-Publication (CIP) Data Applied for.

Canadian Cataloging-in-Publication (CIP) Data Applied for.

Cover Photography (clockwise from top left): Preparing the staple porridge in Filingué, Niger; Buying leafy vegetables from a street vendor in China; Sweet potato vines commonly eaten by Aetas, in Philippines; Key-informant interview in progress in Chamis, Peru; Pile sort using actual foods in Sheriguda, India.

Contents

Preface	i
Acknowledgements	v
Contributing Authors	vii

Part I Vitamin A in Food and Diets

1. Vitamin A and Food: The Current Situation	3
<i>Harriet V. Kuhnlein and Gretel H. Pelto</i>	
Overview: What This Book is About	3
The Vitamin A Situation	4
Proposed Solutions to the Problem	4
Focused Ethnography to Understand Local Culture and Environment for Vitamin A Programs	6
The Structure of This Book	8
2. The Complexities of Understanding Vitamin A in Food and Diets: The Problem	11
<i>Sarah L. Booth, Timothy A. Johns, and Harriet V. Kuhnlein</i>	
Introduction	11
Overview of Natural Food Sources of Vitamin A	12
Vitamin A Food Composition Data	12
Effect of Food Processing on Vitamin A	16
Food Composition Tables for Vitamin A	17
Assessment of Dietary Vitamin A Intake	19
Dietary Vitamin A Intake Patterns	22
Other Dietary and Health Factors Influencing Vitamin A Status	26
Programs That Improve Intake of Vitamin A–Rich Food	27
Summary	28

Part II Creating the Protocol

3. Theory and Process: The Methods	33
<i>Harriet V. Kuhnlein, Perti J. Pelto, Gretel H. Pelto and Members of the IUNS Committee 11/6</i>	
The International Union of Nutritional Sciences, Committee on Nutrition and Anthropology	33
Theory of the Methodological Approach	36

Overview of Methods of Data Collection	
Described in the Protocol Manual	37
Testing the Protocol	47
Comment	51

Part III Assessing Natural Food Sources of Vitamin A in the Community

4. The Philippines: The Aetas of Canawan During Wet and Dry Seasons	55
<i>Cecelia Santos-Acuin, A. Troy Gepte IV, and M. Justiniana Dedace</i>	
The Vitamin A Problem in the Philippines	55
The Aetas of Canawan, Morong	56
The Aeta's Way of Life	58
Concepts of Food and Deficiency	61
Factors Affecting Food Intake	62
A Typical Meal	67
Suggested Dietary Modifications	68
5. Community Assessment of Natural Food Sources of Vitamin A in Niger: The Hausas of Filingué	71
<i>Lauren Blum</i>	
Background Discussion of Niger	71
Food Sources of Vitamin A	78
Meal Patterns and Food Utilization	81
Cultural Beliefs about Vitamin A-Rich Foods	86
Vitamin A Deficiency	87
Summary and Recommendations	92
6. China: The People of Doumen Village, Kai Feng Municipality, Henan Province	97
<i>Li Wen Jun, Ge Ke You, Li Dian, and Chang Su Ying</i>	
Background and Introduction	97
Eating Vitamin A-Rich Vegetable Food	103
Cultural Beliefs Regarding Key Foods	106
Food Patterns	108
Food Preparation	112
Nightblindness	112

7. Peru: The Rural Community of Chamis and the Urban Suburb of San Vicente in Cajamarca	119
<i>Hilary Creed-Kanashiro</i>	
Introduction	119
Overview of the Location	120
Food Sources of Vitamin A	130
Principal Differences Between Chamis and San Vicente	138
Family and Individual Food Patterns	138
Feeding Patterns by Age and Gender	140
Vitamin A–Rich Food Patterns	144
Cultural Beliefs	147
Vitamin A and Health	154
Summary and Conclusions	156
Policy Recommendations	158
Recommendations for Research	159
8. India: The Rural Community of Sheriguda in Andhra Pradesh	161
<i>Shahmaz Vazir, Uma Nayak, Vinodini Reddy, and P. Pushpamma</i>	
Introduction	161
Team Members and Task	161
Current Status of the Problem	162
Study Population	163
Community Food Sources	166
Food Consumption Pattern	168
Cultural/Ecological Pattern	169
Summary and Policy Strategies	171

Part IV Understanding Vitamin A Deficiency in the Community

9. The Contexts of Culture, Environment, and Food	175
<i>Harriet V. Kuhnlein and Gretel H. Pelto</i>	
Overview	175
Overall Performance of the Protocol	176
Keys to Finding Local Community Food Sources to Prevent Vitamin A Deficiency: What Foods are Available and How Much	178

Vitamin A Do They Contain? 178
Keys to Understanding Consumption Patterns of Vulnerable Groups. 179
Keys to Beliefs and Perceptions About Food 181
Keys to Cultural, Ecological and Socioeconomic Factors that
Constrain Consumption of Vitamin A–Rich Food and Prevention
of Deficiency 182
Keys to Explanations and Understandings of Vitamin A Deficiency
Symptoms 184
Looking to the Next Steps: From Ethnography
to Intervention Design 184

Appendix 187

References 191

Preface

Commitments to virtually eliminate vitamin A deficiency and all its consequences by the year 2000 were made by high level politicians attending the World Summit for Children in 1990 and the International Conference on Nutrition in 1992. The World Health Organization (WHO) currently estimates that there are over 250 million preschool-aged children, and an unknown number of women of fertile age, who are vitamin A deficient. Obviously, to meet the goal, it will be essential to improve the dietary intake of vitamin A in a very large segment of the world's growing population.

At a public health level, the primary cause of vitamin A deficiency is an inadequate intake of vitamin A-active foods, both of animal and vegetable origins. The critical immediate need for vitamin A could be met by periodic high-dose supplements to children, and appropriate lower dose supplements to fertile women, a system used by some Western countries where an infrastructure is in place for delivery through a welfare system or through affordable private sources. Governments of most developing countries, however, currently cannot sustain from their own resources the perpetual broad distribution of vitamin supplements, and a well-developed, affordable source for delivery through the private sector is not available. Alternatively, fortification of a suitable, centrally-processed food that is broadly consumed by the vulnerable groups within a limited range of intakes could be an effective approach to the problem, as demonstrated in several industrialized countries. Foods with such characteristics, however, do not exist in many developing countries.

Natural food-based interventions, therefore, are the only sustainable solution to vitamin A deficiency—and to several other nutritional problems—in nonindustrialized countries. For these approaches to be effective in improving vitamin A intake, local answers are needed to the questions of what vulnerable groups are eating, why they are eating it, and if they are willing and have the necessary means to change or modify their dietary patterns. Answers are critical for planners of nutrition, health,

and even more broadly-oriented development programs. This book and the accompanying manual *Community Assessment of Natural Food Sources of Vitamin A: Guidelines for an Ethnographic Protocol* provide a methodology, and demonstrate its flexible application, for an in-depth understanding of the local context critical for designing appropriate interventions.

The purpose of the book is to describe issues regarding the consumption of natural food sources for preventing vitamin A deficiency, to be used by development planners as well as students, in a variety of related areas in nutrition, public health, and anthropology. As such, it is a useful compilation of experiences reflecting widely diverse cultures and settings where vitamin A deficiency occurs in different levels of severity. It brings the reader up to the point where interventions could now be planned, utilizing the information gained locally by applying the focused ethnographic study (FES) methodology.

The FES methodology is, in fact, a subset of general ethnographic approaches for information gathering that can be adapted to various program requirements, in this case to learn about the availability of vitamin A-containing food; perceptions influencing its uses, preparation, preservation and consumption; and age/gender/illness and other factors that modify consumption patterns. Hence, the approach deals with issues of food availability from a perspective not usual in most assessments provided to development planners from agriculturalists on the one hand, and nutritionists on the other. Agriculturalists generally view food availability in terms of yield per acre, and nutritionists by the nutrient content of the food in the household or in the meal as consumed. The FES methodology provides a more holistic framework for viewing the issues within a local cultural and food systems context. From such context interventions can be designed that are more relevant and appropriate to both opportunities and constraints for creating the supportive environment needed for sustainable behavioral changes to occur in eating patterns.

This book is intended for nutrition intervention program and development planners, as well as students from related disciplines. Although it is quite clearly written, some sections, for example parts of Chapter 2, have details that will be of less interest to the development planner, but will be a useful orientation for students.

There are many uses for information about what is being eaten and by whom in specific population settings. One of the most frequent uses of this information is to seek association with nutritional status or, for example, with disease patterns in epidemiologic surveys. Often, the speed required for conducting large, population-based epidemiologic surveys

requires rapid assessment procedures (RAPs) that do not slow the survey process. Yet, local actions that require behavioral changes to improve amenable, diet-related adverse survey findings, must be imbedded in an understanding of the community's organization and resources, and the knowledge and perceptions of vulnerable inhabitants. This information is crucial but often unobtainable from rapidly conducted interviews. The accompanying manual provides detailed guidance and forms for acquiring, recording, and analyzing the required information in a relatively short time frame, i.e., six to eight weeks. It may also be useful, therefore, in conjunction with studies in selected sentinel areas where more extensive surveys are in progress.

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Acknowledgements

Many people deserve recognition for the completion of the book and its companion volume, *Community Assessment of Natural Food Sources of Vitamin A: Guidelines for an Ethnographic Protocol*. This has been a work of many years and we have been fortunate to have the cooperation and outstanding collaboration of people working in three departments in two universities, at least six research centers and institutes, three development agencies, and a committee of the International Union of Nutritional Sciences. The process we followed to develop and create these two volumes is described in Chapter 3. However, we will say a great “Thank You!” to all who were involved in the various stages, and in particular to each of the chapter authors. We fully appreciate Pertti J. Peltó for his outstanding contributions to several drafts of the manual, the training workshop, and field site visits. We recognize his unfailing commitment to the role of ethnography in public health.

Perhaps most important, we want to thank the countless key-informants, respondents to interviews, and other assistants at the community level without whom all this would not have been possible, notwithstanding the involvement of those noted above. As work intended to contribute to the elimination of vitamin A deficiency, the field component among populations vulnerable to deficiency was essential to what we hope will be meaningful and useful policies and programs.

For their assistance in the various stages of securing funding for the completion of this project and its publications, we thank Richard Young and Janice Johnston of the International Development Research Centre, Ottawa, and Nevin Scrimshaw of the International Nutrition Foundation for Developing Countries, Boston.

We express our appreciation to Dr. Wenche Barthe Eide of the Nordic School of Nutrition, University of Oslo, and to Dr. Barbara Underwood of the Nutrition Unit of the World Health Organization, Geneva, for their most helpful comments and perspectives during the last two years.

Finally, the two editors of this book would like to acknowledge each other and the friendship and collegial relationship they have shared, through thick and thin, for more than fifteen years.

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Part I

**Vitamin A in Food
and Diets**

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1

Vitamin A and Food: The Current Situation

Harriet V. Kuhnlein and Gretel H. Pelto

Overview: What This Book is About

The purpose of this book is to contribute to understanding the sociocultural and environmental factors that affect vitamin A intake and responses to vitamin A deficiency. The enterprise described here is based on the assumption that knowledge about the sociocultural and environmental contexts of vitamin A is essential for instituting and sustaining food-based prevention of vitamin A deficiency. It describes how a group of nutritionists and anthropologists worked together to create a protocol to evaluate the natural food sources of vitamin A in areas at risk for vitamin A deficiency. A manual describing the creation of a locally contextual protocol is a companion to this volume, and is titled *Community Assessment of Natural Food Sources of Vitamin A: Guidelines for an Ethnographic Protocol*. The protocol combines nutrition and anthropological tools, and is called focused ethnographic study (FES). FES is within the realm of rapid assessment procedures (RAP) of anthropologically-based methods for relatively rapid evaluation of health problems and prevention programs. In this case, FES is applied to understand how culture, environment, and food can prevent vitamin A deficiency.

We wrote this book for development planners in health, agriculture, education, or other areas. It is also suitable for scholars and students of nutrition, public health, agriculture, anthropology and human cultural ecology to describe and discuss the issues surrounding the use of natural

food sources for the prevention of vitamin A deficiency. Ethnographic research tools and their testing in a broad range of cultures and environments in five developing countries are outlined, as are the findings from this work. Chapters contributed by the investigators in these countries describe the suitability and generalizability of the research tools, the data generated, practical applications, and directions for policy.

The Vitamin A Situation

Vitamin A deficiency is a major global problem, affecting populations in developing areas of more than seventy-five countries where clinical and subclinical conditions have been observed (McLaren, 1986; WHO, 1994). Worldwide, this public health problem involves 2.8 to 3 million children with clinical deficiency and 251 million with subclinical deficiency. Vitamin A affects many physiological systems; it plays an essential role in vision and eye health, and it affects growth and susceptibility to infection (particularly diarrhea and measles) and anemia in children (Sommer et al., 1984; Campos et al., 1987; Chandra and Vyas, 1989). The consequences of vitamin A deficiency include blindness, poor growth, severe infection, and death; its control and prevention are central in child health and survival programs (Wasantwisut and Attig, 1995). The International Conference on Nutrition (WHO/FAO, 1993) pledged the elimination of vitamin A deficiency by the year 2000.

The prevention of vitamin A deficiency at the community and household levels depends on the availability and consumption of vitamin A-rich food from either plant or animal sources, and on the presence of other dietary factors needed for bioavailability, absorption, and metabolism of vitamin A, such as sufficient fat, protein, zinc, and other essential nutrients (Booth et al., 1992). Inadequate intake of the appropriate quantity and quality of food to meet vitamin A requirements affects all members of populations with deficiency, but is most common in infants, young children, and pregnant/lactating women. Extensive reviews of the variety of foods containing vitamin A and the effects of vitamin A deficiency are presented elsewhere, and will not be covered here (see, for example, Sommer, 1982, 1995; Bauerfeind, 1986; West, 1991; Booth et al., 1992; Underwood, 1994).

Proposed Solutions to the Problem

Actions aimed at preventing vitamin A deficiency may draw on several potential types of solutions. Solutions at the community level can be diverse and may involve a variety of multisectoral community and devel-

opment programs. Public health programs in breastfeeding, immunizations, family planning, health education, and maternal and child care are relevant, as are agricultural extension, agricultural education, horticultural promotion, etc. Education sector involvement might include food education, school gardens, and hygiene promotion for the prevention of infection (WHO/UNICEF, 1994). The training of professionals delivering services and programs is key to appropriate activities that will effect positive change.

In general, providing more vitamin A to vulnerable populations has been undertaken in three major intervention activity categories: distribution of large doses of vitamin A supplements, fortification of selected food items, and dietary modification to include more vitamin A-rich food. These have been accomplished in context with public health, agriculture, and/or education sector programs as noted above. A combination of these activities together with various public health measures and economic improvements is considered appropriate and effective (Subcommittee on Nutrition, 1994).

It is recognized that distribution of supplements provides a quick-acting intervention, best accomplished with sufficient health infrastructure to targeted populations, in particular to children at risk for protein-energy malnutrition and various infections. Improving vitamin A status in this way resulted in reduced mortality and morbidity (Beaton et al., 1993).

Fortification of food with vitamin A and its distribution is most feasible where the processed food industry is well-developed and supported, which may not be the case in resource-poor areas where vitamin A is lacking in the diet, deficiency is most extreme, and various barriers exist for the most vulnerable to access fortified food (Trowbridge et al., 1993). Examples of vitamin A fortification programs have been reported (McKigney, 1983), and include cod liver oil in margarine, and vitamin A in milk, sugar, and monosodium glutamate.

Lack of vitamin A in the diet is the root cause of vitamin A deficiency, and dietary modification is generally regarded as the ultimate goal for the prevention of vitamin A deficiency in all members of households and communities. This is a long-term approach and requires improvements in food availability and education of those most vulnerable to take advantage of improved food supplies. One important dietary modification is the sustained breastfeeding of infants when mothers have sufficient dietary vitamin A. It is thought that the most effective dietary modification programs target improvement of dietary intake of vitamin A for women in the child-bearing years, during pregnancy and lactation, and for young

children at weaning and during rapid growth and development (Subcommittee on Nutrition, 1994; Underwood, 1994; Wasantwisut and Attig, 1995).

Considerations for Sustainability

To solve the root cause of vitamin A deficiency, more vitamin A must be present in the diets of vulnerable people. Program planners and development leaders in health, agriculture, education, and other sectors must understand the culture and ecology of food availability and consumption at the local level. This understanding will lead to improvements in the dietary quality and quantity of vitamin A, through dietary modification and food fortification programs. With respect to food supplies, it requires understanding the species of vitamin A-rich foods that are culturally acceptable and available, their seasonality, methods of preservation and preparation, and barriers to their use due to cost, health beliefs, or other reasons of accessibility are also important. Only when these factors are known will agricultural, food processing, social marketing, and public health education programs have a sustained impact on behavior change and in improving dietary modification for vitamin A (Wasantwisut and Attig, 1995).

The elements of understanding the culture and ecology of food availability and consumption at the local level are addressed in several avenues of scientific communications including agriculture, food science, nutrition and social science journals, and other publications. The use of food sources to solve the vitamin A problem has recently been reported by Gopalan et al., 1992; IVACG, 1992; Smitasiri et al., 1993; Wasantwisut et al., 1994; and Wasantwisut and Attig, 1995. These publications give examples of successful programs to improve dietary vitamin A.

Focused Ethnography to Understand Local Culture and Environment for Vitamin A Programs

The methodology that was used in the studies reported in this book can be described as focused ethnography. We drew on research techniques from anthropology and nutrition to create a manual that facilitates the collection and interpretation of data on cultural and environmental aspects of food use and vitamin A deficiency.

Focused ethnography evolved as an approach based on principles of contemporary method and theory in cultural anthropology, modified by the requirements and constraints of program development in public health, agriculture/horticulture, and other public service sectors (Gove and Peltó,

1994). These methods are akin to the pioneering developments widely known as rapid assessment procedures (RAPs) (Scrimshaw and Hurtado, 1987; Scrimshaw and Gleason, 1992).

FES shares many fundamental characteristics with general ethnography:

- Data-gathering is carried out in a specific locality (community or regional cluster of communities).
- In-depth key-informant interviewing is a primary data-gathering
- The research design produces a qualitative description of cultural and behavioral patterns, that is, the models or systems of relationships among elements in a sociocultural domain.
- Data-gathering places an emphasis on describing the perspective of the client (their own language, concepts, and cultural beliefs) the *emic* perspective.
- The theoretical approach of cultural ecology directs data-gathering, that is, attention is given to the description of culture, behavior/practices, and to the physical and social environment.

In contrast to general ethnography, program requirements determine several special features of the FES approach:

- Data-collection is focused on a specific set of predetermined questions. In our work the questions relate to: (i) identifying key foods, particularly those important for vitamin A; (ii) cultural beliefs regarding these foods; (iii) food acquisition, preparation and storage; (iv) patterns of food use and the vitamin A content of diets; and (v) community perceptions about the signs and symptoms of vitamin A deficiency.
- To be feasible with respect to cost, time, and organizational/political logistics, the Protocol is designed to be completed in a short period of time—six to eight weeks.
- Standardized methods are applied in which data-collection is very clearly specified, and forms for data-recording and analysis are provided. As a result, the investigator and field assistants have a clear picture of the expected products of the data. It is therefore possible to have interviewers without university training.

- A manual of the procedures in the protocol provides a framework for training the field team. A pre-study training workshop, with step-by-step instruction in data-collection, insures that interviewers fully understand the purposes and procedures, and that they record data accurately and completely.

The FES approach is intended to demystify the processes of qualitative data-collection, in this case to understand how culture, environment, and food can prevent vitamin A deficiency. FES approaches have been developed for acute respiratory illness, malaria, and diarrhea (Herman and Bentley, 1993; WHO, 1993a, 1993b, 1994). This approach has also been applied to situation analysis of high risk behaviors in relation to HIV/AIDS (Pelto, 1993; NACO, 1994). Similar manuals, some of which include methods for assessing child labor situations in countries such as Bangladesh, are in various stages of preparation (personal communication, P. J. Pelto, 1994). Further discussion of the FES approach is given in Chapter 3.

The Structure of This Book

This book is structured to give the reader the logical flow of our research process to create the FES protocol, the final result which is a manual presented in the companion volume. The book contains four parts: 1) the background of knowledge on vitamin A in food and diets; 2) creating the protocol; 3) the community assessments of natural food sources of vitamin A that tested the protocol; and 4) the final section that contributes new understanding about community deficiency of vitamin A. Following this introduction, we discuss the factors involved in understanding vitamin A in food and diets with emphasis on populations at risk for vitamin A deficiency (Chapter 2). Chapter 3 describes how the process evolved through the International Union of Nutritional Sciences, Committee II/6 in Nutrition and Anthropology, with funding from the International Development Research Centre of Canada. We also describe the FES methods developed for testing in five diverse cultural and environmental areas where vitamin A is at risk.

The manual was tested with the Aetas of Canawan in the Philippines during wet and dry seasons, with the Hausas of Filingué in Niger, with the people of Doumen of Kai Feng Municipality in China, with the Comunidad Campesino of Chamis and the Barrio San Vicente of Cajamarca in Peru, and with the people of Sheriguda Village of the Ranga Reddy District of Andhra Pradesh in India. In Chapters 4 through 8, reports from the research teams in these five areas relate their experiences

with the FES protocol, and important findings that resulted from using the protocol in their countries.

Chapter 9 summarizes key points of the field tests from a methodological perspective. It also includes general observations concerning culture, environment, and vitamin A deficiency. As future studies are conducted with the manual, we hope the methodology provided by the FES structure will serve as the framework for systematic cross-cultural comparisons on a broader database. The chapter concludes with a discussion of utilization of knowledge about culture and environment in developing interventions to prevent vitamin A deficiency.

References are given at the end of the book. These are followed by an Appendix that gives the Table of Contents of the manual, entitled *Community Assessment of Natural Food Sources of Vitamin A: Guidelines for an Ethnographic Protocol*.

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2

The Complexities of Understanding Vitamin A in Food and Diets: The Problem

Sarah L. Booth, Timothy A. Johns, and Harriet V. Kuhnlein

Introduction

We began our work with the premise that to prevent vitamin A deficiency, more vitamin A needs to be present in diets of those vulnerable to deficiency. Where deficiency exists the solution rests in getting more vitamin A into diets on a regular basis. The problem, therefore, is to find out how to do this—and this requires knowing the following:

- How much vitamin A is already in the diet: What and how much food is eaten, what is the vitamin A content of that food?
- Why people eat what they do: what are the food beliefs and behaviors that are practiced?
- What would bring about positive dietary change to prevent vitamin A deficiency: What vitamin A-rich food is available in the local environment that can be used to better advantage, perhaps by better processing? What other dietary and health factors would make dietary vitamin A more physiologically active? How and why would those who are vulnerable to deficiency change their behavior to improve their diet?

In this chapter we review current knowledge of food sources of vitamin A present in nature (natural food sources), and discuss the current status of food composition data. This is followed by a discussion of factors that influence dietary intake of foods rich in vitamin A activity

(that is, both retinol and carotene), and the impact these have on assessment of diets for this nutrient. We also include brief reviews of methods that have been used to assess diets for vitamin A in populations vulnerable to deficiency, and of food programs that have improved dietary vitamin A.

Overview of Natural Food Sources of Vitamin A

Vitamin A in food is found as retinol or as carotenes. Retinol is found exclusively in animal foods including eggs, milk, and milk products (Heinonen, 1991; Booth et al., 1992). Storage of retinol in animal species is not evenly distributed among tissues, with the highest levels of preformed vitamin A found in animal and fish livers and fish oils (Leth and Jacobsen, 1993; Morrison and Kuhnlein, 1993). Retinol is also stored in the intestinal walls of fish, in the body fat of eels, and in the eyes of certain species of shrimp. With the exception of fowl, meat products, including beef and pork, do not contain significant quantities of preformed vitamin A.

Carotenoids are found primarily in plant foods (Simpson and Tsou, 1986), whereas meats, fats, and dairy products are reportedly low in carotenoid content (Heinonen, 1991). The richest known sources of provitamin A are the palm oils. Red palm oil, a common cooking product in West Africa, is usually cited as having the highest concentration of provitamin A activity (Cottrell, 1991).

However, recent studies indicate that the oil of the buriti palm tree has a tenfold greater concentration of vitamin A activity when compared with red palm oil (Rains-Mariath et al., 1989). Other food categories rich in provitamin A activity include dark green, leafy vegetables; algae; red/yellow vegetables and tubers; and red/orange fruits, flowers, and juices (Booth et al., 1992). White roots and tubers and whole grains are considered very low in provitamin A content. Color intensity, however, is not necessarily a reliable indicator of biologically active carotenoids. For example, the chlorophyll of green leafy vegetables masks the carotenoid pigmentation, yet as a group these vegetables are excellent sources of provitamin A (Simpson and Tsou, 1986).

Vitamin A Food Composition Data

This section and the following two sections (“Effect of Food Processing on Vitamin A” and “Food Composition Tables for Vitamin A”) give details of vitamin A chemistry and analysis.

Nomenclature

Vitamin A can be obtained in two forms from the diet: preformed vitamin A, also referred to as retinol, and provitamin A, also known as the carotenoid precursors that are biologically active as retinol. The term vitamin A is used in two contexts; a generic term for all β -ionone derivatives, excluding the carotenoids; and as a generic term for all those compounds, including carotenoids, that are precursors to retinol and can reverse symptoms of deficiency associated with this fat-soluble vitamin (Davison et al., 1993). For the purpose of this chapter, the latter definition will be used, with discussion of carotenoids limited to those that are retinol precursors.

The parent compound of vitamin A is all-trans retinol, which is an isoprenoid compound found in animal tissue (Simpson and Tsou, 1986; Bendich and Langseth, 1989). The major storage form, retinyl palmitate, is an ester of a fatty acid chain, 90% of which is stored in the liver. Carotenoids are a class of more than 600 known naturally occurring pigments found in certain fruits, vegetables, and oils, and animal foods, such as egg yolk and shrimp (Daun, 1988; Erdman, 1988). The nutritional functions of the carotenoids have recently been reviewed in response to the interest in the role of carotenoids as chemoprotective agents (Davison et al., 1993; Thurnham, 1994). Only fifty of these carotenoids, of which β -carotene comprises 10% to 15% of total serum carotenoids in humans, are known to be converted to retinol by oxidative cleavage (Thurnham, 1994).

Units of Expression

Nutrient values of preformed vitamin A and provitamin A can be combined into a single numerical value of vitamin A activity (Thompson, 1986). Originally, the internationally accepted values were international units (IU). One IU was defined as 0.30 μg of all-trans retinol, or 0.60 μg of all-trans β -carotene. These units are still found in many food composition tables.

In theory, one mmol of all-trans β -carotene should cleave to form 2 mmols of all-trans retinol (Olson, 1989). However, the absorption rate for carotene is 20% to 50% compared with that of retinol, which is estimated at 70% to 90%, and the absorption of the former becomes less efficient with increasing levels of intake (Olson, 1990). Discrepancies in the conversion of carotenoids to retinol have been attributed to factors influencing bioavailability and absorption, including the amount of carotenoid in the diet, interactions with other carotenoids, dietary fat and

fibre, nutritional deficiencies of zinc and/or protein, and the substrate requirements for absorption (Olson, 1986; Erdman, 1988).

Given the strong evidence for lower bioavailability, the biological activity of all-trans β -carotene and other carotenoids were revised. This gave rise to units of expression for vitamin A activity called retinol equivalents (RE). These are now the internationally accepted units for vitamin A activity (Simpson and Tsou, 1986), and can be summarized as follows:

- 1 RE = 1 μ g all-trans retinol
- = 6 μ g all-trans β -carotene
- = 12 μ g other biologically active carotenoids
- = 3.33 IU retinol
- = 10.0 IU carotene

However, there is still confusion between IU and RE given the differences in equivalency when converting β -carotene to retinol. Use of RE reduces the contribution of provitamin A to total vitamin A activity compared to the system of IU as described in greater detail by Olson (1987).

Other vitamin A-related compounds exist in dietary sources of preformed A, particularly in fish liver and oils. All-trans dehydroretinol, referred to as vitamin A₂ in the older literature (Moore, 1957), is a vitamin A-related compound found in freshwater fish flesh and liver, and to a lesser extent, in some marine fish (Olson, 1986; Ball, 1988). This compound is estimated to have 40% to 50% of the vitamin A activity of all-trans retinol (Parrish et al., 1985). Likewise, cis isomers of retinol, which can account for up to 35% of preformed vitamin A measured in fish liver oils, have up to 75% relative activity of all-trans retinol. These discrepancies in vitamin A activity have been overlooked frequently in food composition literature, although recent studies have adjusted retinol activity values according to differential biological activity (Pepping et al., 1988; Morrison and Kuhnlein, 1993).

Isomerization is also an important issue in quantifying provitamin A activity in processed forms of plant products, but has not yet been given adequate attention in the calculation of units for expressing vitamin A activity. Likewise, new analytical techniques available for carotenoid analysis have facilitated the analysis of individual carotenoids within a single food item (Rizzolo and Polesello, 1992). This allows for the direct calculation of individual carotenoid intakes, instead of the conventional estimate based on conversion of vitamin A values (Forman et al., 1993).

Analysis of Vitamin A

With recent interest in the possible link between cancer and the intake of carotenoids (Krinsky, 1988; Knekt et al., 1990; Zeigler, 1991), an extensive literature has emerged describing the available methods for analyzing carotenoids, particularly those by high-pressure liquid chromatography (HPLC). Several thorough reviews exist, with descriptions of the theoretical and practical applications of each method (Davies, 1976; Rodriguez-Amaya, 1989; Rizzolo and Polesello, 1992).

Carotenoid analysis is accomplished by extraction, followed by partial purification, separation according to hydroxyl groups, isolation by chromatography, and then measurement by spectral absorption (Lee et al., 1989). The Association of Official Analytical Chemists (AOAC) method for carotene analysis is an open-column chromatography method using a magnesium oxide column, which separates carotenoids from xanthophylls on the basis of polarity, followed by visible absorption spectrophotometry (AOAC, 1984). The first fraction eluted is assumed to be β -carotene.

Recent studies in carotenoid analyses revealed that assumptions inherent in the AOAC method are incorrect, so much of the published provitamin A nutrient data are overestimates of the true carotenoid value of certain foods (Simpson and Tsou, 1986). This is most critical for food items with mixed carotenoid activity, particularly those carotenoids that do not have vitamin A activity but elute out with the β -carotene fraction.

Reversed-phase HPLC is rapidly becoming the preferred method for carotenoid analysis, given its flexibility in the identification and quantification of the numerous carotenoids (Rizzolo and Polesello, 1992). The use of HPLC is also becoming the preferred method of retinol analysis. However, the complexity of carotenoids, their isomers, and other chemical substances in foods prevented the development of a single HPLC method for carotenoid analysis (Lee et al., 1989) until recently. Also, while the methodologies using HPLC for carotenoid and retinol analyses are evolving, standardization among and within different laboratories is difficult to attain. In a recent study on the intercomparison of methods used for vitamin A determination of foods, the results for retinol analyses in milk agreed very well (Hollman et al., 1993). However, comparison of β -carotene contents in green beans analyzed by different laboratories showed poor agreement. Another limiting factor for all analytical methods, particularly HPLC, is the cost of equipment and solvents, which is prohibitive in most developing regions (Rodriguez-Amaya, 1989).

Effect of Food Processing on Vitamin A

Carotenoids and retinol are affected by pH, enzymatic activity, light, and oxidation associated with the conjugated double bond system (Elkins and Dudek, 1985). The chemical changes occurring in carotenoids during processing has been reviewed by Simpson (1986). Fresh plant tissue may contain enzymes that are only activated during and following processing. Therefore, the preformed and provitamin A content of the raw form of a food item may be reduced as a consequence of food preparation. The most dramatic example of this is found in red palm oil, which in its raw form is considered one of the richest sources of provitamin A (Cottrell, 1991). After heating to 200°C for thirty minutes, the β -carotene content becomes negligible.

Numerous reports document changes in carotenoid content attributed to various cooking methods (Park, 1987; Chandler and Schwartz, 1988; Nagra and Khan, 1988; Micozzi et al., 1990). As a general rule, foods boiled in an open container show the greatest losses. Regardless of the method used, most report that dehydration significantly reduces the carotene content in vegetables, which has implications for storage of seasonally available foods (Renquist et al., 1978; Park, 1987). However, in a study that controlled for complete extraction of carotenoids in raw samples, Khachik et al., (1992) reported no significant changes in the β -carotene content in several green vegetables, after microwaving, steaming, or boiling. Likewise, the carotenoid content of tomatoes did not change when they were dehydrated. It should be noted though that dehydration was performed in a laboratory environment and by sun-drying.

Sweeney and Marsh (1971) reported that processing of fruits and vegetables induced isomerization of carotenoids, resulting in an estimated 15% to 20% reduction in vitamin A potency in green leafy vegetables, and 30% to 35% in yellow vegetables. Traditional processing methods, including preservation, induce formation of the *cis*-isomer of carotenoids from the *all-trans* form (O'Neil and Schwartz, 1992). With increased temperature, the presence of light, and catalysts such as acid, isomerization from the *trans* form to the *cis* form of carotenoids increases (Chandler and Schwartz, 1988).

The documentation of processing effects on retinol is less abundant. Losses of up to 40% in fish sources rich in vitamin A have been reported following boiling (Burt, 1988). In a study on the traditional food system of the Sahtú Dene/Métis, there were no consistent trends in retinol levels between raw and cooked forms of various food samples probably due to

biological variation (Morrison and Kuhnlein, 1993). Smoking fish and mammal meat did not appear to reduce retinol levels.

Food Composition Tables for Vitamin A

Reasonably accurate food composition data is needed to calculate the vitamin A intake of a population from dietary surveys, or to select food items rich in this nutrient, for education programs. However, food tables contain nutrient values from chemical analyses of foods, with no allowance for the biological utilization of the item (Ferrando, 1987), so these values are estimates, at best, of active vitamin A. The limitations of vitamin A nutrient values in food composition tables have been reviewed (Simpson and Tsou, 1986; Booth et al., 1992); in their current state, most contain inconsistencies in preformed and provitamin A values. Differential use of units and conversion rates and reliance on outdated analytical techniques limit their use in the identification of vitamin A-rich foods and the calculation of dietary intake of vitamin A, particularly from carotenoid sources.

With the strong evidence that an increased intake of fruits and vegetables is associated with a reduced risk of certain types of cancers, the current food composition database of carotenoid values for foods consumed in the United States was recently re-evaluated (Mangels et al., 1993). An artificial intelligence system was developed to evaluate existing carotenoid data, including indicators of data quality, and to prioritize future laboratory analyses. Only HPLC-generated data were incorporated into the database to eliminate the problem of overestimation associated with analytical methods that quantify total carotenoids instead of individual carotenoids. A modified version of this artificial intelligence system was subsequently used by West and Poortvliet (1993) to evaluate existing carotenoid data for developing countries. Most carotenoid values reported are for vegetables and fruits, although there were limited data for meat, fish, fats, eggs, cereals, and dairy products. Given the paucity of carotenoid data in many geographical regions, particularly African, these authors used less stringent criteria for including food composition data into their data base. In particular, carotenoid data generated from methods other than HPLC were included. This decision was made by West and Poortvliet (1993) in recognition of the limited number of resources available to laboratories in many developing countries.

A common criticism of food composition data is the inadequate amount of information available on sampling methods. Regardless of the analytical method selected for carotenoid and retinol determination, er-

ror introduced during the collection and preparation of samples can create large discrepancies in the final nutrient values. Sources of sampling and preparation error have been reviewed (Elkins and Dudek, 1985; Kuhnlein, 1986), and show that much of the variation is attributable to the nature of the item being analyzed (Thompson, 1986). West and Poortvliet (1993) reported multiple problems in compiling carotenoid data: use of different languages and nomenclature for identification of food items; inadequate data on the sample size and handling; limited data on the time between sampling and analyses, and sample treatment in the interim; exposure to light and air; details on the analytical methods used; and absence of information on the use of quality control procedures. In the absence of information on sampling, it is not known whether discrepancies in the published literature on vitamin A content reflect natural and/or analytical variation.

Heterogeneity in nutrient content is a consequence of numerous factors, including soil pH, amount of rainfall, seasonality, genetic diversity, and the stage of maturation. Vitamin A is not uniformly distributed within the animal or plant tissue, so the accuracy of the nutrient value is determined in part by the portion size and the number of individual units selected for a representative sample. Retinol concentrations in liver oils among fish and mammalian species can differ by more than a thousand-fold, and mammalian liver retinol concentrations within species can vary in a range of more than 200-fold (Moore, 1957; Pepping et al., 1988; Morrison and Kuhnlein, 1993). Bureau and Bushway (1986) found a very large range in provitamin A values for a sample of twenty-two fruits and vegetables, but this was not consistent across seasons or location. Nutrient data of green leaves analyzed in two different seasons also showed inconsistent variation among seasons (Tagaki, 1985). Variation attributable to different cultivars and handling conditions, including the time of marketing, have been confirmed (Johnson et al., 1985; Bushway et al., 1986).

When compiling carotenoid data from multiple sources, Forman et al. (1993) grouped similar foods into a single general food description. Variability was indicated by the range of individual carotenoid values. Unfortunately, there were insufficient data to desegregate carotenoid values for a single food item based on factors such as season, that may influence carotenoid levels. In contrast, West and Poortvliet (1993) limited the amount of aggregation of carotenoid data due to the wide variation in globally generated values.

Assessment of Dietary Vitamin A Intake

In a recent review of the literature about food beliefs and practices pertaining to vitamin A intake, a multidisciplinary approach was taken using literature ranging from clinical trials to anthropological studies of dietary practices among different societies (Johns et al., 1992). The limitations in the available literature highlighted the difficulties in estimating dietary vitamin A intakes in communities with vitamin A deficiency.

Nutritional data are often lacking, so assumptions have to be made about the potential vitamin A activity of the food items being discussed. This is exacerbated when authors do not include scientific names, or even common names of foods, in their discussion of dietary practices. It is impossible to differentiate poor from excellent sources of vitamin A within the commonly used categories of vegetables and meat. Results of any dietary survey method are dependent on the quality of the food composition tables used to calculate nutrient intakes (Bingham, 1991). As discussed earlier, there are many gaps in the current food composition data for this nutrient, particularly for carotenoids. West and Poortvliet (1993) noted that national food composition tables generally reported vitamin A values that were overestimates when compared with data generated from individual studies. Moreover, the significance of the variability in the nutrient content of natural food sources is not always given adequate attention in dietary surveys. There are many stages during which a change in nutrient composition may occur, including storage of raw food at home, preparation of food prior to cooking, cooking, and finally storage of prepared food (Ang and Livingston, 1974). Calloway et al. (1993), for example, expressed concern about the quality of food composition data in their crosscultural study on the vitamin intake of toddlers in Kenya, Mexico, and Egypt. Most of their food composition data was derived from U.S. Department of Agriculture food composition tables, with little data available on the impact that local cooking and preparatory methods had on nutrient values.

Questionnaire Techniques

Despite extensive research on diet survey research methodology, an ideal technique for estimating individual food consumption has yet to be developed (Bingham, 1991). More intrusive methods, such as direct observation, weighed diet records, or diet histories, are considered more accurate in terms of the nutrient intake estimates generated (Barrett-Connor, 1991). However, these methods are too expensive and time-consuming to use at the community level in developing areas at risk for vitamin A deficiency.

Moreover, they only reflect the actual intake of those days recorded and they are not often representative of the usual diet. This is an important consideration when evaluating vitamin A intake that has seasonal fluctuations dependent on food availability. The 24-hour recall method costs less in time and manpower but it only reflects recent diet and not usual intake, unless the interview is repeated many times for the same individual (Block, 1982). Intra-individual variation in nutrient intake is particularly problematic with vitamin A, so repeated measurements are required for a representative index of consumption (Beaton et al., 1983; Basiotis et al., 1987). However, this is not feasible for most field studies due to limitations on resources and the risk of low subject participation (Tangney et al., 1987).

Food frequency questionnaires are considered valuable epidemiological tools because of their simplicity; however, they are not statistically comparable in nutrient estimates to those obtained from other dietary survey methods (Willett, 1990). However, this method is not without its limitations. The order and the actual food items listed may influence responses, so the questionnaires need to be culture-specific as the respondent is prompted by the food items listed (Barrett-Connor, 1991). To determine which foods should be included on the frequency list, descriptive dietary data are required for which recall methods are recommended (Hankin, 1987). This approach was successfully used by Abdullah and Ahmed (1993) in the initial screening of areas and population groups at risk of vitamin A deficiency in Bangladesh. These authors confirmed that 24-hour recalls were inadequate indicators of usual intake if administered in isolation of other dietary survey methods. Simplified food frequency methods have been developed and tested for assessing dietary vitamin A deficiency (IVACG, 1989; Abdullah and Ahmed, 1993; Rosen et al., 1993).

In addition to food frequency questionnaires and 24-hour recalls, other research tools have been used to ascertain food available and consumed in communities at risk for vitamin A deficiency. Market surveys can be simple or complex, depending on their size and the range of imported and local food, as well as the access the population under study has to them. Market surveys, garden surveys, and other information can be used to generate a seasonal calendar of food items under consideration. Seasonal calendars are useful to understand the availability of particular items during the year. Information from public health records or questionnaires can provide data on the extent of breastfeeding and patterns of infant feeding and weaning, all of which are important for peri-

ods when a population may be vulnerable to vitamin A deficiency (Rosen, 1992; Rosen et al., 1993).

All dietary assessment techniques for vitamin A intake require estimations of the amount of food consumed, the vitamin A content of the food, and frequency with which it is consumed. From this information it is possible to calculate intake and potential risk of deficiency in percentages of the population in various age and gender groups (IVACG, 1989; Rosen et al., 1993; Sungpuag et al., 1994). Simple frequency forms for summarizing community data and estimating percentages of risk for those who consume food groups (for example, dark green, leafy vegetables or foods of animal origin) in frequency categories (for example, greater than or less than 3 times/week) can be prepared from brief household surveys (WHO/UNICEF, 1994). The IVACG simplified approach to dietary assessment of vitamin A intake of preschool children was validated in Bangladesh using weighed dietary evaluation for three consecutive days (Abdullah and Ahmed, 1993).

As reviewed by Cassidy (1994), crosscultural differences can also create errors in a diet survey method. Differential dietary practices are observed among different ethnic groups within the same region, or within the same ethnic group in different communities. When authors do not give details on a specific ethnic group and location of the study, generalizations may erroneously be made. This is of particular importance for a study that is devised by an individual who is of a different cultural background than that of the study population. In a study in Liberia, direct translation of English terminology was misinterpreted when administering dietary questionnaires and yielded inaccurate conclusions with respect to the ages at which solid foods were introduced (Jarosz, 1990). Dietary studies often cover reported behavior and statements of beliefs and attitudes, but often do not include reports of direct observations of behavior. There are important differences between reported practice, which tends to fit the ideal or norm, and real practice. Furthermore, although statements of belief may be true, there is not always a direct relation between belief and practice. This is why it is so important not to assume that beliefs and attitudes always dictate the way people act, especially with regard to food.

Unusual Food Sources

Wild foods, particularly local leafy green vegetables and fruits that are generally rich sources of provitamin A, are often overlooked in dietary surveys. In one study examining the dietary habits of preschoolers in

Guatemala, children did not include edible greens when asked to recall food consumed, yet were observed to gather and consume at least two different species (Pigott and Kolasa, 1979). The authors concluded that these plants had a low status, hence were excluded from the dietary recall. In another study, the authors queried the low intakes of vitamin A recorded in the dietary surveys given the low prevalence of nutritional blindness in the same population (Flores et al., 1964). It was suggested that provitamin A-containing foods, such as fruits and vegetables, were not purchased and therefore were not considered part of the diet. It may be that foods not actively cultivated by a population engaged in agriculture (wild greens, insects) would not be classified as food, even though they are consumed. The effectiveness of a recent vitamin A intervention trial was confounded by the onset of mango season (Carlier et al., 1992). These authors argued that it was difficult to quantify the carotenoid intake of mangoes by children because the fruit was not eaten at meal time. As a consequence, the intake of foods rich in vitamin A activity is often underestimated. The same dilemma occurs when foods are consumed outside of the home (e.g., at the kill site for game or at the market).

Dietary Vitamin A Intake Patterns

Recommended Intakes

The current recommended nutrient intakes (RNI) of vitamin A published by the FAO/WHO are two-tiered (FAO, 1988), with a basal level corresponding to a recommended intake to prevent deficiency, and a safe level similar to the recommended dietary allowance (RDA) set for the United States (NRC, 1989) which corresponds to an intake that provides for adequate liver storage of this fat-soluble vitamin (Olson, 1987). The basal level for adults ranges from 270 to 400 retinol equivalents (RE), whereas the recommended safe level corresponds to 500 to 600 RE, with additional recommended intakes of 100 RE during pregnancy and 350 RE during lactation (FAO, 1988).

Forms of Vitamin A

It is estimated that the median intake of vitamin A in the United States is composed of approximately 25% provitamin A (carotene) and 75% preformed vitamin A (retinol), with dairy products and fortified foods being the major contributing dietary items (Olson, 1987). Of the proformed vitamin A, β -carotene is the most abundant carotenoid in the diet, with carrots accounting for more than 30% of the total population intake

(Block, 1994). In contrast, studies from developing regions suggest that up to 80% of the dietary intake of vitamin A comes from provitamin A food sources, predominantly in the form of β -carotene (Simpson and Tsou, 1986).

Differential intake of provitamin A and preformed vitamin A can be explained by the natural variation in the nutrient content of individual food items. As reviewed by Johns et al. (1992), inclusion and exclusion of food items can also be determined by dietary beliefs and practices, as well as by seasonal and economic factors. Dietary prescriptions and proscriptions are structured both in relation to normal physiological status and to illness prevention and management. Exclusion from the diet of an item rich in vitamin A activity can relate to dietary beliefs, although these are usually limited to certain sectors of the population. Certain food items may be proscribed from the diet in response to alterations in physiological status, e.g., menstruation, pregnancy and lactation, and illness. Time availability is also a determinant of food consumption, particularly time to gather and prepare food. Crosscultural differences in parental control and dietary beliefs influence the timing of the introduction of foods rich in vitamin A activity during the weaning period, and the quantity ingested. This has important implications for the vitamin A status of infants and children whose liver stores of this nutrient are more rapidly depleted than those of adults, who eat relatively small quantities of food.

Of the vitamin A-rich food sources, the literature makes ample reference to the dietary use of green leafy vegetables, particularly gathered, wild species, with few examples of limitations on consumption due to dietary beliefs (Johns et al., 1992). However, green leafy vegetables are under-utilized relative to their availability and potential nutrient contribution as documented in Liberia (May and McLellan, 1970), India (Pereira and Begum, 1976), Papua New Guinea (Bailey and Whiteman, 1963), among the Quechua in Peru (Mazess and Baker, 1964), and the Haustec in Mexico (Alcorn, 1981). Although Rahman et al. (1993) demonstrated that children in a clinical setting could eat a sufficient amount of leafy green vegetables to fulfill their daily vitamin A requirements, it was not known if this was a feasible expectation on a daily basis in the home environment.

Vitamin A-rich fruits, such as mangoes and papayas, are also referred to in numerous anthropological and nutritional studies. Wilson (1985) suggested that there is a global promotion of intake of those foods for which there are cravings during pregnancy, fruits being one of the more common food groups. There are also numerous references to the popu-

larity of fruits among children because of their sweet taste and soft texture (Johns et al., 1992).

In contrast, there is very little literature available on dietary beliefs and practices surrounding the use of plant oils other than the documented use of red palm oil in certain regions of Africa (Johns et al., 1992). Given the small quantities that are used in the cooking process, the frequency and amounts of oils consumed are difficult to quantify in a dietary survey (Sommer, 1982). As previously stated, red palm and buriti palm oil are the richest known sources of provitamin A. While other plant oils have little if any vitamin A activity, their contribution to vitamin A intake is important for the absorption of this fat-soluble vitamin (Mejia, 1986). Therefore, promotion of dietary fat should not be limited to those oils known to be rich in vitamin A activity, although the latter arguably would have the greatest impact on improving dietary vitamin A intake.

In terms of natural food sources of retinol, Abrams (1987) stated that all human cultures include some form of animal protein and fat in the diet, with chicken meat and eggs consumed most frequently, followed by cattle meat and milk. Although organ meats are the richest known sources of retinol, there are few data on their inclusion or exclusion in the diet (Johns et al., 1992). There are few reports of egg consumption in the literature compared with the numerous dietary restrictions for them, especially for women of childbearing age (Johns et al., 1992). Milk and its byproducts, such as yogurt and ghee, have important dietary roles for nomadic groups (Casimir, 1988; Nestel, 1989), but other regions and cultures have emerged as nonmilk users. Simoons (1973) offered three possible explanations for exclusion of milk in the diet: lactose intolerance; milk is considered an unpleasant secretion; milk is only considered suitable for feeding calves. Other authors report that milk consumption is not possible in regions of Zambia due to the presence of the tsetse fly (Awdry et al., 1967). Similarly, endemic liver flukes limit beef liver consumption among the Masai in Kenya (T. Johns, personal observation).

Including and Excluding Vitamin A Food

The data strongly reinforce the significance of both intercultural and intracultural diversity with respect to dietary inclusions and exclusions (Cassidy, 1994). The same foods are subject to very different interpretations in different cultural settings. For example, the green leaves of root crops are consumed in the northern regions of India but avoided in the southern regions of the country (Pereira and Begum, 1976). Not all edible species of fruits are consumed, as demonstrated by different species

preference among different ethnic groups within the same ecological region in the Taita Hills of Kenya (Fleuret, 1986). Differential preference for ripeness in mangoes among Gambian women affects the nutrient intake since provitamin A activity varies with the stage of maturation (Villard and Bates, 1987).

Traditional beliefs and practices in many societies are also being modified by the influence of the media and government programs such that both historical and contemporary factors contribute to actual dietary intake (Johns et al., 1992). For example, in Java the majority of women increased consumption of leafy green vegetables during lactation to increase vitamin A intake, a reflection of beliefs introduced by the media and government programs (Hull, 1986). Conversely, Doolan (1991) argued that the current shift to marketed foods among northern native populations results in an inadequate intake of vitamin A. When this extends to methods of food preparation, the vitamin A activity is modified from the estimated nutrient content in the raw form. Therefore, selection and consumption of vitamin A-rich foods appear to be highly situation-specific, which points to the need for locally relevant data.

Season and Economic Constraints

Seasonality in the utilization of vitamin A source foods appears to be significant in many, perhaps most, geographical-cultural settings. Ecological factors such as climate, soil, water, and genetic integrity all determine the availability of a food item, particularly in regions where transport and storage facilities are not well developed (Willett, 1990). Variation in preference for different species of wild greens in some regions of Mexico may reflect differences in availability according to ecological conditions and agricultural practices (Messer, 1972). In contrast, selective weeding encourages growth of preferred species of wild greens in other regions of Mexico (Altieri and Trujillo, 1987). Most descriptions of fruit intake make reference to the seasonal availability that creates periods of variable risk of hypovitaminosis A (Fleuret, 1986; Villard and Bates, 1987; Dei, 1991). There are also many accounts of the seasonal availability and consumption of green leafy vegetables, with an abundance of wild, leafy greens noted during the rainy season in some regions (Newman, 1980; Bates, 1983; Malaisse and Parent, 1985). Booth et al. (1993) noted that a seasonal variation in the consumption of indigenous greens in a region in Guatemala was related to agricultural practices, with the highest intake recorded during the months of clearing land for the maize crop. When liver retinol stores are low or vitamin A status is compromised by disease,

seasonal fluctuations can lead to periods of greater risk of hypovitaminosis A. With the rapid loss of micronutrients associated with light, high temperatures, and oxidation (Harris, 1988), storage needs to be a priority if food sources rich in vitamin A activity are to be fully realized for their potential. This is particularly true in regions that have distinct fluctuations in seasonal availability of vitamin A–rich foods.

Economic constraints may be significant not only in relation to the relatively more costly preformed vitamin A, but also with respect to provitamin A from plant sources. Dietary intake of vitamin A has been positively correlated with household income (Jyothi et al., 1963; May and McLellan, 1970; Villard and Bates, 1987). This correlation is most evident when the provitamin and preformed vitamin A food sources are not readily available. In vitamin A–deficient regions eggs, milk, and fish are sold often, instead of being consumed at the local level (Jyothi et al., 1963; May and McLellan, 1970; Villard and Bates, 1987; Dettwyler and Fishman, 1990). Fruit intake has also been associated with higher income (Hull, 1986). However, Kennedy and Oniang'o (1993) argued that while household income has a positive impact on vitamin A intake, community-based health, sanitation, and nutrition interventions are needed also to improve the dietary needs of preschool-aged children.

Market value is also linked to issues of social status associated with a given food item, and vice versa. Developing commercial markets have created a shift in the species of fish caught by the Miskito of Nicaragua, with the perception of what is valuable determined by what can be sold (Neitschmann, 1972). Conversely, there is a stigma of poverty associated with wild greens that has been documented in various regions, including Mexico (Wilken, 1969), Guatemala (Booth et al., 1993), and India (Jyothi et al., 1963). This negative association is particularly strong among urban populations (Messer, 1972). However, chronic poverty has maintained the knowledge and consumption of wild greens among many populations (Caballero and Mapes, 1985).

Other Dietary and Health Factors Influencing Vitamin A Status

As discussed earlier, the carotenoids with vitamin A activity are less bioavailable compared with retinol because of the former's specific requirement for bile salts for absorption (West and Sommer, 1987). The absorption of vitamin A is dependent on several factors, including the amount of carotenoid consumed in the diet, the interactions of the carotenoids, and digestibility (Erdman, 1988). With increased protein in-

take, there is an increased oxygenase available to convert β -carotene to retinol. Adequate protein also improves activity of lipolytic enzymes needed to hydrolyze fat and produce monoglycerides and lipolytic products to facilitate micellar solubilization of carotenoids before cell uptake. The quantity of fat in the diet is also important for its role in the transport of vitamin A and for the stimulation of bile flow. Physiological conditions, including hormone status, gastrointestinal diseases, and weight changes also affect utilization of carotenoids (Erdman, 1988). Solomons and Bulux (1993; 1994) argued that the assumption that β -carotene has one-sixth the vitamin A activity of an equivalent amount of retinol has not been substantiated *in vivo* in humans. Therefore, absolute nutrient values must be interpreted with caution, preferably in conjunction with other complete food intake data. Promotion of food sources rich in other nutrients, notably fat, protein, and zinc, may optimize the utilization of preformed and provitamin A in natural food sources. These observations have important ramifications in public health policy for communities with documented vitamin A deficiency, as overestimation of the contribution of carotenoids to total vitamin A activity would reduce the effectiveness of dietary interventions (Calloway et al., 1993; Solomons and Bulux, 1994).

Programs That Improve Intake of Vitamin A–Rich Food

Strategies and programs to prevent vitamin A deficiency at the community level by providing vitamin A in food consumed by those vulnerable to deficiency is recognized as the best long-term solution to the problem. Fawzi et al. (1993; 1994) and Nestel et al. (1993) reported that total dietary vitamin A intake was inversely associated with the risk of xerophthalmia and mortality among Sudanese children. Vitamin A supplementation programs have been shown to improve vitamin A status, and reviews of child mortality demonstrated that improved status reduced mortality (Beaton et al., 1993; Glasziou and Mackerras, 1993). However, the logistics for sustaining the delivery of supplements to all those in need on a regular basis has not been demonstrated. Fortification of sugar in Guatemala was reported to improve national vitamin A status, but the fortification of food vehicles in other areas has not been as effective (Arroyave, 1986). While prophylactic use of high dose vitamin A supplements and the use of fortification of food staples are proposed to be effective if coverage is consistent among those most at risk, it is the improvement in dietary intake of vitamin A–rich food that can have the greatest effect for the most people in the community. Combined approaches, using a range of intervention techniques to make best use of

local resources, including local food resources, are expected to be needed in most areas (Underwood, 1994).

Several successful programs to improve vitamin A status with food interventions have been reported. Improvement in the condition of night-blindness in Bangladesh was accomplished by conducting nutrition education among parents, so that more vegetables and fruits rich in vitamin A and oil were incorporated in children's diets (Yusuf and Islam, 1994). A demonstration project in Thailand using participatory action and social marketing of vitamin A-rich food resulted in improved dietary intake and general health (Smitasiri et al., 1992, 1993). Several examples of programs to identify and promote vitamin A-rich foods in Asia and the Pacific Region have been described (Wasantwisut and Attig, 1995). Dietary and anthropological studies in Myanmar revealed several cultural principles important for social marketing of vitamin A-rich foods for interventions to prevent deficiency (Thwin et al., 1995). There has been skepticism that carotene in vegetables can improve vitamin A status because stir-fried vegetables in Indonesia did not improve women's serum retinol compared with controls (de Pee et al., 1995). However, in India, plant food production and processing is recognized as the best way to combat vitamin A deficiency, and several programs for producing and promoting vitamin A-rich plant foods are in effect (Gopalan et al., 1992; Seshadri, 1992).

Communication techniques are important for the success of all intervention programs. Several strategies for successful communications in vitamin A programs have been described recently (IVACG, 1992; Wasantwisut and Attig, 1995). It is clear that for food intervention programs to be successful, strategies that are suitable to the cultural patterns and environmental constraints of the target population must be developed.

Summary

To improve vitamin A status and prevent deficiency, an increase in consumption of vitamin A is needed by those at risk of poor intake. Public health programs that aim to prevent vitamin A deficiency need to proceed with clear ideas on how to accomplish this within the context of the culture and environment of the target population. Understanding the current intake of vitamin A depends on knowing the kinds of food available that are consumed by those vulnerable (young children and women), and the carotene and retinol content. There are various dietary assessment techniques to accomplish this. In order to develop food intervention programs it is essential to understand why people eat what they

do, why they feed their children as they do, and what belief and behavior patterns will support dietary change to use food that is accessible. Successful food intervention programs that improve vitamin A status depend on careful evaluation of the local culture and environment, and communications incorporating this information.

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Part II

Creating the Protocol

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3

Theory and Process: The Methods

*Harriet V. Kuhnlein, Pertti J. Pelto, Gretel H. Pelto, and
Members of IUNS Committee II/6*

The International Union of Nutritional Sciences, Committee on Nutrition and Anthropology

The International Union of Nutritional Sciences (IUNS) Committee II/6 on Nutrition and Anthropology was the conception point for this project. Committee II/6 convened from 1990 to 1994 with the mandate to facilitate solutions to food and nutrition problems through the application of anthropological knowledge and techniques. To this end, the committee identified its objectives to address vitamin A deficiency, and in particular the use of natural food sources of vitamin A in communities to prevent deficiency. A planning subcommittee met in Washington D.C. in November 1990, to define its goals, and to set the framework of the project described here, which became an activity of the committee.

The IUNS Committee II/6 was comprised of Isabel Nieves (Guatemala) and Harriet Kuhnlein (Canada) as co-chairs; Gretel Pelto (USA, WHO), Richard Young (Canada, IDRC), S. Abdel-Azim Wahba (Egypt), C. Santos-Acuin (Philippines), P. Pushpamma (Singapore), K. Kalumba (Zambia), N. Ngokwey (Benin), H. Creed-Kanashiro (Peru), and L.H. Martinez Salgado (Mexico). The planning subcommittee became Kuhnlein, Pelto, Nieves, and Young; other committee members who eventually participated in the project were Acuin, Pushpamma, and Creed-Kanashiro.

Several committee members had previous experience with rapid ethnographic assessments, and it was significant that the origins of the ideas

for the project germinated at the RAP conference in 1990 in Washington (see Scrimshaw and Gleason, 1992). Committee member G. Pelto had substantial experience in the creation of ethnographic assessments in health programs, notably with the respiratory diseases manual in use with WHO (Pelto and Gove, 1992; Gove and Pelto, 1994; WHO, 1993a; 1994). It was therefore felt that sufficient experience in this area existed within the committee.

Objectives and Funding

The planning subcommittee proceeded to define the objectives and workplan of the project, with the first step being a literature review. With the financial assistance of the International Nutrition Foundation for Developing Countries (N. Scrimshaw), a literature review was completed and published through McGill University with the participation of S.L. Booth, T. Johns, H.V. Kuhnlein, and I. Nieves (Booth et al., 1992, Johns et al., 1992, Kuhnlein, 1992; Kuhnlein and Nieves, 1992).

A one-year project proposal was funded by IDRC through McGill University (H.V. Kuhnlein) to develop a community assessment protocol manual for the identification of locally-available food sources of vitamin A. The protocol was to identify food sources, describe current patterns of use, particularly in relation to infants, children, and pregnant and lactating women, and to elucidate the ecological, economic, and cultural factors that influence these patterns. It would identify community beliefs and practices related to the signs and symptoms of xerophthalmia and health care practices related to these. The protocol was to be tested in five diverse areas of culture and ecology/food system type to fine tune it and determine its generalizability. Field testing was used to identify useful information resulting from the protocol for implementing food-based vitamin A deficiency prevention programs.

The International Development Research Centre (IDRC) and the International Nutrition Foundation for Developing Countries (INFDC) agreed to jointly publish two volumes related to the project: *Community Assessment of Natural Food Sources of Vitamin A: Guidelines for Ethnographic Studies* and *Culture, Environment and Food to Prevent Vitamin A Deficiency*. Publication planning and finalization was coordinated through the Centre for Nutrition and the Environment of Indigenous Peoples of McGill University.

Persons Involved, Basic Activities and Timeline

With objectives and planning accomplished, funding was implemented in 1993–1994. The persons finally contributing to the project were as follows:

- *Planning*: H.V. Kuhnlein, G. Pelto, R. Young, P. Pelto, I. Nieves
- *Initial field testing and creation of module sections to the protocol manual*: L. Blum, G. Pelto, T. Johns, S. Booth, H.V. Kuhnlein
- *Literature review*: S. Booth, T. Johns, H.V. Kuhnlein
- *Training workshop*: P. Pelto, L. Blum
- *Field test site supervisors*: L. Blum (Niger), H. Creed-Kanashiro (Peru), C. Santos-Acuin (Philippines), Li Wen Jun (China), P. Pushpamma (India). *Site visits by* P. Pelto, H.V. Kuhnlein
- *Revisions to protocol manual*: P. Pelto, H. V. Kuhnlein, G. Pelto, L. Blum
- *Publications finalizing and submission*: H.V. Kuhnlein

The timeline of activities was as follows:

- Communications with IUNS Committee II/6, identification of interested committee members, planning: 1990–1994
- Planning committee meetings in Washington, and by conference call: 1990–1993
- Training workshop, McGill University: May, 1993
- Commitment by field supervisors, budget distribution: May–August, 1993
- Field site testing: July, 1993–January, 1994
- Receipt of field test results: January, 1994
- Workshop on manual revisions: January, 1994
- Final revisions to manual received: January–June, 1994
- Submission of funding report and final draft of manual: June, 1994
- Reports to scientific meetings:
 - IUNS: August, 1993
 - Experimental Biology (FASEB): April, 1994

American Anthropology Association (AAA): November, 1994
IVACG: March, 1996

- Chapters to companion volume received: June–December, 1995
- Publications: March, 1996

Theory of the Methodological Approach

Positive dietary change is a gradual process initiated by education, food availability, and choice, and has been given low priority in most vitamin A intervention programs (Darnton-Hill, 1988; IVACG, 1989; Kuhnlein and Receveur, 1996). However, food-based programs for the prevention of vitamin A deficiency are recognized as essential components of the mix of interventions that will prevent mortality and morbidity related to the deficiency of this vitamin (Underwood, 1994). Effective positive dietary change that will prevent vitamin A deficiency requires identifying and quantifying natural food sources rich in vitamin A and provitamin A, in conjunction with foods rich in nutrients that impact on vitamin A uptake and bioavailability (Mejia, 1986). Ecological, cultural, and economic factors that influence food availability, cost, and consumption patterns, as well as attitudes and beliefs about food and feeding behaviors need to be defined and incorporated into programs, as these are often the underlying causes of the deficiency (Devadas, 1987; Kuhnlein, 1992).

It becomes increasingly clear that community data must be used to create locally effective programs for the prevention of vitamin A deficiency and improved health that will be sustainable for the long term. Such data include the availability of food; economic value of food; consumption patterns; values of and attitudes and beliefs toward food; feeding behaviors; and existing vitamin A deficiency (Kuhnlein and Nieves, 1992). Protocols are needed to assist community health, agriculture, education, and nutrition personnel and program planners in obtaining critical information for program planning and development aimed at the elimination of vitamin A deficiency as a public health problem.

Research methods grounded in nutrition and anthropology can be used to devise the needed protocols. As described in Chapter 1, the focused ethnographic study (FES) methodology has been developed and used to address the necessary community data in a series of predetermined questions, the answers to which will assist intervention planning. Similar to manuals developed in rapid assessment procedures (RAP) and other guidelines for ethnographic data-gathering, the manual for community assessment of vitamin A includes techniques used to gather both

qualitative and quantitative information. The interviewing methods, including the use of in-depth interviewing, cognitive mapping techniques, and structured observation, are drawn from standard research procedures in the social sciences. Tools incorporated from nutrition research techniques include food frequency, 24-hour recall, market surveys, and food system data compilations. In common with other RAP approaches, but departing from the usual approaches in non-applied qualitative research, the manual sets forth very specific steps for data-collection to be followed by the field team. The provision of forms for data-recording, and instructions for data analysis, are further means of facilitating the goal of producing a programmatically useful report in a timely fashion.

Overview of Methods of Data-Collection Described in the Protocol Manual

The FES protocol addresses a series of questions about the local situation of vitamin A and health. The questions are ordered as primary and secondary, with the secondary questions giving detail to the primary questions. The primary questions are:

- *What are the key foods?* Secondary questions relate to food acquisition, details on location of markets and their prices, food grown in gardens, and gathered from the wild, etc.
- *What are cultural beliefs about key foods?* Secondary questions include the qualities or attributes of the food, how these vary by age and gender, perceptions of vitamin A in food, suitability of food for children, etc.
- *What are the patterns of food use?* Secondary questions include pregnancy, lactation, infancy, and childhood; perceptions of food use and health/illness; specific foods recommended during these times; degree of breastfeeding, etc.
- *How is food prepared and stored?* Secondary questions relate to length of cooking, extent of drying, use of spices, use of vitamin A-rich food in these ways, etc.
- *What are the signs and symptoms of vitamin A deficiency?* Secondary questions refer to local terms for deficiency states, beliefs about the diseases, treatments used, perceptions on degree of illness, etc.
- General questions relate to women's work, family food distribution, food purchasing, presence of infections, and exposure to nutrition and health education.

The methods of data-gathering, that will be described below, are:

- in-depth interviewing of key-informants;
- direct observation in stores, markets, and agricultural production areas;
- structured interviews with small samples of respondents;
- food frequency and 24-hour dietary recall interviews;
- use of written resources to obtain background information about the community and region, demographic and health status data; food species and composition data, past nutrition surveys; ethnographic studies and other descriptions of economic conditions, life styles, and food beliefs.

Selecting the specific locality for the study requires attention to several criteria. These include:

- The area chosen should be characterized by well-documented vitamin A deficiency.
- The area should be representative of a major cultural/ecological region of broadly similar conditions (including nutrient deficiencies), and in which similar food availability and food practices are found.
- The road and communications network systems should be such that data-gathering logistics are not overly difficult.
- The prospects for developing interventions programs, through existing health service networks of other agencies or community groups should also be considered. Frequently the site of a FES data-gathering operation can serve as a suitable location for experimentation with a pilot intervention program.

Key-Informant Interviews

While the goal of the study is to obtain the specific information required to answer the study questions, the manual directs investigators to begin gathering information about foods and food use by engaging in broad discussion with people in the community. Talking with the people leads to the identification of persons who have a lot of knowledge about local food culture and practices, and who are able to formulate clear ideas about why people do what they do with food in the local area. Persons who can talk effectively about their own food use and diet, as well as about general practices, are sought out as key-informants.

Free Listing

An important early step in key-informant interviewing is the application of the free listing technique. The informant is asked a series of questions that are designed to yield a list of foods about which other information can be collected. Examples of the initial questions to elicit food lists include:

- “Please tell me all the kinds of food that you grow here in your garden?”
- “Please tell me all the kinds of food that you can gather from the fields and forests—things you do not plant, but grow naturally and can be eaten?”
- “Please tell me the names of the foods you buy in the market each time you go there?”
- “Are there foods you buy only sometimes, or rarely?”

The lists, gathered from several informants, provide different kinds of information:

- The names or labels given to food, as well as synonyms for food. (The key-informant will sometimes volunteer information about different words with a comment such as, “Some of the people in the lower village call that _____.”)
- As no one remembers every food, a composite list begins to form an exhaustive picture of the local food system.
- Certain items, that are mentioned first and frequently, are usually the most important, the central features of the food system. Less frequently mentioned food items are usually the peripheral sources. Researchers will often find important vitamin A-rich food in the peripheries of the food system.

Describing the Food System

Two data-collection modules are used to obtain information about the general community food system: the community food system data tables and the market survey.

Food system data tables provide a clear framework for organizing the data-gathering. Filling out community food system data tables is started early in the course of the study. The purpose is to obtain systematic

information about vitamin A–rich food, as well as other main sources of nutrients in the local diet. In many target areas investigators will be able to use existing (recent) dietary studies and food composition tables as a starting point.

An important feature of the FES methodology, as noted above, is that local names must be carefully collected for major food sources, so that conversations and interviews with the population are phrased in appropriate language. Investigators must be alert to the possibility that some basic food materials, and some types of prepared food may have different local names in other communities. That is one of the reasons key-informants are of central importance in this stage of data-gathering.

The food system data tables also call attention to seasonality, prices, and the importance of the specific food for the target groups of women and children. Table 3.1 is an example of a data table for one food item.

The instructions in the manual point out that there may be some formerly used, or little-used (wild or cultivated) sources of vitamin A that only a few, older key-informants would remember or have information about. Some of them may be thought of as famine foods by informants. Special effort is required to search for these little known foods.

The market survey consists of direct observation plus interviewing. This technique has an important advantage—the investigators do not have to rely on reports from others, but can see with their own eyes what foods are available in the local markets. Questioning concerning prices of food can, of course, be a more difficult task. The manual suggests that local persons who are familiar with local market conditions are best for finding out food prices in the weekly or daily market scenes.

The market survey is repeated at least twice during the six or eight weeks of data-gathering. Also, questions about prices in the marketplace require investigators to obtain information concerning seasonal variations. A great amount of useful information about available food, the origins of the food, and potential for vitamin A intakes, can be gained through observations and casual conversations in the markets. Fixed stores that sell food are also an integral part of the market survey data.

Collecting Structured Data from Small Samples of Respondents

Food use, dietary practices, and food systems in general are what John M. Roberts has labeled “high concordance systems,” (Roberts et al., 1981), although he applied the concept in a different cultural domain. Food systems can change rapidly in response to modernization. However, for most communities, especially in rural areas, strong cultural preferences

and powerful economic/ecological forces control many aspects of food availability, hence the patterns of food use are strongly structured. Just as any reasonably cosmopolitan diner knows how the food in a Chinese restaurant will be different from that in an Italian trattoria, so the food styles or menus, in rural villages in central India have a particular, predictable, clearly defined format, with only secondary, peripheral variations from one household to another. Of course socioeconomic status affects how families eat, and wealthier families generally have more variety in their diet, but their food patterns (menus) are not in a different world from their less fortunate neighbors. They have the same basic pattern, with the addition of foods that cost more; in most parts of the world this means more animal foods.

Because of high concordance in food culture, it is not necessary to have large samples to describe the basic patterns of food use in relation to vitamin A sources. Instead of surveys of hundreds of households or hundreds of mothers, we can be fairly assured that the basic patterns will be evident from samples of twenty to thirty respondents.

Small samples are adequate to achieve a descriptive goal only when they are representative of the community. Sample selection must give adequate representation to the poor as well as the more affluent portions of the communities. Where feasible, a random sample of households should be used. In areas with important ethnic variations, the samples have to be larger to represent the various ethnic groups.

The following sections describe data-gathering modules that are used with small samples of women:

Cognitive Mapping Procedures

This set of interviews makes use of cognitive mapping techniques from anthropology and cognitive psychology to describe emic perspectives on food.

Pile Sorting of Foods

This technique uses cards or slips of paper — one card or slip of paper for each food item. Each card has the name and a simple picture of the food, for ease of recognition by nonliterate respondents.

The pile sorting technique is done best with about thirty items, and the manual suggests that the investigator select up to fifteen to twenty vitamin A-rich foods (including some that are little used or even totally neglected) and at least ten or twelve other foods. These should be staple foods that are included to make up a representative sampling of the entire

TABLE 3.1

Example of an Entry in a Community Food System Data Table

Food Category: Green leafy vegetables (indigenous)
 Local Name & Other Common Names: Chomtee (K'ekchi); chilete dulce; quilete (Chiapas)
 Scientific Name: Lycianthes Synanthera - Bitter
 Part(s) Used: Leaf, preferably young
 Preparation: Leaf boiled in stew and soups, primarily for the flavor

Nutrient	Nutrient Composition/100g (Edible Portion by Part)		
	Part:	Part:	Part:
Energy, kcal, kJ			
Protein, g			
Fat, g			
Retinol, mg		<i>None Available</i>	
Beta carotene, mg			
Total carotene, mg			
Retinol equivalents			
Ascorbate, mg			
Riboflavin, mg			
Niacin, mg			
Iron, mg			
Calcium, mg			
other:			

Wild, Hunted/Gathered, or Cultivated: Gathered in rural communities only (N/A in urban)

Home Harvested or Purchased: Only available periodically in rural market
(Q0.14 - 03/90 market price in Carcha, Guatamala)

Seasonality of Use: Year round availability, with greatest intake in February and April
when the maize fields are cleared of indigenous greens and weeds

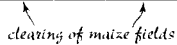
Cost of Production, if Known: _____

food system. The respondents are asked to sort the food items into piles or groups that go together. To assist them in understanding the task, various analogies can be suggested. For example, the sorting out of laundry is sometimes an effective analogy. The respondents are told that there

TABLE 3.1

Example of an Entry in a Community Food System Data Table (continued)

	Use/Price											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High				X				X				
Medium					X							X
Low						X			X	X	X	
None	X	X	X				X					



clearing of maize fields

Importance Value to the Community by Age/Gender: _____

- *No specific preferences, except some parents claim that children dislike greens.*
- *Only used as flavoring in small quantities, and not very frequently, hence minor potential as source of vitamin A.*

Miscellaneous Information: *Little information exists on this species, with at least one variety previously classified as a distinct species (ref. Gentry and Standley, 1974).*

are no right or wrong answers, and that they can use as many, or as few, piles or groups as they wish. The method has proved to be effective in all of the test sites.

In addition to giving the emic sense of food groups, the sorting permits data-gatherers to ask about the meaning, or criteria of similarity, among foods in the same group. Often the respondents' explanations are more revealing and important than the actual composition of the groups themselves. For example, in some societies wild or domestic green vegetables may be used as a relish, sauce or flavoring, or used in much smaller quantities than in places where the same food is considered a vegetable.

Food Attributes

Getting people's views about the attributes, qualities, or selection criteria for food is fundamental for planning dietary intervention, as they provide the basis for communicating about specific food items. For example, in an educated middle-class urban population, you expect to find that people are interested in vitamin-rich food for their children, or food with iron and calcium, whereas these traits may be less meaningful to rural people.

Of greatest interest to participants in vitamin A interventions in deficient areas is gaining an understanding of how people select or judge various foods for themselves and for their children. In many parts of the world, for example, food may be labeled as "hot" or "cold," in ways that affect decisions about feeding them to pregnant women and children. Such attributes can affect the success or failure of intervention programs that encourage people to increase consumption of particular food items.

The same list of food developed for the pile sorting, described above, can be used when interviewing for food attributes. The list of twenty-five to thirty-five food items is the basic format. Each respondent is asked to tell about the qualities or characteristics of each food. In some areas it is useful to ask: "What would you describe as the 'personality' of this food?"

The attributes or criteria that were given for the various piles or groups in the structured pile sorting can be used as prompts or probes for getting respondents started with this topic.

Rating by Predetermined Attributes

In this technique respondents are directed to sort the cards by categories that are predetermined by the investigators because of their relevance to potential interventions. These categories may include "good for the eyes," or "good for pregnant women."

Sorting by Degrees

This mapping procedure is another technique for examining attributes. Respondents are asked to sort the food cards into three or more piles representing degrees of a previously identified attribute. For example, researchers ask the respondents to sort the food cards into those that are "very hot," "very cool," and "intermediate."

Household Food Acquisition (Structured Interview)

Many of the daily food items regularly used in an area are available in markets and stores, but are also homegrown. Some families rely mainly on their own production; others are busy with other occupations, so they

buy most of their food. The patterns vary from one community to another. They also vary among households, even among families of similar socioeconomic status. Therefore, it is important to assess the range of variation in the target population.

The list of food is the same as used for the pile sorting and other structured interviews. Before beginning this set of structured interviews the field workers have already established all the different ways by which people obtain their food (gathering, hunting, growing, buying in store, buying in market, exchange for labor, etc.). Households may obtain some food items from several different sources. For example, for some households the response to “rice” might look like this: Rice—homegrown 50%, exchange for labor 25%, buy in market 25%.

The form used for collecting food acquisition data also includes the usual price (per usual quantity), season, and which member of the household acquires that food item. In many regions certain foods are acquired, grown, or purchased by the women, while others are acquired by the men. Also, the role of children in acquiring the food items can be important.

Besides getting the overall picture for the acquisition of different important food items, a major aim of this element of data-gathering is to find out if some subgroups in the community have different food acquisition patterns that would affect any planned intervention program. Information about seasonal variations is also important to consider in planning interventions.

Individual Food Intakes: 24-hour Recall and Food Frequency Check Lists

This step in the data-collection, again from a small sample of households, draws on standard procedures from nutritional science. The intent of the data-gathering is to get a systematic view of the actual (reported) food intakes of the children from six months to six years of age, as well as women of reproductive age. Special attention should be paid to the dietary intakes of pregnant and lactating women in the community. It is recommended that researchers seek out small samples of pregnant women in order to supplement the data gathered from key-informants.

Obtaining Information on How People Recognize Vitamin A Deficiencies. Hypothetical Scenarios

This section of the manual is designed to find out whether people recognize signs and symptoms of vitamin A deficiencies, what explanations are offered concerning these manifestations, and what treatments, if any, are

utilized. The technique of data-collection is the presentation of hypothetical scenarios about which the respondents are asked a series of questions. The manual instructs the data-gatherers to modify the scenarios to fit local cultural conditions (including, of course, the names of the persons mentioned). The scenarios include:

- a three-year-old boy with nightblindness;
- an eight-month-old infant who is being bottle fed, and now has diarrhea, sore mouth, rash, and other symptoms;
- a five-year-old child with a white foamy patch on the white part of the eye;
- a woman who is seven months pregnant and suffers from nightblindness.

In the manual, the interviewers are instructed to record all home treatments, as well as actions or medications that would be obtained from other sources, including health providers.

For ease in completing the data summaries, instructions are given for categorizing or grouping the responses. For example, “remedies” might be grouped into the following categories: (1) Food, (2) Rest and/or bed, (3) Medicine (capsule, tablets), (4) Medicine (injection), (5) Tea, (6) Magico-religious ritual, (7) Other.

Additional Guidelines and Information in the Manual Appendix

The manual has further comments and guidelines designed to be used in the training of field data-gathering personnel. For example, there is a list of “Do’s and Don’ts” that cover major ethical issues, as well as other elements of good data-gathering practice. Data-gatherers are particularly urged not to criticize people about their food habits, hygiene practices, and other behaviors.

The Appendix also gives suggestions concerning selection of field sites and data-gatherers; training of field personnel; notes on translation from local to national languages; comments on using microcomputers; further notes on working with key-informants; a section on recording and organizing field notes; checklists of important background information concerning the research location; guidelines concerning the vitamin A contents of various types of foods; suggestions about selection of representative samples of respondents; and finally, a glossary of terminology.

It is our feeling that the presentation, in FES manuals, of specific, step-by-step procedures, gives field interviewers and their supervisors confidence that they can indeed assemble the information needed for the practical objectives of the study. For some people, the data-recording formats are at first confusing, even daunting. However, when they are approached one step at a time, the mystery disappears, and field teams are able to manage the data easily. Having a specific format, labeled and ruled off in specific fields and boxes, gives a clear meaning to the vague and mysterious directive, “record the qualities or attributes assigned to each of the foods....”

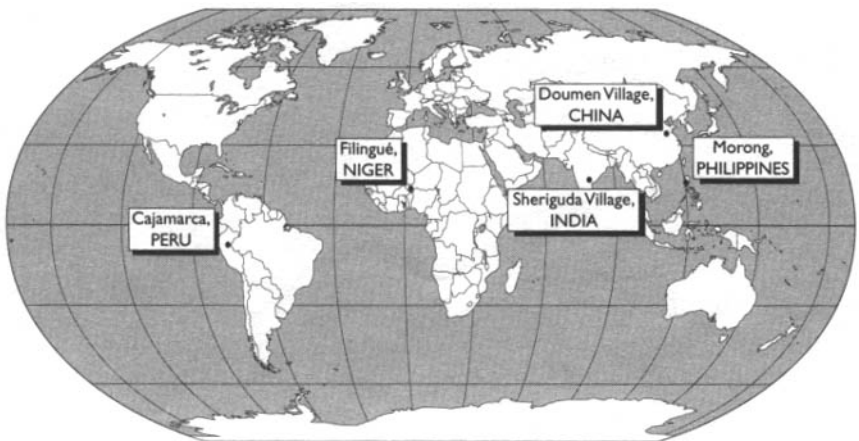
The table of contents of the manual, including the list of appendices and data forms are given in Appendix 1 at the end of this book.

Testing the Protocol

The FES protocol was field tested during 1993–1994 in five areas selected for diversity in culture, environment, and food system type, and availability of a capable field team (see Map 1). The objectives of the field testing were to find whether the protocol could be used in the particular environment and culture; in other words, could the research questions be answered using the procedures as described? We also wanted to address key elements in personnel training and timing. Finally, we wanted to

M A P 1

Five Geographic Areas in which the FES Protocol was Tested



know if usable information resulted in the development of potential intervention plans for the improvement of vitamin A status.

The academic backgrounds of the field teams were diverse, which was evident in the ways they implemented the procedural testing. The reports given by the field teams in Chapters 4 through 8 reflect these differences. We have confidence that the protocol instructions can be understood easily, and that they apply equally to a range of different cultures, environments, and field situations.

Peru

Field testing took place in highland Peru, in the district of Cajamarca, in two areas: the Comunidad Campesino de Chamis (rural) and the Barrio de San Vicente (urban). Field testing was under the supervision of Dr. Hilary Creed-Kanashiro of the Instituto de Investigacion Nutricional in Lima. The field team leader and the field assistants were from the local area and trained as nurses: Rocio Narro (team leader), Charito Barrenachea, Doris Saldaña, Elena Sanchez, and Idamia Bustamante. The field testing took place in September and October in both places. Harriet Kuhnlein made a site visit from October 5th to the 10th.

This field test provided valuable guidance for conducting the protocol in adjacent rural and urban communities. It was not possible to sample an identical culture in both communities, although the environments were similar. It was found that, because of the availability of a greater variety of market food in the urban area, the food list for conducting the modules varied somewhat from that of the rural area. The project team devised excellent methods for deciding on the final list of thirty food items with which to complete the studies; their strategy for selecting the households in the urban area was exceptional as well, and is included as an appendix to the protocol manual.

Niger

The assessment protocol was conducted with the Hausas of Filingué under the supervision of Lauren Blum, a cultural anthropologist with extensive previous field experience in Niger with the Peace Corps and Helen Keller International. Lauren conducted the preliminary test to construct the first draft of the manual, as well as a final field test. The last field test took place in the arid area of Niger during November and December, 1993. She produced exceptional field notes and reports on the various test procedures.

Of special note was the fact that the protocol could be conducted with two village-resident field assistants who did not have any education beyond high school. They were able to conduct the interviews in Hausa and record the responses in English. Green leafy vegetables were a valuable source of provitamin A in this area, but little food composition data exist for these items. There is a word for nightblindness in all four of the languages spoken in the area, and it is recognized as a common problem, as are Bitot's spots and corneal ulceration.

China

The field test in China was conducted with the people of Doumen Village, Kai Feng Municipality, by Dr. Li Wen Jun of the National Institute of Nutrition and Food Hygiene in Beijing. The procedure was tested during September and October, 1993. The field team consisted of Dr. Li Wen Jun, Dr. Li Dan, and Ms. Chang Su Ying, assisted by Mrs. Bai Yan, Miss Yuan, and Mr. Wang Wei Dong. Dr. P. Pelto conducted a site visit with the team September 26th to October 6th.

Several varieties of wild vegetables collected from the field were found to be seasonal and infrequently used. A fascinating account was given about why the people of this village refuse to eat carrots. Nightblindness is common in the area, and cod liver oil and pig or goat liver are recommended by public health authorities as a remedy.

Philippines

Field testing in the Philippines took place during both wet and dry seasons with the Aetas of Canawan, Morong district, under the supervision of Dr. Cecelia Santos-Acuin. Dr. Acuin had previous experience with the preparation of an ethnographic manual for respiratory disease. She organized a field team consisting of Dr. Troy Gepte, Ms. Tina Dedace, and Ms. Mila Fulache; the latter two persons having B.Sc.s in Nutrition. Dr. H. Kuhnlein conducted a site visit from September 19th to September 25th.

As with all the field test sites, there were many valuable experiences from this area. Of particular note was the realization that only some of the modules required repeating for the change of season. The key foods list, and the use of particular food items changed somewhat, but people's perceptions and beliefs about food did not. Performing the assessment in two seasons enriches understanding of acquisition and food frequency, and greater knowledge of the market availability of food. Also noteworthy was Dr. Acuin's suggestions for additional components of the re-

search report from the assessment, revisions to the manual structure, and suggestions for appendices to the manual.

Data from this area led to the inclusion of the 24-hour recall preliminary to the food frequency questionnaire. This technique was found to ground the interviewee in concepts of how often something is eaten. Several other excellent suggestions were offered.

Of all field test sites, the community food system in this tropical, coastal area contained the greatest number of food items, and many of them did not have food species identification or composition data available.

India

In India, the field test took place with the people of Sheriguda village, Ranga Reddy District, Andhra Pradesh, under the supervision of Dr. S. Vazir and Dr. Pushpamma. A site visit and training session was conducted by Dr. P. Pelto from November 28th to December 5th. In addition, the research team from the National Institute of Nutrition in Hyderabad) included Ms. Uma Nayak, Ms. Anita Naidu, Dr. Anjhali Devi, and Ms. N. Saroja.

The assessment protocol was exceptionally well received by the Indian team. They recognized the need for knowing the perceptions, needs, and resources of the community which are strongly influenced by social, cultural, environmental, and economic considerations, and their value in planning and implementing nutrition interventions relevant and appropriate to the community. They reported that the application of the ethnographic techniques suggested in the manual gave answers for many "why's," and helped them understand factors that influence the food behavior and forces responsible for changes in behavior.

Important information from this area included the highly variable seasonality of food availability and the economic situation of families. It appears that most of the sights of xerophthalmia are rarely experienced here, even though they are documented in health reports. The team suggested revisions to the format of the food system data tables, the timing and equipment of the field assistance, and suggestions to several modules. In this area of India, it was difficult to define quantities of food consumed and the price per serving because of great variability of serving sizes within households.

Comment

To a large extent, the widespread applicability of the protocol manual is due to the similarities in basic food use patterning in human societies. Compared with religious practices, political arrangements, family structure, and many other areas of culture, food and diet are much more constrained. These constraints are more pronounced in small children and pregnant women, the groups most at risk for vitamin A deficiency.

The FES approach for community assessment of natural food sources of vitamin A is intended to address a specific need for new ways to understand food use and diet in areas of serious vitamin A deficiency. While we recognize the use of vitamin A supplementation, in the form of capsules and other methods for target populations, more sustained and economically sound measures should include serious attempts to improve the use of locally available vitamin A–rich food. In part, this manual is based on the faith that such approaches to malnutrition can be effective, provided that there is sufficient, carefully gathered information available about current food quality, food practices, and peoples' reasons for choosing their food consumption patterns.

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Part III

**Assessing Natural Food
Sources of Vitamin A in
the Community**

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The Philippines: The Aetas of Canawan During Wet and Dry Seasons

Cecelia Santos-Acuin, A. Troy Gepte IV, and M. Justiniana Dedace

The Vitamin A Problem in the Philippines

Vitamin A continues to be a leading cause of micronutrient deficiency, blindness, and eye disorders in the Philippines. Among children six months to six years of age, the prevalence of nightblindness is 0.7% and of Bitot's spots 0.2% (UNICEF, 1992). Certain communities (remote rural *barangays* or villages, urban slums) and population groups (children from large families, with poorly educated mothers, from unlanded farms or small/hired fishing households) are considered at higher risk than others. The Aetas possess a number of these factors and their children are considered at high risk for vitamin A deficiency.

The current management strategy of the Department of Health is to provide 200,000 IU of vitamin A in a capsule every six months to children suffering from or at high risk of developing the deficiency (those who are mildly, moderately, or severely malnourished; those with chronic diarrhea or recent measles). However, this policy is more curative in approach, seeking to correct the deficiency when it already exists. Recently, a campaign was launched to administer vitamin A capsules to all children and pregnant women, with or without the deficiency. As in other interventions of this nature, problems of supply and distribution influence its effective implementation. Moreover, administration of large doses of vitamin A must be adequately supervised because of the danger of toxicity.

The Aetas of Canawan, Morong

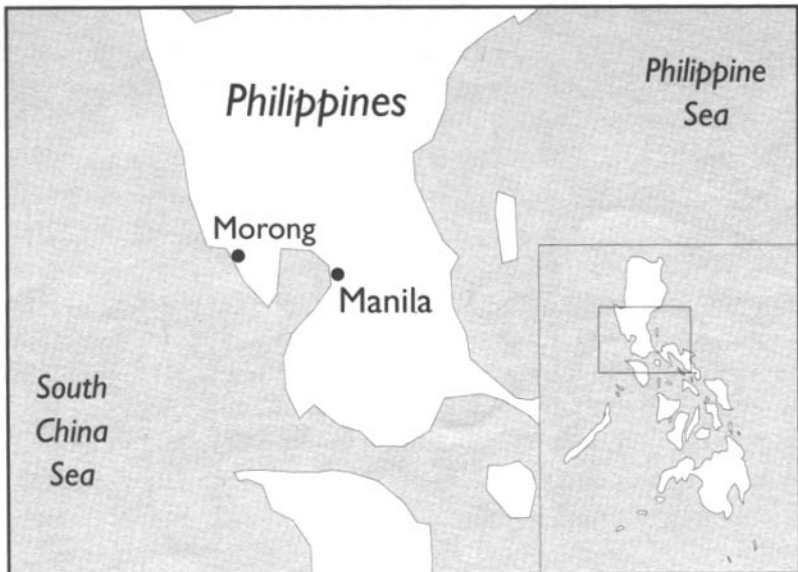
Geography of Canawan, Morong, Bataan

Morong is a municipality in the province of Bataan, about 150 kilometers northwest of Manila (Map 2). It lies at the foot of the tail end of the Zambales mountain range that extends from the north of the province of Zambales down the western side of the island of Luzon to end in Bataan. Morong has a population of about 19,000 living in five barangays or villages. It is bounded on the north by the Subic Naval Base forest (that was an American territory until 1992), on the west by the Subic Bay (that opens into the South China Sea), on the south by the municipality of Bagac, and on the east by Mt. Natib (a dormant volcano). Morong's barangays are laid out so that a portion of each lies along the coast and flat land, with larger areas at the foothills or mountain slopes. This is typical of many coastal towns in the country.

Canawan (also Kanawan) is a *sitio* or hamlet of barangay Binaritan, about eight kilometers from the town proper at approximately 200 meters above sea level, along a mountain slope denuded of forest cover. Its nearest neighbor is the Philippine Refugee Processing Center (PRPC).

M A P 2

The FES Protocol was Tested in Canawan, Morong, the Philippines



A single dirt road leads from the PRPC to a hanging bridge about thirty to forty meters in length spanning the Batalan River. This road and foot bridge serve as the only link between Canawan and the lowlands. From the bridge, a trail of caked mud and loose stones slopes upward (the average slope is forty-five degrees), leveling off on a grassy plateau where the Aetas have built most of their houses. The entire climb from the hanging bridge takes about thirty minutes. Other houses, that are situated in the *hulo* or in places farther from the center of the sitio or village, are built near the fields they cultivate. To get to the *hulo* requires another thirty to sixty minutes of hiking through rolling hills.

There are no official census records, but unofficial estimates place about thirty families living in Canawan that are of Aeta origin and five families from intermarriages between Aetas and lowlander Tagalogs.

Climate

Canawan's climate is typical of a tropical forest fringe with temperatures from 25°C to 35°C. There are roughly two seasons, dry and wet, although some would add a cold season (December to February), called *taglamig* by the Tagalogs, when temperatures may drop to the high teens. In terms of food availability, however, this cold season does not vary considerably from the dry season and is considered part of the latter in this discussion.

The dry season is from March to May or June and is characterized by a warm, humid climate with temperatures reaching as high as 38°C to 40°C. Since many plants that are not cultivated in irrigated fields die, food can become scarce. These months are considered *taghirap* (times of difficulty or hardship). This is the time when young men of the village go into the forest to look for game or honey.

Once the rains come in June or July, it rains heavily almost daily, usually from mid-morning to late afternoon and evening. All of Canawan becomes covered by clouds and travel is difficult. Vegetables and tubers are plentiful at this time. This is the rice planting season so that this staple becomes scarce. Harvest will not take place for another six months or so given the elementary agricultural skills of the Aetas.

History

It is believed that the Aetas were the first people to live in the hills of Morong, and were there before the Spaniards arrived in 1521 (Rahmann, 1963). Living independently by hunting wild animals and a slash and burn method of land cultivation, the Aetas occupied the valleys, knolls,

and dense rainforests of Bataan. The Aeta settlements gradually receded to the more remote reaches of Morong, driven by the progress of lowlander civilization and abetted by their own destructive techniques of farming (personal communication, E. Mendoza, Jr., 1992).

At the behest of a local chieftain, Pablo Sulangi, in the 1930s, the Aetas dispersed throughout Morong and resettled together in one hillside community by the Morong River. They remained there until 1942 when they were forced to hide from the Japanese invaders during World War II. Unable to practice their slash and burn method of farming (*kaingin*) for fear of being found and captured, the Aetas suffered hunger and deprivation.

The Hukbalahap uprising, a local rebellion in the mountain and plains of Central Luzon, prevented the Aetas from completely retaking their pre-war settlement until the late 1950s. In the late 1970s, they were forced to relocate again because the government claimed their land for construction of the PRPC.

The Aetas chose Canawan, a piece of land situated a few kilometers from the site of PRPC. Eventually, the government, through the issuance of Proclamation #192, allotted 165 hectares of land from the Bataan National Park Reservation for the creation of the Canawan Negritos Reservation Area. It ordered the exclusive use of this land for the benefit of the Negritos (the racial group to which the Aetas belong) living within the area. The Department of Environment and Natural Resources (DENR) and the Office of the Northern Cultural Communities (ONCC) administer and manage the land.

The Aeta way of life is considered the most primitive among the various ethnic groups existing in the Philippines. With the objective of exploring indigenous vitamin A-rich foods, they were deemed ideal for this qualitative research because of their closeness to nature and their remoteness from the existing healthcare delivery system.

The Aeta's Way of Life

The life of the Aetas of Canawan revolves around the extended family. Aeta families freely intermarry so that almost all members of the tribe are related in some way and often share the same family names (e.g., Malunik, Quitain, Cayetano, Alejo). Community members are thus closely knit and mutually supportive.

Most traditional Aeta culture (agriculture, working tools, manner of dress, decorative ornaments), has been influenced by the lowland Tagalogs. The Aetas' capacity to selectively accept change, cherishing some

aspects of their culture while abandoning others, has been influenced largely by their interactions with the Tagalog *umat* (meaning straight-haired, in contrast to the Aetas who are called *kulot* or curly-haired).

Agriculture

The Aetas have practiced slash and burn agriculture (*kaingin* or *gasak*) for many generations. Produce is mainly root crops (mostly sweet potatoes or *kamote*), bananas, and a variety of vegetables. Rice is not planted extensively and is usually bought to supplement their insufficient stores. Planting starts in May when the rains come. The vegetable harvest takes place after four to five months; the harvest of rice four months later. The bounty of produce depends on adequate rain since there is no irrigation system, and on vigilant protection from rats and other wild animals. With better tools, rice stock, and field management, lowlanders have managed to plant and harvest two to three rice crops a year. The Aetas barely manage one crop per year.

The Aetas do not seem to practice any system of crop rotation. Most of their produce is sold through a cooperative market in the town. Like all other co-op members, they supply certain kinds of vegetables or fruits predetermined by an agreement with the traders in the cooperative and the market. Most of the foods they consume are bought from the same market with the money earned from selling their produce.

With the ban on *gasak* farming, in order to preserve the few remaining trees in the already denuded forests of Morong, the Aetas have been forced to make do with whatever cultivable lands have been allotted to them. This increases the intensity of land use and heightens the urgency to improve methods of cultivation to maximize production.

Hunting and Gathering

Unlike the Agtas (a related racial and ethnic group also found in Luzon), the Aetas of Canawan seldom hunt for wild deer, pigs, monkeys, and lizards, as they did previously. Likewise gathering is rare and usually limited to honey. The honey-gathering process, (*namumukyutan* or *namumuay*) is generally done on dry, non-windy days. The bees are driven away by smoking the hive and the whole hive is obtained. The honey is collected and sold for about 1000 Phillipine Pesos (\$40 US dollars) per gallon. The Aetas regard this as one way to generate income, especially during the difficult dry season. This and other traditional skills in procuring wild food are gradually being neglected as forest resources dwindle, and the Aetas rely more and more on the market for their needs.

The Tagalogs regard the hunting and gathering way of life as evidence that the Aetas tend to be lazy and resistant to change. True or not, the Aetas have remained remarkably isolated from improvements in farming technology that have been of immense benefit to the lowland Tagalogs.

Water, Sanitation, and Hygiene

The recent installation of a water system (steel pipes, rubber hoses, and faucets) through the assistance of the World Relief Corporation (WRC) has facilitated the delivery of water from a nearby spring to the center of the village. Although the Aetas now have running water to use for bathing and laundry, it has not changed the way they maintain personal hygiene. They change their clothes only after several days of wear. Children are allowed to play on the ground barefoot and clad only in dirty shirts. Food is handled without handwashing, and soap is rarely used.

The few material possessions of the Aeta family consist of some clothing, cookware, utensils, plates, and homemade furniture, such as benches and tables. Their trash usually consists of organic wastes from food preparation. Cigarette cartons and candy wrappers are seldom found in the trash because these items are beyond the reach of most members of the community. Since the Aetas have a minimal amount of waste, garbage disposal is not much of a problem.

Toilets are nonexistent in Canawan. Aetas defecate and bury their stools in nearby fields. Remarkably, there have been no reported major outbreaks of diarrheal diseases in the area, the local perception being that they have become immune to diarrhea-causing germs. As one Tagalog remarked, "Sanay na ang mga iyan sa marumi!" (They are used to being dirty!)

Health Status and Practices

The Aetas believe that evil spirits are the usual cause of illness. They still practice a ritual called *kagon*, a form of spirit healing performed with dance, song, and guitar music to exorcise the *dimonyo* from ailing individuals. It is customary to wear a necklace of stringed pieces of sticks to ward off bad spirits like *lamang-lupa*, inhabitants of the earth believed to enter the body and cause disease.

When an illness persists, the Aetas seek medical help at the local clinic built by the WRC, an evangelical organization based in the United States, in the Canawan Village. Other health facilities include the PRPC hospital and the Rural Health Unit (RHU) in the town proper. Generic drugs are given free of charge at the clinic by a nurse who comes once a week. A

weighing and feeding program for the underweight and malnourished is also undertaken by the WRC. However, lack of resources and appropriate health education hinder effective delivery of healthcare to the Aetas. The RHU staff come to Canawan about once a year, usually on a vaccination campaign. They claim that the remoteness of the village precludes more frequent visits with the limited available resources and manpower.

Malnutrition is a problem, particularly among children. It is common to find reddish or yellowish hair, a sign of protein deficiency, among children three to eight years old. In fact, this is considered *karaniwan* or normal by the Aetas. This age group is no longer breastfed, but they are unable to successfully forage for their own food. Readily available sources of animal protein are scarce. Except for a few chickens, no other livestock is raised, and they seldom hunt for animals such as wild deer and pigs. As a result, the Aetas are dependent on plant protein sources.

Cases of diseases related to malnutrition (diarrhea, measles, pneumonia) have been reported occasionally. Proximity to the forest has also led to outbreaks of malaria. In the course of our fieldwork during the dry season, there was one month in particular when almost every household had a member sick with malaria. During the wet season, a wave of upper respiratory infections swept through the community.

Although there are records of patients consulting at the RHU for eye symptoms, no signs indicative of vitamin A deficiency were documented.

Concepts of Food and Deficiency

We asked the oldest man in the village, (Mang Aquino Malunik, estimated to be about ninety years old, but appeared thirty years younger) what he wanted to eat. He replied, “Kung ano man ang ipagkaloob ng Diyos” (“Whatever God provides.”) The response captures the entire attitude that most Aetas have toward food. They eat to survive and will take whatever is available. According to Mang Aquino, this attitude enables them to survive during difficult times. Another belief that influences food consumption is that of “makasanayan ang isang bagay” (“getting used to something”). Aetas are afraid to eat too much food or partake of what they consider to be “rich” foods, like meat, because they do not want to get used to them to the extent that they will “pine” for them.

These concepts regarding food availability affect the consumption of vitamin A-rich food as well as other food. A number of Aeta fruit and vegetable crops are rich in vitamin A and are available throughout the year. The problem the study team identified is not an inadequate intake of vitamin A-rich food, but what appears to be deficient vitamin A

absorption and storage in the body. A review of actual intakes from food frequency tables and 24-hour recalls shows that the Aeta diet does not have a regular source of fat, whether animal or plant-based. As a result, those who have increased needs, such as pregnant and lactating women or children with illness (measles or diarrhea), may develop vitamin A deficiency.

From key-informant interviews, nightblindness appears to affect women only when they are pregnant, and the only memory they had of a person who manifested what may be Bitor's spots involved a young child who had other signs of malnutrition as well, and subsequently succumbed to infection.

Factors Affecting Food Intake

Vitamin A in Breastmilk

Although no interviewee could recall any eye signs of vitamin A deficiency in infants, this group may be at risk for vitamin A deficiency, since Aetas exclusively breastfeed until about eight months of age. If the breastfeeding mother is deficient herself or has minimal vitamin A stores, it is likely that her child will not get sufficient vitamin A from her milk, since vitamin A in breastmilk is largely a product of maternal intake. Bongga's study of the nutrient content of breastmilk of Filipinas showed a mean retinol content of 36 $\mu\text{g}/\text{dL}$ (Bongga, 1986). This is far below estimates made from U.S. mothers of 67 $\mu\text{g}/\text{dL}$ (NAS, 1991). While it has been observed that infants who consume as low as 100 to 151 μg of RE per day do not show signs of vitamin A deficiency, the Filipino values are still a cause for concern. While Bongga did her work among urban poor Tagalogs, and the retinol content of the Aetas' breastmilk may vary, it raises the possibility that breastmilk as a source of vitamin A for infants may be less adequate in populations with marginal vitamin A intake.

It was difficult to elicit responses from the Aetas suggestive of micronutrient deficiency, other than that of vitamin A. The strongest evidence of nutritional deficiency seems to be the well-recognized observation that during times of hunger and inadequate intake, people get thinner and children get sick more often. However, a more specific link between an illness and a deficiency state cannot be made. This results from the concept that illness is caused by evil spirits. Signs of vitamin A deficiency were therefore elicited by showing pictures and describing the eye signs of deficiency, rather than by asking about deficiency states as a whole.

Food Availability

Among Aetas, three factors affect the availability and absorption of vitamin A-rich food: cost, season, and the site of the procurement (whether food is purchased, homegrown, gathered from the wild, etc.).

Most plant sources of vitamin A are homegrown and available throughout the year. Except for carrots, that they do not grow and are very expensive, the Aetas frequently have leafy vegetables such as *talbos ng kamote* (camote tops), or *malunggay* (horseradish tree leaves) with their rice. Animal sources of vitamin A, such as liver, are rarely eaten as these are usually bought from the market or caught in the wild. Except for chickens, few animals are raised for food. Recently, the government distributed piglets to some families. This was a gift with which the Aetas were not entirely happy, because the breed of piglets given to them are perceived to be prone to disease and selective in feeding.

The abundance of a particular nutrient source at any given time may vary. For instance, *kalabasa* (squash) is a wet season crop and may be unavailable or expensive during the dry season; *mangga* (mango), on the other hand, is a dry season fruit and can be had for the asking at this time, yet is exorbitantly priced the rest of the year. Year-round sources are also abundant, such as *malunggay*, papaya, and kamote tops.

The nearest market, about thirty minutes by foot, was the PRPC market which closed in mid-1994. This market was important, not only as a source of food, but also because it was where the Aetas sold their produce. It was here that crops commissioned by the cooperative were brought for selling and where foods such as rice, meats, fish, canned produce, candies, snacks, and tobacco were purchased. To get to the next nearest market, the town market, the Aetas either have to ride a tricycle (which costs about five pesos per person) or walk an additional forty-five minutes. Another option, especially with a lot of goods to carry, is to ride in a caribou-driven cart, which is difficult given the narrow mountain trails; the trails could be widened to accommodate the carts. Unfortunately, there are very few caribous, and these are used in the fields. Thus, this option would probably not be used often. Given the market cost of vitamin A-rich animal sources, it is unlikely that the Aetas would spend much on these foods, even if an easier (and cheaper) way to town could be found.

Hunting wild animals, as the Aetas ancestors did, will probably become rarer as the forest diminishes. During the time of the fieldwork (about half of the year), there was only one occasion when two wild pigs were caught. There may have been other instances when the adults who tend their remote fields have eaten food from the wild, but these would

not be available to the children, or the lactating women who usually stay in the village, and are the most at risk for deficiency.

Food Beliefs

Food beliefs would be a secondary consideration in deciding what to eat. If food were abundant, concepts, perceptions, and personal preferences might prevail. For example, a lactating woman would probably opt to take malunggay leaves rather than take *pechay* (Chinese cabbage) if both were available, because she believes the former would increase her milk supply. A man with loose stools might choose a *latundan* banana (a variety of banana believed to cure diarrhea) over a mango because he thinks the banana will cure his diarrhea. However, a child would select mangoes over vegetables because fruits are more delicious, even if vegetables are believed to be *mas masustansiya* (more nutritious). Other food items perceived as *masustansiya* are meats, fish, eggs, and rice. But being *masustansiya* alone will not guarantee that the food would be eaten. Carristel, a *masustansiya* fruit abundant during the dry season, is rich in vitamin A and calories, but is seldom eaten because people do not like its taste. During taghirap (periods of difficulty) when only vegetables would be available, they would be eaten regardless of beliefs and taste preferences. Beliefs would take a major role in food selection only in times of plenty and can therefore be considered independent of seasonality. However, they may play a bigger role in food selection during seasons of abundance.

The perceptions of food seem to be independent of season. The most important food for the Aetas is rice, referred to as *gatas ng langit* (milk from heaven). During times of scarcity, all remaining resources (i.e., cash) would be directed towards its procurement.

The desire for wet season tubers, such as *kalot* and *boloy*, was expressed during the dry season phase of the field work. Food for taghirap, such as *batong-patay* (literally dead stones) and *sisila* (grubs), are readily recalled without regard for season. The only effect seasonality may have is to affect the hierarchy or preference, as some foods may be more abundant than others at a certain time. For example, during the rainy season a wider variety of fruits and vegetables is available, so that year-round vitamin A-rich food such as malunggay and papaya may be ignored in favor of tubers like *boloy* or *kalot* that are low in vitamin A, but considered delicious. The Aetas might prefer the tubers because these are available only during this time of the year and thus take on the attributes of a delicacy.

Food Supply and Acquisition

The Aetas eat whatever is available from their environment. They harvest most fruits and vegetables from their fields and gardens (see Table 4.1). However, there are plants in the wild that produce fruits like bananas and carristel, and vegetables like *pako* (a fern).

Although much of their food consists of homegrown vegetables, there is an increasing proportion bought from the markets. These include rice (the staple), as well as eggs, meat, fish, canned goods, milk (including powdered infant formula), coffee, snack foods, and alcoholic beverages (beer, gin). Most of these market products are not affected by seasonality, however, travel becomes more difficult during the rainy season. The cost of these items is dictated by middlemen, who in turn blame typhoons, the oil crisis, the distance from Manila, and the residues from Mt. Pinatubo eruptions (which threatens critical bridges on the highway to Manila) for the high prices and the irregularity of supply.

Rice is especially crucial since the Aetas consider this the center of their food world. Many of them say that as long as there is rice, they are satisfied. Unfortunately, none of the families are self-sufficient in this staple. The Maluniks, who seem to be the most self-reliant, only plant about a two month supply and buy the rest from the PRPC market. Other families do not even plant rice. They say that the land is not suitable for planting rice, and when they try, the yield is not enough. Attempts to introduce better methods of farming and better varieties of rice have not been successful. The farmers say that representatives from the DENR and the Department of Agriculture (DAR) do not visit often enough. However, the DENR and DAR claim that the people are uncooperative and lazy.

Food from the wild is still an important, though unreliable food source, particularly of animal protein. Aside from honey and wild pig, other foods obtained are: bananas, coconuts, *alupag* (a kind of fruit), *bulaig* (a tuber also used as pig feed), ferns (*pako*, *lagulo*, and *bago*), *lima-lima* (a tuber), *ubod ng yantok* (rattan trunk), fresh-water shrimps and fish, birds, monkeys, deer, *labuyong gubat* (forest chicken), *abaw* (beetles), and *bayawak* (forest lizard). Two interesting foods that Mang Aquino recalls eating during times of extreme want are *sisila* (grubs), and *batong-patay* (dead rock). The latter has been described as a stone that looks like bread and is edible. It is said to "*pampatigas ng tuhod*" ("strengthen the knees") and is considered good for the body. Food from the wild is more likely to be sought during the dry season when other sources are not available. There is, however, some food from the wild (such as *kalot*, *boloy*, and *buli*), that is

TABLE 4.1

List of Important Plant Foods by Seasonal Availability and Retinol Equivalents

Wet		Dry		Year-Round	
Food	RE/100g	Food	RE/100g	Food	RE100g
Taro leaves	1252.5	Cashew leaves	783.3	Chili pepper leaves	1860.8
Jute	1220.8	Mustard	270.8	Carrots	1667.5
Bittermelon leaves	33.3	Mango, ripe	250.0	Horseradish tree leaves (malunggay)	1290.0
Carristel (Tiesa)	205.8	Melon	214.2	Fern	516.7
Squash fruit	146.7	Papaya	75.0	Swamp cabbage (Kangkong)	429.2
Sigarilyas (goa/winged bean)	51.7	Spanish plum (Siniguelas)	37.5	Bago leaves	63.3
Sitaw (yard-long leaves)	41.7	Watermelon	16.7	Sweet potato	90.0
Corn	35.0	Mungbean	13.3	Tomato	63.3
Bittermelon (ampalaya) fruit	33.3	Jackfruit	3.3	Cassava	11.7
Okra	24.2	Cabbage	3.3	Guava	10.8
Eggplant	13.3	Cashew fruit	2.5	Banana	5.0
Taro Tuber	5.0	Pineapple	1.7	Potato	0.0
Lagulo (fern)	*	Star apple	0.8	Coconut	*
Buloy	*	Black plum (Duhat)	0.0	Rice	*
		Yam bean (Singkamas)	*	Babayan leaves	*

*Data not available.

available only during the wet season. Most of these items do not have species identification or food composition information.

There is no division of labor as far as food acquisition is concerned. Both men and women are responsible for procuring food. However, because women become pregnant and need to take care of their infants, they may be confined to the village more often than men.

Aetas of all ages are involved in looking for food for the household. Children as young as five have been observed to dig their own camote while old women, like Aling Juanita (Mang Aquino's wife, one of the oldest and one of two women in the village who can still perform the kagon), are seldom found in the village because they are usually tending their fields.

Since almost everyone is family, the Aetas tend to share their food not only with household members but with neighbors as well. It is not unusual for a woman returning from the fields to be carrying a large bundle of string beans which she distributes to the houses she passes along the way. The whole village made a feast of two wild pigs caught by one of the young men, though a large portion was brought to town to be sold.

This generosity extended even to the study team, much to our discomfort, as we were aware of how limited their resources were. Yet it was a rare visit to Canawan that we would come down empty-handed. Someone usually pressed on us a few papayas, some camote, a bag of vegetables, or some bananas.

A Typical Meal

The typical meal of an Aeta would probably vary depending on the season of the year, whether he or she is at the village, near the fields, or in the forest. Age, of course, would also be a determinant, since all infants are breastfed. There was only one infant in the entire village who was not breastfed at the time of the field work, and this was because his mother became mentally ill soon after giving birth. Weaning takes place when the child begins to have teeth and begins to reach out for food (“nagsisimula nang umabot-abot ng pagkain”). Once the child starts taking solids, he is fed whatever the older members of the household are having.

The Aetas start the day by going to their fields. They may take a mid-morning meal consisting of coffee made from burnt rice, and any leftovers from the previous evening’s supper. The women, children, and older men who are left behind in the village have lunch at midday. This would consist of boiled rice and boiled or broiled vegetables, again usually leftovers. The main meal would be taken at dusk. The men and women who have returned from the fields bring home vegetables from their fields or plants growing in the wild (such as mushrooms) or, when lucky, birds or fish caught on the way. These are cooked by roasting or boiling and are eaten with rice. Meals are prepared with a minimum of utensils and little seasoning (usually salt, and occasionally *bagoong* or salted fish paste). There are times when a meal would consist only of rice and salt.

Seasonal variation would be reflected in the types of vegetables available for cooking. Those who stay near their fields with minimal cooking implements may opt to partake of foods from the wild (ferns, fruits, mushrooms) the availability of which will also be affected by the season.

More elaborate meal preparation is done during feasts, held to celebrate events, such as the opening of a new school or the Baptism of a child. On these occasions, noodles and meats with sauces may be prepared. The recipes, however, are of Tagalog origin.

Dry Season

The typical meal during the dry season would consist of rice (provided there is money to buy it from the market, or leftover grain stored from

the previous harvest) and whatever vegetables are in season (*mustasa*, *munggo*, *pechay*). The vegetables would most likely be boiled. With luck, there could be freshwater fish or wild birds, either of which would be roasted. As their economy becomes more and more market-oriented, however, fish and birds when caught might well be brought to the market for cash to buy rice. Fruits like mangoes, carristel, cashew, black plums, Spanish plums, star apple, and pineapple are plentiful during the summer, so that it is common to see children walking about munching on some fruit.

Wet Season

Rice is scarce during the wet season that is also the planting season. When money is tight, or travel to the market impossible, the people turn to alternative staples, such as camote, kalot, and boloy (all tubers). Fortunately, vegetables are plentiful at this time, as are ferns and mushrooms. Fruits are limited to those available year-round, such as papayas or bananas. However, after a bad storm, even these are hard to find.

Suggested Dietary Modifications

Food intake is a complex behavior affected by a web of factors, only a few of which are mentioned above. It may seem that the Aetas would respond readily to suggested modifications as long as food is available. The perception of *tiesa* (carristel) should caution such optimism. People know that it is *masustansiya* (nutritious) and *mabuti para sa mata* (good for the eyes) and it is abundant in the summer months, but they would prefer not to eat it because they do not like its taste. There is need to experiment with recipes that would make *tiesa* more palatable, since this is in season during the dry months when not many food items are available. It is also rich in energy and vitamin C.

Our suggested modifications were directed toward improving the absorption of vitamin A and increasing body stores. We also recommended ways to improve the overall diet, keeping in mind other factors that could affect intake, such as taste and ease in preparation.

The first set of recommendations would help increase the fat in the diet. One way would be to use coconut milk more often. The Aetas already eat dishes in which vegetables are cooked in coconut milk. However, extracting the milk from coconut meat can be tedious and this may be the reason it is seldom done, even if coconuts are available. They would have to be convinced that the outcome would be worthwhile. Although coconut milk can be bought in ready-to-use form in Manila, it

is unlikely that people from Morong and Canawan would buy it, given the availability of coconuts and the limited cash available.

A second way to add more fat in their diet is to encourage them to eat more nuts, such as peanuts, cashews, and sesame seeds. They, of course, need to be convinced to plant these crops. Cashew is already being produced, but peanut and sesame seeds could be introduced, both as cash crops and for personal consumption.

The Aetas also need to increase the amount of protein in their diets. One way would be use the nuts noted above. Another would be to eat more legumes, such as *munggo* (mungbean). Yet another would be to find ways to procure animal sources more readily. We proposed that more animals, such as chickens, pigs, and goats be raised.

Chicken would be a good source of nutrients. The eggs and skin are rich in fat, the liver in vitamin A, and the meat in protein. Pigs and goats would also be good sources of protein, and their livers of vitamin A. The Aetas would probably prefer the native breed of chickens and pigs, that are hardier and require little care. Goats will eat almost anything, so feeding should not be a problem, and their milk could be an additional source of fat as well. Perhaps, if the Aetas are hesitant to use goat or even caribou milk (they believe that this would make them behave like animals), they could be taught to make cheese from their milk and eat this instead. Cheese would be a good source of fat and protein.

A far more expensive way to increase vitamin A intake would be to fortify the foods that the Aetas eat often, such as rice and condiments like salt and soy sauce. However, marketing and distribution would be problematical for remote locations such as Canawan. On the other hand, this method could be implemented on a regional or national scale, which would require policy and legislative changes.

These suggestions could be implemented through a concerted effort involving community mobilization and health education. People like the Aetas have become wary of suggestions, even from well-meaning sources. It may be a good strategy to start with a few families who will adopt these changes by raising more animals, and planting a wider variety of crops. When this succeeds, other families will follow.

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Community Assessment of Natural Food Sources of Vitamin A in Niger: The Hausas of Filingué

Lauren Blum

Background Discussion of Niger

The research was conducted in the land-locked country of Niger located in the Sahelien region of West Africa. Erratic and low rainfall plagues this arid area, resulting in unpredictable harvests and insufficient food production to meet the population's needs. Three ecological zones span Niger including a relatively fertile strip in the savanna zone located at the southernmost part of the country where average annual rainfall is 300 to 650 mm, the pastoral or sahelien zone averaging 200 to 300 mm of water annually, and the Sahara zone which is part of the Sahara desert covering three-fifths of the country and inhabited primarily by nomadic groups (Ministère de la Santé, 1992). Most agriculture production is conducted in the savanna zone of the country where millet, sorghum, maize, and groundnuts are cultivated.

Nigerians generally characterize the country as having two seasons, dry and rainy. The dry season begins in October and lasts through June, with no precipitation during this period. Immediately following the rains, the month of October is hot and daytime temperatures reach close to 40°C. In November, the temperature begins to drop dramatically, and through February temperatures do not rise over 35°C and dip to below 10°C at night. This is also the time when dry season gardening takes place. Both indigenous and western varieties of vegetables are cultivated in small plots located either in the family compound or near water sources scat-

tered in communities. Examples of indigenous plants are red sorrel or amaranth while newly introduced foods include lettuce, tomatoes, carrots, cabbage, and eggplant. In March the temperature rises on a daily basis and reaches a constant in April when oppressive heat in the mid-forties is to be expected. The rainy season begins in mid-May or June and goes through September, and in the most southern and fertile areas of the country rain may fall every three or four days. Rains can be dramatic, preceded by high winds precipitating fierce dust storms, and followed by torrential downpours that last from thirty minutes to several hours.

Five primary ethnic groups inhabit Niger including Hausa (55%), Djerma (23%), Toareg (10%), Fulani (5%), and Kanouri (5%). Islam is practiced by approximately 99% of the population (Kourgueni et al., 1993). Approximately 85% of the population lives in rural areas and engage in farming, although a recent increase in migration occurred as the desert rapidly encroached, environmental degradation escalated, and people were no longer able to rely on the precarious ecological conditions that existed.

In 1992, the population was estimated at 8.7 million, with the average birth rate at 3.4 and 7.4 live births per woman (Kourgueni et al., 1993). Although child and infant mortality rates are among the highest in the world, demographers project that with the present birth rate the population will double in twenty-one years, putting an exorbitant amount of additional strain on already limited natural resources and a fragile ecosystem.

Literacy rates in Niger hover around 14%, with a discrepancy between males (20%) and females (10%) (Kourgueni et al., 1993). These rates are far more striking when analyzing the majority of the rural population where literacy among men is 14% and 6% among women.

Uncharacteristic of most places in the world, child and infant mortality rates in Niger have increased over the past few years. In 1992, a demographic survey found child mortality to be the highest in the world (123/1000), excluding war zones (318/1000) (Kourgueni et al., 1993). Vaccination coverage of children immunized against the illnesses targeted by the EPI program is estimated at a low 17% (Kourgueni et al., 1993).

The major causes of infant and child mortality are infectious and parasitic diseases aggravated by undernutrition, with respiratory infections the most reported childhood illness followed by malaria, diarrheal diseases, measles, whooping cough, and meningitis (Issa, 1993). These health problems are related to many factors including harsh environmental conditions, poverty, poor sanitation and hygiene practices, poor ac-

cess to health services, and a general lack of awareness among the population regarding causes of disease, preventive measures, and treatment.

Children's diets are both deficient in calories and poorly balanced, leading to undernutrition and high rates of chronic and acute malnutrition, and severe micronutrient deficiencies. Studies indicate that acute and chronic malnutrition are highest among children ages one to three, especially during the weaning period when children are abruptly removed from the breast and expected to follow the family meal pattern. The nationwide demographic study conducted in 1992 shows chronic malnutrition among children five and under at 33%, of which 16% are severely malnourished. Inadequate food intake coupled with exposure to illness leads to the classic synergistic cycle of undernutrition, poor health, and infection.

Vitamin A Situation

Given the high rates of malnutrition, it is not surprising that vitamin A deficiency constitutes a significant health problem in Niger. In 1986, a morbidity assessment (Sloan et al., 1986) found rates of xerophthalmia at two to three times the WHO critical level among children under six years of age. Following this study, Niger was included on the WHO/IVACG/UNICEF list of twenty-four countries in which vitamin A deficiency is a significant public health problem (WHO/UNICEF/IVACG, 1988).

Since 1986, research has substantiated the initial findings; included were a study conducted in 1987 in five regions, by WHO/UNICEF/Ministry of Health and the World Bank, that found nightblindness to be eleven times the WHO critical level among children (Ministère de la Santé, 1991) and a national xerophthalmia survey, carried out in 1989 that replicated the results of the 1986 study (MOH, Niger, 1989).

Keith (1991a) conducted a more qualitative assessment in southern Niger on vitamin A food availability and factors affecting the intake of vitamin A-rich foods. Despite the fact that many preformed vitamin A and carotene-rich foods are available year round, the results indicated that nearly half of the children ages thirteen to thirty-six months are at high risk of developing vitamin A deficiency and 62% of children thirty-six to seventy-two months also fall into the high risk category.

The Research Site—Ecological, Climatic and Demographic Factors

The study was conducted in the village of Filingué located in the Department of Tillabery, 185 kilometers north of the Nigerian capital, Niamey (Map 3). Filingué is the county seat and the home of regional govern-

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The FES Protocol was Tested in the Village of Filingué in Niger



ment offices and services, including the *sous-prefecture* or local government structure, the regional health center, the central post office, and two secondary schools.

There are approximately 12,700 inhabitants in Filingué representing a range of ethnic backgrounds including the majority Hausa group (70%), Djerma (10%), Toareg (10%), and Fulani (5%) (Ministère des Finances et du Plan, 1990). The rest of the inhabitants include a mix of people from neighboring countries. The interaction among this exotic range of cultures and backgrounds, representing different lifestyles, makes for a rich and dynamic environment.

Filingué is situated in a rift with dramatic cliffs only a couple of kilometers from the town center. A *wadi*, which is fullest in the summer when it is replenished by the annual rains and dries out around April or May at the height of the hot season, is on the northern end of the town, providing a source of water for herds of animals passing through or voyagers traveling on camel or horseback. During the cold season that

lasts from December through February, people make use of this water source for off-season gardening.

Having been a fertile area in the past, the vast majority of the population are agriculturalists. More recently, Filingué, located on the border of the sahelien ecological zone which averages 200 to 300 mm of rainfall annually, has experienced extremely poor harvests as the desert rapidly invades the area. Although people continue to practice agriculture, severe economic strain has forced household heads to migrate to southern regions during the dry season in search of a supplementary income often leaving their families for several months at a time. Economic hardship and the need for additional financial resources has perpetuated an increase in female involvement in small enterprise, including sewing projects, the preparation and selling of snack foods and condiments, and local commerce such as the selling of traditional cloth.

The primary crop and staple food cultivated in the surrounding region is millet, which is planted after the first rain in June or July and harvested in October. If the harvest is good, people set aside a stock for the family's annual consumption and sell the remainder for cash in order to purchase food staples such as maize, meat, and sauce ingredients, as well as to ensure for family provisions. Cowpeas and sorghum, although less fruitful in this arid climate, are also cultivated. Fields are generally intercropped with indigenous green leafy vegetables that are an important sauce ingredient.

During the rainy season an array of indigenous green leafy vegetables can be found growing wild in the bush surrounding Filingué. These leaves are collected by women and children and are sold by street hawkers who circulate the streets, going from one compound to another, or who may sell the fresh leaves in central locations around the town. At this time of year both local wild green leafy vegetables and imported fresh greens are abundant on market day, while during the dry season leaves are sold in a dried form. From October through May female vendors from more southern regions travel to Filingué with huge burlap sacs full of baobab and horseradish tree leaves and other varieties of green leaves that had been dried during the summer months.

The market, which is held on Sunday, is critical to the livelihood of people living in Filingué and the surrounding region. People trek ten kilometers by foot or as far as thirty kilometers by camel or horseback to visit the Filingué market. There are also vendors who travel up to eighty-five kilometers in bush taxis to purchase goods in Filingué which they resell in local markets. During the rainy season, the market is particularly

lively and colorful when it is stocked with a greater variety of foods. As is true of market settings throughout Africa, it serves as a meeting center where nomadic groups and sedentary agriculturalists from different ethnic backgrounds convene to conduct business transactions and exchange news and information.

Large sacks of staple foods such as millet, sorghum, maize, and dried cassava are plentiful on market day. Most fresh fruits (people generally buy a supply of fruits for a two- to three-day period) and vegetables are purchased in the market, as are tubers, dairy products such as eggs, cow's butter, and milk, and sauce condiments. Large quantities of meat are also obtained in the Sunday market and consumed during a special noontime or evening meal.

Filingué residents purchase smaller quantities of foods on a daily basis. Meat can be acquired from a local butcher and other sauce ingredients are purchased from market vendors or from one of the small food stores located at the center of town.

In 1992, health indicators collected by the medical center in Filingué show that among children under five years of age, malaria was the most common illness followed by respiratory illnesses and diarrhea (Ministère de la Santé, 1992). Rates of moderate malnutrition (weight-for-age) among children under two years of age attending the well-baby clinic were estimated at 16%, while severe malnutrition was over 4% (Ministère de la Santé, 1992).

As is true in most Nigerian villages the population in the town of Filingué is concentrated. High density housing without pumped water, the absence of latrines, and poor sewage disposal coupled with waste produced by ruminants that spend the night in the family compound all contribute to poor sanitary conditions. While adults defecate in the surrounding bush area, children relieve themselves within the compound. The fecal waste is covered with dirt and discarded in the street. A general lack of water further aggravates the sanitation problems manifesting poor hygiene and contributing to infection and disease.

Household finances are maintained separately and financial obligations follow Moslem tenets and are thus distinct and well-defined. According to Islamic principles, the *mai gida* or male head of household is responsible for purchasing all household food items and is expected to provide for clothes and medical needs. If a female head or co-wife is involved in petty commerce and her husband is unable to obtain the necessary staples she may choose to participate in the household economy

by occasionally obtaining sauce ingredients or providing food from her personal stock.

Typically, the *mai gida* leaves a small sum of money every morning for his wife or wives to use to buy sauce foods. Men claim that women have a tendency to pocket small amounts of this daily sum for their own use and therefore they are justified in forgetting to supply the food money occasionally. By neglecting these obligations or leaving an inadequate sum the *mai gida* places pressure on his wife to supply or supplement daily purchases. There is virtually no communication between the husband and wife concerning finances, and spouses, knowing their roles, are reluctant to confront the situation. As indicated by both Hill (1969) and Keith (1991b), a general feeling of secrecy, deception, and mistrust associated with money manifests itself in Hausa compounds and in households where women are economically viable. Competition surrounding finances can be fierce. Men express a resentment for the unwillingness of women to contribute to the household economy, while women partaking in economic endeavors strive to attain independence and security in this unpredictable environment where divorce is common, male off-season migration is high and often leads to long-term absences, and average life-span is short.

The Research

The researcher arrived in Niger in late October. Before traveling to the research site, approximately one week was spent in the capital city acquiring the necessary government permission to conduct the research, meeting with Ministry of Health personnel, and identifying a local botanist who would be available to assist in the research. The study was initiated in Filingué in early November. During the first few days the researcher introduced the project to government officials, traditional leaders, and health personnel, identified two research assistants, and selected key-informants. A census conducted in 1989 was used to identify the various neighborhoods and to select the locations in which the structured interviews would be conducted. A sample of respondents was chosen in five neighborhoods representing a range of ethnic backgrounds and socio-economic levels. Each respondent was visited on four occasions.

The research team consisted of the primary investigator and two research assistants who administered structured interviews. Following a brief training period with the two assistants, the initial series of structured interviews began within a week of the primary investigator's arrival to the area. Twenty-seven compounds were visited over five weeks where struc-

tured interviews were carried out with mother-respondents. Key-informants included three experienced mothers, one male and one female village elder, one male head of household, a government health worker, and a traditional health practitioner. Interviews with these individuals continued for the duration of the research period. The primary investigator returned to Niamey in mid-December where data were analyzed and the preliminary report written.

Food Sources of Vitamin A

The research results illustrate that a range of vitamin A-rich foods are available throughout the year. Animal sources of vitamin A include meat, liver, eggs, cow's butter or ghee, milk, and poultry. As in most parts of the sahelien zone of Niger, where Fulani pastoralists spend most of the year, meats including beef, mutton, and goat are viewed by the inhabitants of Filingué as a critical component of the diet. Villagers try to include small portions of meat in the sauce, generally goat or mutton which are less expensive than beef, two to three times a week. When distributing the sauce the mother apportions pieces of meat according to the age of the children eating from a communal plate. Occasionally, the *mai gida* also purchases grilled meat, most frequently mutton or beef, from one of the many meat vendors, preparing meat over an open fire pit, scattered around the town of Filingué. Grilled meat, which may include pieces of liver, is bought in quantities ranging from 100 CFA to 500 CFA (one-half pound to two pounds) and may be a weekly, bi-monthly, or monthly treat depending on the socioeconomic status of the family. The meat is wrapped in paper, carried home, and partitioned among the family members. The female head of the household distributes the meat and apportions it according to the age of the child. If liver is included in the purchase a women will generally give the larger portions to the youngest children. Liver is a highly valued food that people try to buy on a bi-weekly basis in small quantities, particularly to feed young children in the household.

Although liver and eggs are recognized as foods with special qualities for children, research results show that due to their cost, consumption is infrequent. Among children six months to six years (liver is introduced at eight to twelve months) portions of liver consisting of two to three small bite-size pieces are consumed at most once a week and more often bi-weekly. When asked whether people can afford to buy liver one informant replied, "Not really, unless they are sick. Then they think that it is important to eat. Liver provides protection because it is full of vitamins and blood, which gives us good health." Eggs are available mostly during

the rainy season but can be found at other times of the year in the Sunday market or obtained from individuals who raise poultry. However, eggs are scarce during the hottest months of April and May. Mothers try to feed children one egg a week during the rainy season when eggs are plentiful and less costly. When eggs are expensive consumption falls dramatically and eggs may only be acquired as a gift. Consumption of eggs is higher among households who raise chickens or guinea hens, where on a weekly basis a couple of eggs may be scrambled and fed to the children, once again as a special treat.

Nigerians use large quantities of oil in sauces, side dishes, and in dressings for salads and green leafy snacks. Although peanut oil is most commonly used, cow's butter, also known as ghee, is the preferred source of cooking oil in Filingué and is considered to enhance the taste of the sauce. Butter is skimmed from cows' milk and sold in the market either in liter bottles or in small tablespoon-sized portions. Depending on the economic status of the family, butter may be purchased by the liter and used on a daily basis in the sauce. In this case respondents suggested that they measure a couple of tablespoons of butter into the sauce or actually pour the ghee directly from the container into the pot. Mothers indicated that the more ghee the better the sauce tastes. Use of butter is significantly higher among families who own cows.

Milk is consumed on a daily basis by a majority of Nigerians in *hura*. However, the staple millet porridge is a combination of pounded and cooked millet and milk. The milk is purchased skimmed and thus is lacking in vitamin A. Whole milk is considered a luxury and is not affordable by most families, and those who do consume whole milk generally have cows in their compound.

Both chicken and guinea hens are raised in the Filingué area but, due to the expense, are consumed only on special occasions such as holidays, weddings, or baptisms.

Carotene-rich foods include indigenous green leafy vegetables, cultivated greens, and garden vegetables that are grown in the area or transported in from more southern regions, and fruits that are also brought into the region. Indigenous green leafy vegetables begin to sprout after the first rains in June and are gathered in the bush by women and children throughout the rainy season. At sunrise groups of young girls and elderly women can be seen heading toward the surrounding bush of Filingué with large gourd containers in which they collect a variety of wild leaves. These foragers return in the evening with mounds of leaves that they take home for household consumption, sell fresh door-to-door,

or sell in pockets of town where foods are sold during the week or in the Sunday market. Other local greens such as red sorrel are intercropped with millet or sorghum in farmer's fields during the summer months.

An elderly informant suggested that consumption of these wild greens is higher when millet production is poor or during times of hunger or hardship. He stated, "If people are full of millet they don't need to gather wild foods. If there is no millet people look for these foods in the bush and eat them. We aren't getting as much millet as we used to, so people are resorting to wild greens growing in the bush."

Most of the indigenous leaves are preferred at the beginning of the rainy season, when they are still young and tender. As a result, the young leaves are consumed on a regular basis at the outset and midway into the rainy season. As the season progresses and the leaves lose the young fresh quality sought after by the Filingué population, consumption of fresh leaves decreases. The more mature leaves are dried over a two- to three-day period in direct sunlight and stored in a sheltered structure for household consumption or sold in the Sunday market at other times of the year.

Leaves are commonly prepared in the afternoon and evening as sauce. The leaves most frequently used as a sauce ingredient are the baobab leaf and red sorrel, both of which are available either fresh or dried throughout the year. Other leaves added to the sauce are amaranth (there is a wild and cultivated variety), sickle, and jute, but these leaves are less abundant and therefore most frequently consumed fresh during the summer months.

Women also use indigenous green leaves to make two traditional dishes called *kupto* and *dambo*. *Kupto* is a combination of boiled leaves mixed with onions, peanut extract, oil, salt, and hot pepper, and is sold by street vendors in small cup size mounds. The use of horseradish tree leaves is the most popular way to prepare *kupto* and is highly desired by married women who share this vitamin A-rich concoction with their young children during the morning meal or as a late afternoon snack. *Dambo* is a combination of boiled greens and dried maize, cassava, millet, or sorghum mixed with onions and oil, and is also sold by hawkers in small cup size portions. This traditional dish is described as both nutritious and filling, attributes which Nigerians strive to attain in food consumption. During the summer months these dishes are made with fresh leaves.

Other sources of carotene are grown in local gardens during the cold period (December–February) of the dry season and sold in the community. Gardening was commonly practiced in the mid- to late-1980s, particularly following the 1984–1985 Sahelian drought when the Nigerian government implemented nationwide campaigns promoting dry sea-

son cultivation. However, the past few years the number of gardens has declined. Residents indicate that since they are limited to planting large garden plots by the wadi on the outskirts of town they are unable to protect the produce, which is pillaged by young children. Small gardens are also cultivated within households where a portion of the compound may be sectioned off to plant lettuce, tomatoes, and red sorrel, that are used during the winter months for home consumption or distributed as gifts to neighbors or relatives.

Carotene-rich garden food includes carrots, lettuce, and tomatoes, and are widely consumed when available. During the months of January through March, local table vendors can be seen walking the streets marketing freshly picked carrots that they carry on their heads. Lettuce and tomatoes are available on a daily basis in the market or can be purchased from one of several coastal women who prepare salads of lettuce, tomatoes, and onions marinated in a dressing made predominantly of peanut oil with vinegar and salt.

Pumpkin is brought to the Filingué area from southern regions year-round and prepared in the sauce by residents a couple of times a week. Typically, slices of pumpkin are purchased in the market in the morning or obtained from street hawkers who sell their produce door-to-door. Cubes of pumpkin are cooked for twenty to thirty minutes toward the end of the preparation of the sauce. A popular lunch dish is sauce made of pumpkin and red sorrel poured over rice.

The only vitamin A-rich fruit widely consumed in the area is mango that is available March through September. Both a large, meaty mango transported from Niamey and a local variety can be purchased. While the larger mango is more expensive and therefore not afforded by most, the local variety is a popular snack food for both children and adults, and can be obtained daily in the market place. The height of the mango season falls during the hottest months of the year, April and May, a time when other fresh produce is rare and unaffordable. During this period mangoes provide an important source of vitamin A and may replenish and build low vitamin A stores for the coming months.

Meal Patterns and Food Utilization

Nigerians typically eat two large meals during the day and, depending on the family, may also consume a light breakfast. The most important meal is served at noon and generally consists of *hura* or sauce and *tuwo*, baobab or okra sauce poured over millet or sorghum paste. Rice with a sauce made of meat, pumpkin, and a green leafy vegetable is eaten daily by civil

servants and prosperous merchants and may be served on a bi-weekly basis in more typical compounds. Two to three times a week, during the midday meal, Filingués try to include small servings of meat in the sauce. Informants viewed sauce without meat as lacking substance or “use for the body.” Other sauce ingredients typically include peanut oil, tomato paste, an indigenous green leafy vegetable, onions, salt, and seasoning. The dinner meal is frequently corn paste with okra or baobab leaf sauce. Breakfast is the least substantial meal often consisting of leftovers from the night before, locally made fried donuts, or *koko*, a semiliquid millet porridge that is slightly fermented and spiced, and eaten hot.

Cooked midday and evening meals are served on large communal plates and shared among children according to gender and age. Although young boys and girls may eat from a dish with their mother, when children reach the age of seven or eight, the boys and girls are separated and meals are taken with other children of the same sex. Separate plates may be given to older children (also according to gender) depending on how many people are in the household. In Niger, the male head of household is served his own plate which includes a more generous portion of meat and other sought after foods.

Pregnant Women

Although women of reproductive age typically consume large quantities of *hura* both at mealtime or as between meal snacks, during pregnancy women indicated that they reduce their intake of this rich staple because “tana a sa nowi cikin ciki” (it puts too much weight in the stomach). Their consumption of millet, corn, and sorghum paste is also reduced for similar reasons. Mother-respondents indicated that they avoid gaining too much weight during pregnancy since they believe the food they consume goes to the fetus, so too many heavy foods will cause the fetus to grow too large leading to a difficult delivery.

Women suggested that their nutritional needs are greater when they are pregnant, and that they seek out both tasty and nutritious or special foods including snacks of meat, grilled liver, and green leaves. In particular, informants mentioned that during pregnancy women crave *kupto* which they try to eat in large quantities. They also indicated that they choose to eat rice and beans rather than millet or maize paste and desire fresh garden vegetables, such as lettuce and cabbage, which they consume in season. Baobab leaf sauce is thought to be a blood enhancer and a food good during pregnancy.

Lactating Women

Koko is the food most consumed during the immediate postpartum period and both *koko* and *duca*, millet bran mixed with water, are supposed to increase breastmilk and facilitate lactation. A primary goal during the forty-day period of seclusion following delivery is to increase pounds, which they indicated will strengthen the body and help restore health. Therefore, women strive to eat foods that are heavy and facilitate weight gain. Women drink large quantities of *koko*, *hura*, *duca*, or *miyai* (an uncooked version of *hura*) and may consume the equivalent of two buckets during the course of a day. The desire to fatten-up is so great that women interrupt their sleep to consume these liquids during the night. They also try to eat meat and liver to return the blood lost during the delivery and prefer a richer, tasty sauce made with leafy condiments and larger portions of meat that make millet or maize paste more appetizing and thus increases intake. Other foods that lactating women try to consume in large quantities are rice and beans, *dambo* and *kupto*. Eggs are widely restricted during lactation and are believed to give women *kodai*, a craving for too many good things.

Women indicated that they strive to gain weight and eat good foods during the postpartum period to restore their own health and to benefit the breastfeeding child. They believe that the nutritional value of food they consume is passed directly on to the child. One informant said, "We believe if the women benefits from these good foods, such as liver and *kupto*, so will the child." Another respondent said, "We think that it is much more important to eat lots of food when you are lactating than when you are pregnant. Furthermore, we believe that if we eat good foods, foods rich in vitamins, the breastfeeding child will also get the same foods from the breastmilk. Because of this we want to eat foods that are good for them, foods that are rich in vitamins." In addition, blood-rich foods, believed to increase circulation, energize the body, and restore health, are highly sought after.

Following delivery it is paramount that *tsoho jini* or the old blood be extracted from the body and replaced by new blood. During the forty-day postpartum period a bathing ritual called *wanka biki* is practiced in the early morning and afternoon. Women dip the branch of a local tree into boiling water swatting their bodies, particularly their backside, with the leaves dripping with scalding water. This action cleanses the body by extracting the old blood. In addition, the abdomen is massaged on a regular basis in an effort to encourage the blood to leave the body. The

goal is to *bude ciki* or open the stomach to increase the appetite and allow the woman to gain weight, restoring health and strength.

Infant Feeding

In Filingué, the infant is fed sugar water before the colostrum is offered. Although colostrum is generally given the day of delivery, there is a waiting period when the woman squeezes the initial colostrum called the *baki-baki*, that refers to the old milk, from the breast. Women believe the milk has been sitting in the breast for too long a period (between the time the last child was weaned and this birth) and therefore this very first milk is not good for the newborn. Once this milk has been extracted the woman washes her breasts thoroughly, fixing her body, and starts to give the colostrum.

Female respondents generally recognized that colostrum is beneficial to the health of the infant. For example, when inquiring about colostrum one woman said, “The child will not be well if he does not get this milk. We think this is very good for the child.”

In more rural areas traditional practices can delay or prohibit the use of colostrum. In a village surveyed just five kilometers outside of Filingué, where six respondents were interviewed, a postnatal ceremony is followed that may prevent its introduction. The following conversation with one of the key-informants describes this tradition.

“After giving birth we give the baby water and sugar. We don’t give the breastmilk at first if the milk (colostrum) is no good.” The respondent was asked how they know whether the breastmilk is good and she replied, “We empty the colostrum into a calabash. We then put ants in the colostrum. If the ants can crawl out of the milk the colostrum is good. If the ants die in the colostrum the milk is no good, it will give the children *kai-kai*” (an affliction that causes severe itching followed by lesions). The informant was then asked what is done if the ants die in the colostrum. She said, “We give her medicine if the ants die in the colostrum, the pounded wood that I showed you earlier. We boil the wood in water and then she drinks it. This will fix her milk and make the milk good.” When asked what is given to the baby if the milk is no good she answered, “We give sugar water, juice made with oranges, water, and sugar, and cows’ milk.” Finally the interviewer inquired when they give breastmilk if the initial milk is no good. She answered, “We can give the milk after the mother drinks the medicine and the milk becomes white.”

Sugar water is given to infants throughout the first week and is mixed with orange juice starting in the second week and fed until porridge is introduced. Women perceive the juice as the initiation of the gradual weaning process. The liquid is additionally used as a purgative.

Infants spend all of their time either on their mother's back or by their mother's side and are breastfed on demand, and mother's milk is considered a critical source of nourishment. Unless the breastmilk is insufficient or the child is an orphan no other forms of milk are fed to the child. Whole milk obtained from animals is believed to give infants and children diarrhea.

When the mother becomes pregnant again the child is abruptly taken off the breast. The breastmilk is no longer considered good for this child and will give the child diarrhea and lead to poor health. If the mother does not get pregnant during the second year the child is generally removed from the breast between twenty-four and thirty months. Women indicated that household economics may dictate their decision when to wean, as it is financially advantageous for the child to breastfeed.

Supplementary foods are introduced to the infant's diet anywhere from three to eight months, generally depending on whether the woman has attended baby weighing in the health center. (Women frequenting weighing are instructed to begin feeding infants a porridge at four months). At about eight months infants are introduced to millet paste and sauce, that the mother feeds to the infant with her fingers, and for many children the leaves in the sauce may be their first exposure to foods rich in vitamin A. Also at eight to twelve months women begin to introduce the infant to *kupto*, perhaps a teaspoon at a time. Meat is first given to infants at eight to ten months and may include beef that the mother has chewed or pounded pieces of liver.

Child Feeding

Children are weaned from mother's milk anywhere from seventeen to thirty months. Between the age of one and two years children start to eat like adults, following the family eating schedule. Children generally consume two main meals, one at lunchtime and the evening meal. As indicated earlier breakfast is less substantial, consisting of the evening meal leftovers, two to three bean cakes, fried donuts, *bura* or *koko*.

Mothers do not encourage young children to eat. They wait for them to indicate when they are hungry or allow them to feed themselves. Before the child develops *wuyo*, which literally means cleverness and occurs around age two to three, the child is at a disadvantage since he

does not have the ability to verbalize his needs and, as one informant pointed out, may not be able to assess or identify the feeling of hunger as well as older children. His only option is to follow the family meal schedule. Furthermore, at this pre-*wuyo* stage he is not as mobile as his older siblings who are able to obtain street foods or forage for foods, nor has the small child mastered the ability to solicit small gifts of pocket money from adults.

As children get older and develop *wuyo* they leave the compound and seek snacks. Snack foods constitute an important part of children's diets and range from treats they buy on the street with pocket money given to them by their parents or visitors, to foods that are foraged in the area. These between meal foods may include wild fruits, oranges, mangoes, liver, carrots, dates, peanuts, fried bean cakes, cookies, candy, or a green leafy vegetable boiled and mixed with peanut extract. Older children also venture out to the surrounding bush to gather wild leaves that they consume fresh. Not only are these foods often nutritious but between meal snacks provide an opportunity for a child to eat on his/her own without having to share with siblings in this society where both gift-giving and sharing of consumable items are implicit tenets. In a group setting social norms compel people of all ages to share food.

There do not seem to any be feeding differences between boys and girls. Portion sizes are simply divided according to the ages of the children eating from the communal plate.

Cultural Beliefs about Vitamin A–Rich Foods

Animal sources of vitamin A, particularly liver, eggs, milk, cow's butter, and meats, are considered prestigious foods and are well liked by the population. They are most frequently described as healthful, strengthening, or fattening, characteristics that people seek out in food, and blood-rich or having the quality of increasing blood or returning blood to the body. This concept related to the blood level in the body came up over and over again throughout the duration of the research. People in the Filingué area believe that the amount of blood in the body fluctuates considerably affecting circulation and health status. If consumption of blood-rich food is limited the blood will sit in the body allowing blood levels and circulation to decrease. This can have a negative impact on the overall health and energy level of the individual, leaving the person more susceptible to illness. The consumption of blood-rich food returns new blood to the body, thus increasing circulation and positively affecting overall health status. Liver, the food richest in blood, is believed to elimi-

nate deficiencies or special needs the body has and facilitates weight gain, leading to a stronger constitution.

People of all ages need blood-rich food on a regular basis and particularly when in poor health. Liver is fed to both adults and children when they are ill and, as the food richest in blood, is believed to restore health. Liver is also viewed as an important children's food and was described by a significant percentage of the respondents as specifically "returning blood to children" or "increasing the blood of children." Furthermore, blood-rich food is consumed as medicine for nightblindness and intake of liver is a common treatment.

Both liver and eggs were consistently cited as children's foods, foods rich in vitamins, foods that increase weight, and foods that make them feel good. Mother-respondents described vitamin-rich substances as foods that make both children and adults big or fat and increase the appetite. These foods enhance the health of children and conversely, if consumption of these foods is insufficient, they will lose weight making them more vulnerable.

Respondents most frequently described green leafy vegetables as healthful and tasty. The research results suggest that respondents also perceive these green leafy foods as vitamin-rich, filling, increasing blood, and fattening, all attributes that are sought after in foods. One key-informant described *kupto* as *magani talaka* or medicine for the poor. She explained, "We know that it is good, that it can do the same good things for our bodies that liver does, but it is more affordable."

Other carotene-rich foods, including pumpkin and vegetables grown in the off-season gardens, such as carrots, lettuce, and tomatoes are well liked and described as healthful, tasty, and vitamin-rich. Unfortunately, the garden season is very short and gardening seems to be decreasing in popularity.

Mangoes, available from March through September, are enjoyed by both adults and children and were most frequently described as tasty, and children's food. Children use pocket money that they are given or earn to purchase mangoes as between meal snacks.

Vitamin A Deficiency

There is a word for nightblindness in all four of the local languages spoken in the area (*dundumi* in Hausa) and nightblindness is most commonly reported by pregnant and lactating women. In a study I conducted in 1994, 21% of women reported experiencing episodes of nightblindness during pregnancy or lactation and one-third of these cases

suffered from repeated episodes. Results indicate a strong correlation between cases of nightblindness and poor socioeconomic status. Nightblindness is additionally believed to be an affliction that old people get because, as one key-informant suggested, “their blood has changed because they don’t get good foods.” Informants consistently indicated that nightblindness is associated with *lame* (a deficient diet) or *rishin ci albinci* (inadequate consumption) leading to *yumwa* (hunger). In particular, nightblindness indicates that the individual is lacking in intake of blood-rich foods such as liver, meats, and milk. Traditionally this affliction is most appropriately treated by feeding the nightblind person foods that are referred to as *magani dundumi* (medicine for nightblindness). For example, when inquiring about nightblindness, a male head of household said, “People get this when they don’t eat meat, when they don’t drink milk. If people have animals they don’t get this. If they have animals they receive milk and this isn’t a problem.” A female informant said, “Nightblindness is related to the diet. Also *anago* (a drastic change in the diet or the removal of an important component of the diet) can give you eye problems.” When asked what people think of *dundumi* another female informant said, “They know that they haven’t eaten well, that they haven’t consumed enough food with vitamins and blood in them, like liver or meat or leaves.” Others said that it is carried to them by *iska* or the devil.

Mother-respondents also suggested that *dundumi* is caused by too much exposure to the sun causing blood to fall into the eyes and *wahala* or hardship related to inadequate food intake. People from a lower socioeconomic status spend most of the daytime hours in the harsh Nigerian climate, and a shortage of millet resulting from a poor harvest seriously affects subsistence farmers and their families who rely solely on millet production. Poor production leads to a decrease in millet consumption and thus calorie intake as well as a reduction in purchasing power perpetuating less frequent intake, smaller portions of vitamin A-rich sauce ingredients, and a reduction in snack food consumption. A classic synergistic cycle results—granary stores are depleted early forcing both men and women to seek labor intensive sources of income such as collecting and transporting straw or wood from the bush. Nutritional needs are increased at a time when both quality and quantity of food intake has decreased. Once the millet stores are exhausted it is common for indigent families to subsist on *gari rogo*, a course cassava flour prepared with water and mixed with oil, onions, and pimento, or watered down *hura*. It is important to emphasize that results showed an association between socioeconomic status and nightblindness, and among those who suffered from

nightblindness several women experienced multiple episodes indicating severely deficient vitamin A stores.

Many women indicated that although nightblindness is considered a serious problem it is a normal symptom of pregnancy and a temporary affliction, caused by tiredness and overwork generally during the sixth or seventh month, which will pass with delivery. Since it is viewed as short-term, treatment is not often sought outside the home.

There are several ways in which liver is used as a home remedy for stages of xerophthalmia. One treatment is to place a piece of liver over the eyes while another portion is bitten into. The blood from the liver is believed to be transmitted to the eyes and subsequent to this pieces of liver are consumed.

During an interview a Fulani respondent described the liver treatment as follows:

“When we have dundumi we buy liver. We take some of the liver and bite into it.” She continued, “We take two pieces of liver and place it on our eyes to transmit the heat. (She explained that they then throw these pieces of liver away). We then eat the remaining liver.” When asked how much liver they buy she said, “We buy anywhere from 100 to 150 CFA (1/2 to 3/4 cup).” When asked how long they go through this process she responded, “Until we can see, until enough heat from the liver gets into the eyes.”

Most pregnant or lactating women who experienced episodes of nightblindness indicated that they consumed small portions of liver as a treatment.

Another traditional treatment is to consume baobab sauce or red sorrel. When asked about nightblindness a female informant offered the following information:

“If people don’t eat meat or if they are in the sun too long they get dundumi. Dundumi comes from wahala (hardship), from too much exposure to the sun and not enough meat.” When asked what people do when they have dundumi she said, “Here we cook surre (red sorrel), place it in a dish and put the dish in a room at prayer hour when the sun is setting and there is little light. We allow the person with dundumi to seek out the leaves in the dark. When she finds the dish she puts it near her eyes so that the wind from the leaves gets into the eyes. Afterwards that person is supposed to eat the leaves.” She was then asked how many times they go through this exercise and she

replied one or two, indicating that about six cups of the leaf mixture is actually consumed. She also emphasized that the leaves are only for that person to eat, that the person with *dundumi* is not supposed to share the leaves with anybody else. As previously mentioned this is very unusual since food is always shared. She continued, "All of this is from *lame*, *rishin ci nama* (not eating enough meat). They don't eat good foods, like meat and oil, and this leads to *rishin gani* (not being able to see)."

A case scenario illustrating a pregnant woman with nightblindness was presented to mother-respondents who were asked what they recommended for treatment. Out of a sample of fourteen women, five initially responded that the appropriate homecare action would be for the woman to consume grilled liver and to apply the juice of the grilled liver to the eyes. Seven of the fourteen women indicated that strenuous work coupled with the pregnancy caused the nightblindness, and that the woman in question required foods that were good for her, especially meats.

Although the traditional liver treatment is appropriate, the amount and frequency of consumption often appears to be insufficient to resolve the problem. As mentioned previously, since women feel that nightblindness will pass with delivery, if the affliction persists following the liver treatment women generally do not seek other curative measures.

Two respondents indicated that pills are available that can cure nightblindness. If the liver treatment does not resolve the problem the next step would be to go to the market to obtain these pills that they described as a quick and easy way to resolve the problem. The research team investigated the availability of capsules and found that mega-doses of vitamin A come from Nigeria and are sold in vast quantities in the market. The price for the mega-dose capsules can be negotiated down to about ten cents a capsule, less than what a woman would pay for a visit to the dispensary. Other vendors were selling encapsulated cod liver oil, evidently imported to Nigeria from India and transported to Niger.

The market survey suggested that people seek and purchase vitamin A in the area. It is interesting to note that in a more southern region where similar research was being conducted, vitamin A capsules were not available, and nightblindness is rare, although markets are infiltrated with medications from Nigeria.

Using a story format to describe a three-year-old child suffering from nightblindness, six of the sixteen mother-respondents advised that the mother place a piece of uncooked liver on the child's eye so that the eye

could absorb the blood from the liver. Subsequent to that, women suggested that the mother feed the child grilled liver. Seven respondents indicated that the child was suffering from hunger, and if the child were fed foods rich in vitamins, such as liver, meat, green leaves, eggs, and milk, the problem would be resolved.

Women suggested they would take the child to the dispensary for treatment if nightblindness persisted. There are two apparent problems. The first is that there is a delay between the time when the affliction is detected and when the child is taken to the dispensary. This may be due to the fact that since the appearance of the eye is still healthy or pretty, nightblindness is not considered a precursor to more advanced stages of eye problems causing visible signs and possibly manifesting decay. In addition, although nightblindness may be detected among an older cohort of children, the research results suggest that it is not recognized as often among two- to three-year-olds who are less able to express themselves and who often go to sleep early in the evening. Given poor weaning practices, high rates of disease and malnutrition, and the fact that these children are not encouraged to eat but are expected to indicate when they are hungry, this age group appears to be the most vulnerable to develop severe vitamin A deficiency.

The same story format was used to gather information on children suffering from childhood illnesses accompanied by eye afflictions. Data generated from three case scenarios, with illustrations of the ocular stages leading to nutritional blindness, showed that mother-respondents associate several childhood illnesses with the later stages of xerophthalmia. Women indicated that a white spot in the conjunctiva was a danger sign that could manifest into a severe eye problem leading to the loss of one or both eyes. Several respondents conveyed that the underlying cause of this white spot is related to chronic malnutrition beginning at the time when the mother's milk was no longer sufficient to sustain the child's nutritional needs (*lame*), and general hardship exacerbated by childhood illnesses including diarrhea, malnutrition, and measles.

When asked about corneal xerosis one key-informant said, "If there is no water in the eye, or if it dries up, the eye will close and be lost. Because of this when the eye has problems we try to keep it open." Respondents indicated that corneal deterioration in one eye could lead to the loss of the second eye, and is an indication that the child's life is in jeopardy.

The childhood diseases most often associated with eye problems are measles followed by chickenpox. Both diseases can cause extreme "heat" in the eye, "put lesions in the eye," and "eat away at the eye," and can

potentially “ruin” one or both eyes. Other illnesses include malnutrition or a poor diet, diarrhea, *zahi* or heat in the stomach, and *kai-kai*, which leads to severe itching and a red eye, and can manifest lesions in the eye. *Lame* was consistently mentioned when discussing causes for eye lesions, as was *daikashi*, which is goat’s milk fed to orphans or infants whose mother’s breastmilk is considered bad.

Most women indicated that children with eye problems other than nightblindness should first be treated in the health center. These problems can “destroy the eye” and, as one informant stated, “can enter the body and kill the child.” Household remedies commonly mentioned for eye signs resembling Bitot’s spots and corneal xerosis include medicinal plants soaked in water, a sodium/water mixture dropped in the eye, and consumption of various traditional leaf and twig concoctions. These treatments all have cooling properties and are believed to counteract the *zahi* or heat that has manifested in the eye and can lead to lesions. A home remedy recounted on several occasions entailed placing onions around the eye. The burning sensation will force the eye to remain open exposing it to air and save the eye from permanent closure and thus the loss of the eye.

If the treatment at the health center is ineffective local health practitioners most often consulted for serious eye problems are old women who sell medicinal plants in the market, a local sorcerer, and the *marabout*. When all else fails, women indicated that they would go home and pray to God.

Summary and Recommendations

The research instrument and the methods used facilitated the identification of both ideational and economic factors, and their interaction contributing to deficient vitamin A intake among children. This multifaceted analysis of vitamin A consumption and practices related to stages of xerophthalmia from a social and cultural perspective enabled the researchers to gain a better understanding of vitamin A deficiency in the research area and factors influencing decision-making for vitamin A deficiency treatment. The study also generated information that highlights local explanatory models as they relate to the stages of signs and symptoms of vitamin A deficiency.

The research instrument has practical implications for eliciting data to develop culturally-specific vitamin A education messages and to design vitamin A program strategies in the Filingué region. Furthermore, the data collected could be adapted for vitamin A programming in other sites

in the Sahelian zone of Niger, and the methods used can be applied to locations throughout the country.

The breadth of knowledge uncovered relating to the causes of ocular signs and symptoms associated with vitamin A deficiency and the extent to which traditional food practices coincide with appropriate preventive measures and remedies is reflective of an in-depth understanding residents have developed due to extensive exposure to stages of xerophthalmia. Furthermore, foods rich in vitamin A, particularly animal sources, are described as having highly sought after qualities such as blood-rich, tasty, strengthening, fattening, and healthful and are generally suitable for children. This information has programmatic implications for the development of regionally-specific health and nutrition education messages.

One obvious constraint in increasing consumption is that many of the animal sources of vitamin A are expensive. All three primary key-informants suggested that people in the area cannot afford to eat these more costly foods on a regular basis. For example, one informant said, "Money stops us from buying these good foods," while a second informant, when talking specifically about liver stated, "People cannot afford to spend money on liver unless they are sick—this is when they think that it is important to buy liver."

Green leafy vegetables are well-liked and associated with important food characteristics. However, if they are not treated or stored properly, traditional dishes provide a vehicle for parasites. Additionally, preparation often involves extensive boiling of the leaves and preservation methods that expose them to the sun over a two to three day period, depleting the vitamin A value. Other carotene-rich foods have become less available recently with a decrease in gardening. Although the gardening season is short it occurs at a critical time of year when other foods rich in vitamin A may be less available. Efforts could be made to use the various water sources in the area, including the pumped water system operated by the government, to encourage gardening. It also seems feasible that the problem of pillaging of produce could be resolved.

Women believe that the nutritional value of food eaten during pregnancy or lactation is passed on to the infant. Although less likely to eat good food for their own needs or benefit, women indicated that during pregnancy or lactation they would alter their diet appropriately for the benefit of the child. This is an important factor that should be considered when developing health and nutrition strategies.

Between the ages of one and three, particularly at the time the child is removed from the breast, which is abrupt and traumatic, children in the

Filingué region are most vulnerable for developing vitamin A deficiency and associated illnesses. This is a time when children are no longer under the direct supervision of their mother and have to fend for themselves to seek between meal foods. They follow the family food pattern, a diet that does not fulfill children's special nutritional needs, and share meals with their siblings from a communal plate. A way to increase the vitamin A consumption in this age group would be to encourage women to put a portion of ghee or cow's butter into the sauce of the age group most at risk for developing vitamin A deficiency. Once a child reaches three or four years and has developed *wuyo*, he or she will be better able to obtain between meal snacks. It is important to note that several of the foods richest in vitamin A are labeled as good for children or containing vitamins for children, and are eaten as snack foods. These includes mangoes and carrots, that are relatively affordable, as well as liver and eggs that mothers indicated could be purchased periodically. Health messages promoting an increase in consumption of these nutritious foods could be developed.

Several of the mother-respondents interviewed suffered from nightblindness during pregnancy. Although women indicated that the traditional liver treatment should resolve the problem, they suggested that nightblindness is caused by the additional requirements of pregnancy combined with the demands strenuous work places on the body, which will pass with delivery. Therefore, if the affliction continues following the home remedy women generally do not seek outside care. Given the number of pregnancies women go through, and the extent to which the deficiency exists, women of reproductive age are at risk for developing vitamin A deficiency, thus putting infants at a higher risk from birth.

Mother-respondents consistently associated nightblindness among children with hardship or lack of good food. Among under six-year-olds nightblindness is less likely to be recognized prior to the *wuyo* stage when children can walk and talk. Although respondents indicated that if the home remedy did not work they would take children to the dispensary for treatment of nightblindness, the failure to recognize nightblindness among this younger age group puts them at a disadvantage and could result in a delay in administering a home remedy or accessing outside care.

The home treatment given to children is generally either liver or another blood-rich food such as meat, green leaves, eggs, or milk. The liver treatment for nightblindness is most widely known and seems to be frequently practiced. If nightblindness is to be remedied, these practices must be modified so that the child (or woman) gets adequate portions to resolve

the problem. Adaptations of these food measures should be promoted and integrated into nutrition education messages. Although research shows that if the home remedy does not eliminate the problem women generally seek outside care at the dispensary, the time spent at home waiting for the home treatment to work is dangerously long. Educational strategies could be developed to encourage mothers to take quick action.

It is important to reiterate that women recognize Bitot's spots and corneal xerosis as severe problems, potentially leading to the loss of both eyes. People frequently indicated that these danger signs are associated with poor diet or lack of sufficient breastmilk and commonly occur in conjunction with other illnesses. But given the extent of household demands women may not have the contact with children necessary to recognize the danger signs when they first develop. The data indicate that the lag period between the time when clinical vitamin A deficiency occurs, which once manifested can develop extremely rapidly, and when it is actually detected could be long. Furthermore, nightblindness is not associated with these later stages and is not considered serious.

Since men control the finances and are responsible for paying health care fees, it is clear that male heads of households must also be targeted in any nutrition education/vitamin A programming strategy. In addition, when delineating household decision-making around treatment choice, women indicated that they need to get permission from their husbands in order to visit a health practitioner. It is therefore paramount that men are aware of the seriousness of vitamin A deficiency and its possible health repercussions.

Given the apparent extent of the problem in the area, and the high rates of malnutrition and fatality rates associated with measles, adequate stocks of capsules should be available at the health center and routinely administered to children suffering from signs of xerophthalmia and childhood illnesses associated with vitamin A deficiency. Ongoing training of the healthworkers on recent findings of vitamin A deficiency, as well as preventive and curative measures, is also recommended.

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China: The People of Doumen Village, Kai Feng Municipality, Henan Province

Li Wen Jun, Ge Ke You, Li Dian, and Chang Su Ying

Background and Introduction

Hypovitaminosis A is considered one of the major nutritional deficiency diseases affecting populations in developing regions. It has been estimated that approximately 500,000 new cases of xerophthalmia with corneal involvement occur annually in Asia, about half of which may lead to blindness. Before and at the early stage of the founding of The People's Republic of China, vitamin A deficiency was a serious problem and one of the major causes of blindness, especially among children. Along with the development of the national economy and the medical care and health services extended to rural areas, the vitamin A nutritional status has greatly improved. It was recently reported that since the 1960s the incidence of xerophthalmia in China has fallen below .7%. According to a nutrition survey carried out in 1982, the incidence of vitamin A deficiency was .9% among the 30,000 subjects examined. In recent years few cases of xerophthalmia have been reported.

However, it was reported that serum retinol levels of rural preschool children were quite low. The percentage of children with serum retinol levels less than 20 $\mu\text{g}/\text{dL}$ was 32.7, 37.1, 39.3, and 33.5%, respectively. Of 307 children, six to thirty-six months old in rural northern China, 8.1% had serum vitamin A levels less than 10 $\mu\text{g}/\text{dL}$. In a high esophageal cancer incidence area in northern China, 8.5% of people in five villages had serum retinol concentrations below 10 $\mu\text{g}/\text{dL}$. From a recent study,

we know that 40% to 50% of preschool children in rural areas have serum vitamin A values less than 20 µg/dL. A few cases of nightblindness in children were found during interviews with parents. The incidence of nightblindness is not high.

In a study from 1985 to 1989, the average dietary vitamin A intake of 5211 two- to five-year-old preschool children in eighteen rural sites was 42% to 72% of the Chinese RDA. Of the children studied, 51% to 87% had inadequate vitamin A intake (using a probability approach). In 1990, the baseline data of a surveillance and improvement of children's nutrition project, in 101 poor, remote, and mountainous counties in twenty-seven provinces in China, showed that the average vitamin A intake of preschool children was only 25% to 52% of the Chinese RDA.

Two studies showed that supplementation of six-month to three-year-old rural children with large doses of vitamin A decreased the incidence and severity of diarrhea and respiratory disease significantly. A significant decrease in the percentage of children with low height and weight was also observed.

In summary, vitamin A deficiency is possibly a serious problem among infants and children in China, especially in poor, remote, mountainous areas.

The Geography of the Study Site—Kai Feng, Doumen

Kai Feng is a municipality in the east part of Henan province, about 800 kilometers south of Beijing and sixty-five kilometers east of Zheng Zhou City, the capital of Henan province. It is located in the southeast part of the vast Hua Bei flatland. It is bound on the north by the Yellow River, on the west by the Zheng Zhou City, on the south by the Zhou Kou and Xu Chang municipalities and on the east by the Shang Qiu and He Ze municipalities of Shan Dong province. The Yellow River passes on the north boundary of Kai Feng City from west to the east (Map 4).

Kai Feng was the capital for four dynasties in ancient China, Xia (21st century BC–16th century BC), Wei (391 BC–225 BC), Wu Dai (907–960), Bei Song (960–1127). It is an ancient city with many cultural and historical assets. Due to the geographical location of the Kai Feng City, it has suffered from many natural disasters, such as flood, insects, etc. The dike of the Yellow River breached an average of every two years from 1194 to 1949. During that time, life mainly depended on the weather and nature. After the liberation, Chairman Mao and the government made great efforts to control the Yellow River. Many irrigation systems

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The FES Protocol was Tested in Two Communities in Doumen, a Village of the Kai Feng Township in China



and networks were constructed. The Yellow River has been totally controlled and has not breached the dikes since 1949.

The Kai Feng area is fifty-eight to seventy-eight meters above sea level. The northwest side is generally higher than the southeast. The total area of Kai Feng municipality is 6444 square kilometers and the city covers 359 square kilometers. The total population is 4.2 million, with .7 million living in city areas.

There are four distinct seasons during a year: spring (March–May), summer (June–August), autumn (September–November) and winter (December–February). The average temperature is 14.4°C with the highest (39°C) in summer and the lowest (-15°C) in winter. The average annual rainfall is about 600 mm.

Doumen is one of fifteen administrative villages of the west suburb township of Kai Feng City with a distance of ten kilometers. It is five kilometers from the Yellow River. The altitude of the Doumen community is ten meters lower than the bed of the Yellow River.

Doumen consists of five small communities, Zhang, Tian, Sun, Wang, and Han Doumen. The study was conducted in Zhang and Tian Doumen. Zhang Doumen has thirty-seven households and a population of 130. Tian Doumen has ninety-six households and a population of 370. The total cultivated land area of these communities is 2500 mu, which equals about 167 hectares. More than three-fourths of the land is sandy and cannot be irrigated. The average cultivated land is about four mu per capita. The average gross income in Doumen village is about 600 to 700 RMB (8 RMB is equal to \$1 US), generated from agriculture. The net annual income is about 400 RMB per capita. Wheat, corn, roots, and beans are the main grain crops raised. The economic crops are peanuts, watermelons, and cotton.

There are two village clinics in this community. One village doctor, Mr. Ma, practices both Western and Chinese medicine. The other, Mr. Liu, has practiced Chinese medicine for more than twenty years. Neither graduated from the medical university, but both were trained and passed the government medical examination.

The Field Work in Doumen

The field team in Doumen consisted of Dr. Li Wen Jun, Dr. Li Dan, and Ms. Chang Su Ying as the primary interviewers, assisted by Mrs. Bai Yan, Miss Yuan, and Mr. Wang Wei Dong. The group divided into three teams. Li Wen Jun with Mrs. Bai; Li Dan and Miss Yuan, and Ms. Chang with Mr. Wang Wei Dong. Dr. Li Dan and Miss Chang were trained for two days by Dr. Li using the English manual. All team members were trained for two days using the Chinese translation of the English manual. All other staff members also received training. Dr. Li Wen Jun, Dr. Li Dan, and Miss Chang conducted the basic interviews. The other three persons took notes and assisted in local dialectical translation, as they are local persons.

The interviewers were taken to the houses of key-informants and to the sample of respondents, by the local village doctors. The local village doctors (Mr. Ma, Western medicine and Mr. Liu, Chinese medicine) helped find key-informants, and introduced the researchers to the individual households (including the selected respondent households). The interviewers visited each house an average of four times.

How Is Food Acquired?

In this area of central China, those in farming communities grow a significant part of their food, but they also rely on local markets for food

not grown at home. In Doumen the soil is sandier than that in some of the neighboring communities, so unlike rural families in most parts of China, the people in Doumen are less reliant on home gardens.

The main local crops are soybeans, long kidney beans, hot peppers, peanuts, some varieties of melons, and wheat. Depending on soil conditions, some houses have no home gardens, while others invest considerable energy into cultivating them.

In addition to the vegetable crops grown locally, most households raise goats, pigs, and chickens, and some have ducks. Nearly all households have egg-producing chickens. They do not sell eggs, but consume them themselves. Some families buy eggs in the market from time to time. They also rely on their own animals for meat that they consume mainly on special occasions, such as the Moon Festival, the New Year, and other special family observances (including visits of relatives from other regions).

Some households obtain foods from small-scale local vendors and traders. For example, an individual may buy a sack of rice (perhaps in Kai Feng City or another region), and then bicycle into Doumen to trade the rice for wheat in local households. Another individual may produce a basket of bean curd (tofu) and go to the village to trade cakes of bean curd for soybeans. Dried noodles, bean sprouts, and some vegetables are traded in the same way. Only a small amount of food is acquired in this manner, but this method may become more significant as new entrepreneurial activities develop in the area.

Local Markets

There are two small gallery shops that sell beer, wine, soft drinks, cigarettes, biscuits, infant formula milk powder, fast noodles, soy sources, cooking spices, and other commodities, but vegetables and fruits are usually purchased from the Wang Fu Zai market or in Kai Feng City.

The nearest market is in Wang Fu Zai, a distance of three kilometers on the paved all-weather road. Market days are every third day of the lunar moon, as follows: third, sixth, ninth, thirteenth, sixteenth, nineteenth, twenty-third, twenty-sixth, and twenty-ninth. There is no bus service from the village to Wang Fu Zai; the main means of transportation are bicycles, small tractors, and carts pulled by donkeys, mules, or horses. Bicycles seem to be the most important means of transportation for both people and their goods.

The list of products purchased regularly in the market is long, but the main food items purchased are shown in Table 6.1.

TABLE 6.1

Food Items Regularly Purchased in the Market

Regular Food Items		
Animal Entrails	Coriander	Lotus Root
Apple	Cucumber	Onion
Bean Sprouts	Dried Shrimp	Orange
Cabbage	Dried Starch Noodles	Pork
Cauliflower	Eggplant	Potato
Celery	Fennel	Rice
Chicken	Fish	Sugar
Chinese Cabbage	Fresh Hot Pepper	Tomato
Chives	Garlic	Wax Gourd
Chives Flowers	Garlic Bulb	White Radish, etc.

A more complete list of foods purchased in the market and the usual price range is provided in the community food system data tables.

Most of the daily food consumed is obtained from that market. A few purchases are made in Kai Feng City, when people have other business to transact there, when guests are expected, or when it is not the market day in Wang Fu Zai.

Non-Animal Foods

Table 6.2 contains a list of non-animal foods commonly consumed. All of this food is seasonal. The wild foods (the last three items) are available only for short periods in the spring. Other food items are most abundant in summer and fall. However, the use of greenhouses in the area, including the Doumen local community, has changed the seasonal pattern dramatically in recent years. Tomatoes, chives, celery, cucumber, spinach, peppers, and a few other crops are grown in greenhouses, making them available throughout the year, but the price may be very high during the slack season.

Home Gardens

There is no clear distinction between cash crops and home gardens since all the crops grown are for home use, even though some are also main sources of income. Thus, soybeans, peanuts, maize, and wheat grown in household plots are both sold and used at home. Peppers are grown mainly for home use. Pumpkins, melons and other miscellaneous crops are also grown.

However, since Doumen has sandy soil, a narrower variety of crops are grown in home gardens. Due to the poor quality of the soil, most

TABLE 6.2

Non-Animal Sources of Vitamin A

Bean Sprouts	Peanuts (oil aids absorption of vitamin A)
Cabbage	Pumpkin*
Celery	Scholar trees flower (in spring)*
Chives*	Soybean
Cucumber	Spinach*
Dried Hot Pepper	Tomatoes*
Eggplant	Watermelon
Fresh Hot Pepper*	Young Elm Leaves (in spring)*
Kong Xin Cai*	Young Willow Leaves (in spring)*

* Contains Vitamin A

families do not grow green vegetables, but only towel gourd, calabash, and other crops that are more easily grown.

The basic seasons for home production of vegetables are summer and autumn (with planting beginning in March). Therefore autumn—September and October—is the time of peak production. Crops planted most frequently are peanut, purslane, soybean, sweet potato, watermelon, pumpkin, fresh long kidney bean, jujube, wheat, and corn.

Green Leafy Vegetables, Including Wild Crops

None of the local crops are green leafy vegetables. We found that people collect more varieties of wild vegetables from the field. The value and price of wild vegetables seem to increase in urban areas, such as in Kai Feng, due to the desire to seek rare and different tastes. The village people consider wild vegetables cheap and easy sources of food, and a good taste change occasionally. The most common wild vegetables consumed in Doumen are: *ma zhu cai* (summer), sesame leaf (summer), young elm leaf (spring), and scholar trees flower (spring). These wild foods are used seasonally. The young willow and elm leaves are gathered for only about ten days in the early spring. The other wild vegetables like *ma zhu cai* and sesame leaf are available in summer for about ten to fifteen days, so these vegetables would not be an effective solution to increasing vitamin A intakes in this type of community.

Eating Vitamin A–Rich Vegetable Food

Several vitamin A–rich foods are used by the people of Doumen, but not as extensively as would be desired. That is, foods such as spinach, celery (especially the leaves), tomatoes, pumpkin, green onions, carrots, and

chives are good sources of vitamin A, but are not consumed at a level that will increase intakes to the RDA level. *Kong xin cai* is another food rich in vitamin A that has been recently introduced in this area.

Celery leaf is a good source of vitamin A, but most families in Doumen eat only the stalks. They pluck off the leaves to feed to the chickens or pigs. Most people have little basic nutrition knowledge and do not know that the celery leaf is edible.

Some years ago the cultivation and consumption of carrots was common in this area. The sandy soil would appear to be ideal for carrot cultivation. However, they seem to have tired of them and have discontinued cultivation.

Why Don't They Eat Carrots?

Three key-informants gave the same explanation concerning the disappearance of carrots from the region. They said that carrots were very popular from the late 1960s to 1980. Farmers felt that since the growing season was so long, it was usually not possible to plant another crop after the carrots were harvested. Also, the total production of the carrots was lower than that for other food. The third reason given was that people ate so many carrots during the 1960s and 1970s they just got tired of them. Some important political economic history also contributes to the explanation.

The land was owned by landlords before the founding of the People's Republic of China. From 1950 to 1953, the Chinese government began the land reform movement. The lands belonged to the government, and each household was given a piece of land according to the size of the family. Agriculture production was practiced individually. People's working groups and communes were established that were intended to increase their power to fight against natural disasters. Production was greatly increased for a certain period of time. However, due to poor management and policy mistakes, production became monotonous and income did not increase. Therefore, farmers did not work actively and could not implement their own ideas and skills. The second land and agricultural reform was initiated in 1978, and an agriculture input and output responsibility policy was implemented. This policy promoted the initiatives of the farmers, who were allowed to plant whatever they liked according to the market demand. Currently, the people in Doumen village have their own land areas and grow various crops and vegetables.

Carrots were introduced in the 1960s by the government, and were intended to be part of a health and nutrition policy. As long as lands were

farmed communally, carrot production (and eating) continued. Between 1978 and 1980 the collective farming system changed, and land was distributed to individual households for cultivation. Farmers began to focus on profit and the economic efficiencies of different crops. Both the labor intensity and the long growing season make the carrot a poor capital investment. They are not very popular among the people, and since they are cheap, do not bring in profits compared with spinach, broccoli, cauliflower, and other vegetables.

The interviewer asked the question: "Do you eat carrots often?"

Mr. Ma replied: "We don't eat carrots too often...we ate them too much previously. The second reason is that the total production is low, and the price is low. Also the growing season is too long...(that is why we don't produce and eat carrots here)." Another key-informant commented: "We don't eat carrots very much in our family...If we want to eat them we can buy them in Kai Feng City or occasionally in Wang Fu Zai market." This statement reflects the fact that carrots are not available as a regular vegetable in the local market at Wang Fu Zai, except in the winter. The few carrots sold in the local market during the winter are from Kai Feng City or imported from more distant growers. The people of Doumen usually do most of their food shopping every third day in the market that is only three kilometers away.

Animal Sources of Vitamin A

There are several important animal sources of vitamin A available in the community. These include goats, pigs, cows, chickens, and eggs. However, all animal food is expensive, and meat is not eaten except on holidays or other special occasions. Many respondents reported eating meat only a few times a year.

Eggs, however, are eaten regularly if the household flock of chickens is producing. Almost all of the eggs produced locally are consumed in the households, rather than sold in the market. Eggs are said to be particularly good for children, pregnant and lactating women, and sick people. This is the only animal source of vitamin A that is frequently used by the people of Doumen.

Milk products are used infrequently, although a few families reported buying small quantities of milk for their children. With the exception of eggs, animal sources of vitamin A are considered unaffordable by the local people.

Pig and goat liver, or any animal liver, are extremely good sources of vitamin A. However, most of the respondents think it is too expensive

and that families cannot afford to buy it for regular consumption. They may buy pig and goat liver for family consumption only during the Spring Festival, or other special days when they or other neighbors butcher some animals for holidays.

The different foods and their price range for 1000 RE is listed in Table 6.3.

From the above table, we can see that many vitamin A-rich foods are available in Doumen and the prices are not very high. If the people could learn the nutritive value, they may gradually change their diet pattern according to nutritional needs.

Cultural Beliefs Regarding Key Foods

The most important attributes of food recognized by the people of Doumen are as follows: tasty (like or dislike), price (expensive or cheap), nutritious and healthful, prestigious, filling, seasonality, can be cooked or eaten together, etc.

When buying or growing food the people in Doumen generally consider the type of food. All the interviewees recognized noodles, rice, or steamed bread as staple foods used mainly for filling the stomach. The

TABLE 6.3

Foods from Least to Most Expensive

Rank	Food Item	Price Range (RBM)/1000RE
1	Carrots	0.01 – 0.03
2	Kong Xin Cai	0.02 – 0.09
3	Goat Liver	0.04 – 0.06
4	Spinach	0.08 – 0.40
5	Chives	0.08 – 0.46
6	Pig Liver	0.14 – 0.21
7	Pumpkin	0.15 – 0.25
8	Tomato	0.28 – 0.71
9	Fresh Hot Pepper	0.93 – 1.86
10	Cucumber	1.20 – 6.80
11	Chinese Cabbage	2.00 – 20.00
12	Egg	2.04 – 2.38
13	Celery	2.30 – 7.70
14	Dried Hot Pepper	3.86 – 4.83
15	Eggplant	4.00 – 10.00
16	Cabbage	4.60 – 7.70
17	Bean Sprouts	10.00 – 20.00
18	Chicken	31.60 – 36.80
19	Peanut	45.70 – 71.40

two attributes most often mentioned for vegetables, beans, bean products, and animal foods are taste and price. The preference of the head of the household (husband or wife) is crucial in selecting food for the family. For example, Mr. Ban Ke Jian, who is the head and the decision-maker of the household, does not like bean curd, so he does not buy bean curd often for family consumption. His wife also does not buy the bean curd because she and other family members respect him, and do not want to do something unfavorable towards him. This practice may influence food habits of their children in the future. However, such practices may weaken with economic growth and cultural modernization.

Most animal food, processed food, and canned fruits are expensive, except for eggs which are produced locally. Eggs are also considered prestigious foods. Prestigious foods are generally consumed when there are guests or relatives, or during special festivals or holidays. Families generally buy and bring canned fruit and processed food such as biscuits, fast noodles, pastry, milk powder, and formulas when they visit relatives or someone who is sick. The actual price of eggs is not low, but since they are mostly home-produced, they are considered cheap.

Generally, the people in Doumen do not know the term vitamin. Two key-informants replied that they have heard and seen the word vitamin. One said that the village doctor gave him a small bottle of vitamin C when he was sick. The other saw the word vitamin in an advertisement on television. The informant who studied in the professional school in Doumen knows that a vitamin is a nutrient that can be used as medicine, but does not know how it functions. The young respondents seemed to know a little bit more about vitamins than the older ones. They obtained most of their knowledge from television.

Parents feed their babies according to the availability of food in the household. Generally they do not force children to eat what they do not like. If they think a child is not hungry or is sick, they will change to other available food that the he likes. The parents do not pay more attention to children who eat the adult diet, they let them eat what they like from what is on the table.

Hot pepper is generally considered not suitable for the very young child, because it is hot and children may suffer from the "red eye" if they eat it. Chives are considered undigestible for children. Some families do not let the children eat rabbit meat. They have the superstitious concept that if a child eats rabbit meat, his or her mouth and lips might grow to be like those of the rabbit.

Food Patterns

The women of child-bearing age typically eat three meals a day. There are no special foods for them. They eat the same foods as the other family members. The diet of pregnant women does not change much. Most respondents said they could not eat dishes with much oil due to a poor appetite and vomiting in the first period of pregnancy. Fruits and sour foods are consumed more than usual during this period. Young couples with higher education levels buy milk powder, tonics, and some “nourished liquids.” Some husbands said they will buy some foods that their wives ask for, or will let their pregnant wives go to the market and buy the foods they like.

Nearly all respondents recognized that nutritional needs are greater during pregnancy. The foods to be eaten are fish, chicken, banana, biscuits, and other fruits. However, they think that the availability of nutritious foods is limited and the price is high, so they cannot afford to purchase them. Some mentioned foods to be “nutritious” that are not, and that are processed and expensive. Due to lack of nutrition knowledge, most people do not recognize the nutritional value of locally produced food.

Vitamin A-rich foods consumed by women are the same as listed earlier, and available locally. Although some women do not know the relationship between food intake and pregnancy outcome, most think that there is a link between food intake and the baby. They said that growth of children in their rural village is poorer than those in the cities. They heard that eating better during pregnancy will produce a better and healthier baby. The problem is that they do not have the income to buy many foods. These answers show that there is a need for conducting nutrition education activities in this area focusing on nutritional needs during pregnancy and how to eat better using locally available food.

Some foods such as hot pepper, rabbit, dog, beef, mutton, and donkey, are not encouraged during pregnancy. It is thought that the dog meat can induce abortion, donkey meat will prolong pregnancy, beef and mutton can cause discomfort. These ideas are inherited from the older generation and have been practiced for a long time. However, we found some young women who said that it is not so strict now, and some of them eat those foods during pregnancy, but some worry about it when they do.

Among the ten key-informants, five answered that egg, fish, meat (pork), fruits including canned fruits, pig and goat liver, and other nutritious foods or tonics are thought to be beneficial during pregnancy, but all of these foods are relatively expensive. Only eggs and some locally

available fruits are common beneficial foods during pregnancy. The other five informants said that they do not know which foods are good for pregnant women.

Eggs, black rice, red jujube, red sugar, and chicken soup are special foods for women during the first thirty days after delivery. Women lose a lot of blood during the delivery, so they should eat more of these foods that are thought to enrich the blood. This concept is actually from Chinese traditional medicine and has been practiced for a long time in nearly all of China. As mentioned above, egg is considered to be a nutritious and healthy food. Postpartum women are supposed to eat lots of eggs, particularly during the first thirty days after delivery. The family generally stores or prepares a certain amount of eggs or egg dishes before the predicted delivery date. Relatives and neighbors bring twenty to fifty eggs to the woman during the congratulatory visit, generally on the ninth day after delivery for a girl, and twelfth day for a boy. It is common for them to eat five, ten, or even twenty eggs a day during that period. One key-informant said she just could not eat so many eggs in a day.

Spinach and green leaf cabbage were mentioned as good foods during that period. Chicken soup and noodles, especially noodles mashed with a lot of soup, are thought to accelerate milk secretion. Traditionally, egg consumption is stopped at thirty days after delivery. The consumption of other foods mentioned above will be discontinued also, and lactating women will resume the normal family diet. There is a need to educate the public to change this practice. The daily egg consumption should be decreased to two to three per day in the first month after delivery, and should be maintained during the whole lactating period.

Hot pepper is also prohibited during lactation since it is believed that child will suffer from red eye if the mother eats it and that it makes the breastmilk hot and the child will not eat it. Most importantly lactating women should not eat the chinese prickly, aniseed, pepper, and other strong scented flavorings. These condiments should not be used in any dishes, since the people think that they will decrease or even stop the breastmilk secretion. Eggplant is another food that should not be eaten by lactating women for the same reason.

Breastfeeding is generally started the third day after delivery. People explained that there was no milk during the first three days. The baby is fed with sugar water or breastmilk borrowed from a neighboring mother who is breastfeeding. Goat or sheep milk will be used for the baby by some families who raise these animals. Colostrum is not fed to the infant in most families because mothers do not know its value. They said that

the colostrum does not look like milk, so most of them discard it. Only two young informants answered that they fed the colostrum to their children. One of them heard that colostrum contains antibiotics that can help the newborn resist infectious disease. This message was disseminated by doctors in the township hospital. The other said that her child started to suck her nipple very early, so she did not squeeze out the yellow water.

Nearly all infants were exclusively breastfed from the third day, with the exception of those whose mothers were ill or had poor milk secretion. Most babies were continuously breastfed until one and half to two years old. Some were fed until they were three years old.

Food supplementation for infants begins at about the age of six months, usually with rice porridge and mashed noodles with soup. Rice porridge is cooked with water for a long time until the water becomes sticky. Mashed noodles are also boiled for a long time. Eggs are an important supplementary food, after porridge and noodles. They are generally boiled or steamed. Boiled egg yolk is the first part that is fed to the infant. The mother feeds the baby the egg yolk mixed with rice porridge, mashed noodles, or alone. After the child gets used to the egg yolk, the white part is fed to him or her. Children are given eggs frequently; they are considered healthy, and are also given to sick people. Eggs given to babies under one year of age are steamed. An egg is broken into a bowl, stirred with a chopstick or spoon and bits of green onions are added. The bowl with the egg mixture is placed in an oven in which vegetables or steamed bread are being cooked, producing lots of steam. The dish is soft and tender, unlike fried or boiled eggs, and can be fed to the infant easily with a spoon. The frequency of feeding eggs to young children is shown in Table 6.4, in comparison with overall household intakes.

The three families who reported eating eggs less than once a week commented to the interviewer that they know that eggs are healthy food. They do not eat eggs very much because they have had bad luck with

TABLE 6.4

Frequency of Weekly Egg Consumption in Households (Doumen)

Age Group	Less than						
	Once	One	Two	Three	Four	Five	Six or Seven
Up to 5 Years	1	2	3	2	1	1	7
Household	3	4	3	6		1	9

Note: Egg consumption (and intakes of other foods) was obtained first for the overall household, then for individuals.

chicken diseases. Their chickens died off and they became discouraged with raising them.

Oil and animal fat are not fed to young infants. The respondents said that the infant cannot digest oil or animal fat, and they get diarrhea when they eat them.

The infant is generally breastfed on demand except when the mother has to work in the field. Some mothers bring their babies with them to the field when the farm workers are busy, and there is no one to take care of the infant at home. Usually the mother-in-law or older sibling takes care of the baby when the mother works outside the home. In this case, breastmilk cannot be given to the infant. The infant will be given milk powder or adult foods chewed first by the caretakers. In Doumen village, most mothers breastfeed their children for one and half years. Some children were breastfed for two to three years. No other form of milk is fed to the infant during the first year of life. Mothers whose breastmilk is not sufficient will use goat milk, milk powder, or infant formula. The quantity of these foods purchased is small. The infant is fed mainly with rice porridge or mashed noodles. Some families might buy one or two bags of milk powder for the infant during the first year. But along with the economic growth, this practice may become more popular in this area.

In this poor rural area, mothers generally stop breastfeeding when the child is one and half years old to two years old. The breastfeeding period is much longer here than in urban areas. The reasons to stop breastmilk feeding are: it is the time to stop; the child can eat the adult diet already; and there is no more breastmilk.

Parents try to start feeding table food when the child is more than one year old. They feel that the child may not digest the solid or harder foods, so they usually feed younger children with tender foods like porridge, mashed noodles, taros, etc. Eggs are still good sources of vitamin A. After two years, children eat the regular adult diet, and parents do not prepare special dishes for them unless they are sick. A common concept of mothers is the more food the child eats, the better. Otherwise, the child may be sick or dislikes the food, so parents generally encourage children to eat.

Most of the key-informants said that children eat between meals, usually foods leftover from the previous meal, such as steamed bread, sweet potato, a steamed corn stick, or a few peanuts, etc. Some families with a little extra income will buy biscuits or fast noodles from the local small gallery or from Kai Feng City.

After two years, children eat fruits and vegetables, the same as adults. Two older key-informants said that ten to fifteen years ago, male children

were better cared for than females. However, since the family planning policy was initiated in 1980, the practice has changed. The government allows couples to have two children in farming and poor rural areas, unlike the one child policy in urban and more developed areas. The number of children in a family has greatly decreased. Therefore, parents have gradually recognized that they should pay more attention to the growth and development of their children without any sex bias. Now there is practically no difference in feeding practices between boys and girls.

Food Preparation

Preparation methods for vitamin A-rich foods vary according to the type of food. Eggs can be boiled, fried, steamed, or cooked with other vegetables such as tomatoes, spinach, chives, and cabbages, etc. Animal meats, such as pork and beef, are cut into small pieces and fried with vegetables. Pork can be prepared as meat stuffing and mixed with minced vegetables for dumplings. Chicken is generally boiled for a long time with condiments and vegetables, making a nutritious soup. Spinach and other green leafy vegetables are usually fried or boiled with meat. After picking, hot peppers are sun-dried for winter consumption, or for making hot pepper powder and *guadou* (a vegetable paste popular in Doumen village). Most households process *guadou* for their own consumption. It is made of fermented soybeans, wax gourd, bean curd, and hot pepper with different condiments. It is very salty and can be preserved for a long time. People in Doumen village eat *guadou* nearly every day, and it may be a good source of vitamin A for the people in this community.

Peanuts are sun-dried first, then sold in the market or to the government. They can also be exchanged for peanut oil. Families generally produce 500 to 2000 kg of peanuts. Therefore fried or boiled peanuts are usually available and will be served to visiting guests or relatives as well as to the family. Children eat them as between-meal snacks.

Salted and pickled cucumber, eggplant, and cabbages are prepared for the slack seasons of winter and early spring. Along with the increase in greenhouses, many kinds of green leafy vegetables are available in Kai Feng and Wang Fu Zai markets throughout the year. The quantities and varieties will increase rapidly over the next few years.

Nightblindness

The term for nightblindness is *que hu* (literally: “bird fuzzy”) in Doumen. This term was new to our working team. Local people also use the expression *ji xu yan* (literally “chicken’s eye”), a term that is widespread in China.

The first step on entering the community was to interview the head of the village and the village doctors. They informed us that there were four recent cases of nightblindness: two school-aged children and two adults. All four cases were examined by the working team, and all sought treatment from the village doctor, which was cod liver oil. They all said that when they had the cod liver oil for a few days, their eyes became normal or much better. None were found suffering from vitamin A deficiency with Bitot's spots.

Liver (from pig, goat, or any animal) is the other usual remedy for nightblindness. Goat liver is said to be the best, however, it is not always easily available. The Chinese traditional medical belief system includes the idea that liver (especially goat and pig liver) is good for the eyes.

Key-informants reported that there was a general occurrence of nightblindness, particularly among young people, during the construction of the irrigation works in the 1960s. Many of the youths had difficulty returning home on their bicycles from the work site in the winter darkness.

Fish liver oil has been commonly used in China (and hence in this area) only since the 1960s and 1970s. However, the general idea that liver is good for the eyes has been a common feature of Chinese health beliefs and traditional medicine for a long time.

The production and eating of carrots was introduced in the 1960s and 1970s. This may be the reason that vitamin A deficiency (nightblindness and Bitot's spots) was controlled to a very low level before the 1980s. Along with the economic growth, the quantity and quality of food intake has greatly improved, and clinical vitamin A deficiency cases are very rare.

In detailed discussions with the four individuals with nightblindness, we learned that although the standard of living has improved a lot, personal food habits and preferences still remain factors contributing to vitamin A deficiency. None of them had any basic knowledge about nutrition and vitamin deficiency. One school-aged girl said that she dislikes hot peppers, peanuts, and liver. Her parents and the village doctors encouraged her to eat more pig or goat liver, but she would not. None of the individuals liked carrots, nor did they eat chives or spinach. This means that dietary vitamin A and carotene intakes were very low. Nutrition education for basic nutrition knowledge and prevention of vitamin deficiency is urgently needed. The people in Doumen should be taught that poor dietary habits will lead to nutrient deficiency, and that they will be healthier with more variety of food and a more balanced diet.

The respondents generally recognized nightblindness and measles, but could not identify the diseases. The people in Doumen considered

eyes very important. Although they cannot recognize the kinds of diseases, their first recommendation was that more attention should be paid to eyes, and the cases should be brought to the village doctor. Few respondents said that if a person suffers from *qubu* (nightblindness), they should be given cod fish oil and liver, especially pig and goat liver. They said that if a patient eats liver for a few days, his eyes will recover after two to three months. If the disease become severe, the patient should go to a hospital in Kai Feng City. Liver is good for any kind of eye disease. Eggs and green leafy vegetables were also mentioned as good foods for patients. Eleven respondents said that if a child suffers from measles, he should stay home with all the windows closed to avoid the wind. The home remedy is boiled reed rhizome water with sugar. After drinking the reed rhizome water the child will sweat, and then recover. This home remedy is based on traditional Chinese medicine. The people in Doumen heavily rely on the village doctors for their health care and medical treatment. They also have the same ideas about the effects of some Chinese herbs.

Generalizations about Vitamin A Intake

Sixteen food intake checklists that give food frequencies of individuals were collected, as well as twenty-five household food frequency checklists. From these lists, the following results were summarized:

- Hot chili peppers are the most frequent source of vitamin A in this population. Hot peppers are eaten nearly every day during the summer and winter. However, fresh peppers are available only during summer and fall during which time a typical household might consume as much as 250 grams of fresh hot pepper every day. Peppers are sun-dried for winter use. Dried hot chili pepper is used as a spice in cooking. It is also used to produce *gua dou*, a type of bean paste that is consumed every day.
- Eggs are consumed regularly. As they are produced in households their high price and economic value in the market is not important.
- Peanut oil is the universal cooking oil. Households grow their own peanuts and process their own supply for cooking oil. Informants estimate that thirty-five to sixty kilograms of peanut oil are used during the year. Their estimates would appear to be fairly credible since they take the peanut oil harvest from the processing plant to their homes only one to three times each year.

- Celery, chives, and spinach are the next most common vitamin A-rich foods in the diet. Chives are used as a vegetable, not as a garnish or spice as in Western cuisine. The researchers found three families who used celery leaves in cooking. They mixed the leaves with wheat, soya, or corn flour, added salt and spices, and steamed them. This was unusual, as Chinese generally eat only the stalks of celery. Celery leaves, of course, are a fairly good source of vitamin A. Spinach is generally stir-fried during the peak season, late spring and early summer, and boiled in soup during the off season.
- Despite the prevalence of greenhouse vegetables, there still appears to be a greater likelihood of vitamin A deficiency in the winter. The use of chili peppers continues, but sun-dried peppers probably have a considerably lower vitamin A content.
- Pork, goat, and chicken are consumed, but not frequently. Fish consumption is about the same as chicken (very low), four to five times a year on special holidays. There are many fish ponds in the area for carp. Fish is bought only for very special occasions as it is expensive. Every family tries to have at least one fish dinner during the New Year. The symbol for fish is *yu*, a very lucky character. Note that Chinese protein intakes are also marginal, and mainly from cereals. Nutrition workers and researchers in China are trying to promote soybeans and family husbandry of meat products, especially fish.
- Some wild plants that appear to be rich in vitamin A are gathered for cooking. However, they are seasonal and the quantities are small.
- Greenhouses are widespread, so vegetables such as tomatoes, celery, and chives are available during the winter months. Some newly imported varieties have been produced and sold in the market. For example, kong xin cai (*Ipomoea aquatica*) has just been introduced there. Although most of the people do not recognize the new vegetables as rich in vitamin A, some respondents said that they taste good.
- Beans are another fairly common source of vitamin A. The long kidney bean is consumed every day, especially during the autumn.

Vitamin A deficiency is one of the most severe nutritional problems in the world. Many factors contribute to this problem. It has been controlled in China for a long time, although there is some prevalence of nightblindness. Some researchers found that dietary vitamin A intake is very low, especially among preschool children. Four cases of nightblind-

ness were identified in Doumen. This in-depth study probed for some factors that may be related to the problem:

Doumen is a typical rural community in the central part of China. People there are engaged in agriculture production. Due to the poor soil quality, the production is monotonous and practically no green leafy vegetables are grown. The practice of home gardening is also very poor. The food produced is not even enough for the family's consumption. Because of low production, the income level is very low which affects accessibility to vitamin A-rich foods.

The people of Doumen rely heavily on the nearby Wang Fu Zai market where vitamin A-rich foods are available, but the price is high, especially for animal foods, and they cannot afford to buy them. Another problem is that the vegetables rich in vitamin A are seasonal.

The people of Doumen purchase foods mainly based on taste. Nutritional value has not been considered, and some of their nutrition knowledge is incorrect. They tend to use their limited income to purchase high priced processed foods with poor nutritional value.

The diet of women does not change during pregnancy, although some of the respondents were aware of the need for more nutrients. The diet of children is simple and consists mainly of noodles and steamed bread. It is necessary to recommend more green leafy vegetables and animal foods.

Eggs are one of the good sources of vitamin A-rich food commonly consumed by the local people. This practice should continue to be encouraged.

Hot pepper is a commonly consumed vitamin A-rich food, however, the preservation method, sun-drying, decreases the vitamin A content.

The use of carrots should be encouraged, not only because of the high content of vitamin A, but also their low cost. The sandy soil is also suitable for carrot production. There is a need to conduct nutrition education activities to teach the people about the value of carrots. Cooperation with the agriculture sector will help shorten the growing period and increase total production.

Traditional beliefs about food should be maintained, such as the use of goat liver for eyes, but some concepts might be changed, such as that children should not eat much meat, especially rabbit. The food taboos for pregnant women may also be changed. The large number of eggs consumed during the first thirty days after the delivery could be modified. It is better to eat two or three eggs a day for a long time rather than to consume ten to twenty a day only for thirty days.

The breastfeeding practices in Doumen village could be modified. The newborn should be breastfed as early as possible after delivery, and not wait for the third day. People need to know the nutritional value of the colostrum. It should be fed to the baby and not wasted. Under the current situation in China, the consumption of egg by infants should be encouraged, especially in poor rural areas.

The local people rely heavily on the village doctors for their general health care and medication. The doctor should be well trained in the prevention and treatment of vitamin A deficiency.

The consumption of vitamin A-rich foods should be encouraged. Carotene and retinol values for community food sources of vitamin A are shown in table 6.5. People can select foods according to nutritional value and price.

TABLE 6.5

Community Vitamin A Food Sources

Chinese Name	English Name	Edible Part	Cooking Method	Carotene µg / 100g	Retinol RE / 100g
Mian Tiao	Noodle		Boil	0	0
Muo	Steamed Bread		Steam	0	0
Qing La Jiao	Fresh Pepper	Fruit	Stir-fry	263	43
Hua Sheng	Peanut	Fruit	Boil, Fry	40	7
Qie Zi	Eggplant	Fruit	Stir-fry, Boil	30	5
Zhu Rou	Pork		Fry, Stew, Boil	—	—
Qin Cai	Celery	Whole	Stir-fry, Steam	80	13
Dou Jiao	Long Kidney Beans		Stir-fry, Boil	140	23
Huang Gua	Cucumber		Stir-fry, Raw	150	25
Tu Dou	Potato	Root	Stir-fry, Boil	0	0
Dou Ya	Bean Sprouts		Stir-fry	50	8
Huang Dou	Chinbean		Boil, Stew	350	58
Da Bai Cai	Chinese Cabbage	Leaf	Stir-fry, Stew	30	5
Bai Luo Be	White Radish	Root	Boil, Stir-fry	0	0
Gua Dou	Bean and Melon Paste		Fermented	—	—
Gan La Jiao	Dried Pepper		Stir-fry, Fry	1240	207
Cong	Green Onion		Raw, Stir-fry	0	0
Dou Fu	Bean Curd		Stew, Stir-fry	0	0
Ji Dan	Egg		Stir-fry, Boil, Fry	0	235
Yu Qian	Young Elm Leaf	Leaf	Steam	730	122
Xi Hong Shi	Tomato	Fruit	Raw, Stir-fry	420	70
Xi Gua	Watermelon		Raw	80	13
Hua Sheng You	Peanut Oil		Cooking Oil	0	0
Nan Gua	Pumpkin		Boil	940	157
Jiu Cai	Chives	Leaf	Stir-fry	2890	482
Hong Shu	Sweet Potato	Root	Steam	20	3
Zao	Jujube	Fruit	Raw, Boil	0	0
Huai Hua	Scholar Trees Flower	Flower	Steam	—	—
Buo Cai	Spinach	Leaf	Stir-fry, Boil	1480	247
Ji	Chicken	Meat	Fry, Stew	0	19
Yuan Bai Cai	Cabbage	Leaf	Stir-fry	80	13
Zhu Gan	Pig Liver		Stir-fry, Boil	0	5656
Yang Gan	Goat Liver		Stir-fry, Boil	0	28800
Gang Dou	Cowpea		Boil, Stew	—	—
Kong Xin Cai	Water Convulrolus	Stalk, Leaf	Stir-fry	3400	567

Peru: The Rural Community of Chamis and the Urban Suburb of San Vicente in Cajamarca

Hilary Creed-Kanashiro

Introduction

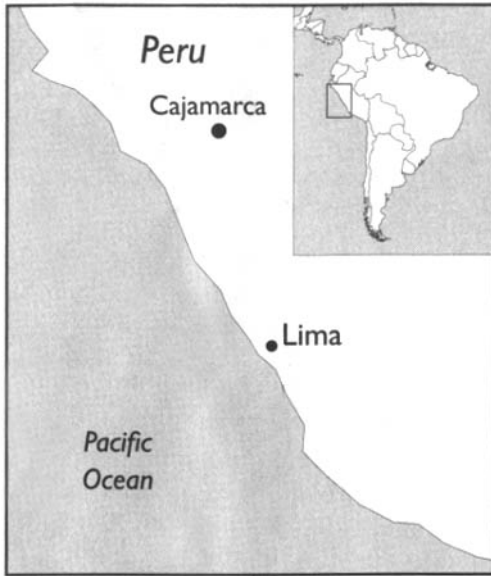
Peru, situated on the Pacific coast of South America, comprises three major ecological regions: the coastal desert plains, the highland region of the Andean mountains, and the expansive jungle area on the east side of the Andes. Although the country produces a variety of natural products, poverty, health, and nutrition problems affect a large proportion of the population. Within Peru the population of the highland region is most affected. Cajamarca is situated in the northern highlands in the region Nor Oriental del Marañón (Map 5). This region has one of the highest levels of poverty and has been selected as a priority zone by the government for providing services and promoting development.

Interventions to improve the vitamin A status of the population are part of the government's nutrition strategy. Clinical deficiency of vitamin A is rarely observed although there is considerable evidence of subclinical deficiency in children. Consequently, among the possible strategies for intervention, improving the intake of vitamin A from dietary sources is of prime importance, particularly since much of the population has access to potential vitamin A food sources, at least during certain times of the year.

The highland areas are among those where vitamin A deficiencies, as measured by serum retinol levels and low dietary intakes, have been described. For the community assessment of natural foods sources of vitamin A two sites were selected in the department of Cajamarca: one rural population, the Comunidad Campesino (peasant community) of

M A P 5

The FES Protocol was Tested in Both an Urban and a Rural site in the Department of Cajamarca, Peru



Chamis, and one urban, the suburb (*barrio*) of San Vicente. As well as an evaluation of each of the sites this permitted a comparison of feeding patterns related to vitamin A between urban and rural communities.

Overview of the Location

Geographic and Demographic Characteristics

The climate of Cajamarca is dry, of low humidity and semi-arid. The annual rainfall is around 780 mm, falling mainly between October and April. July is the driest month and March the wettest. Due to this semi-arid climate cultivation depends on irrigation; Cajamarca lacks water (Manco Pisconti, 1985; Manco Pisconti and Cáceres, 1986). The average annual maximum temperature is 21°C with little variation. The average minimum temperature is 4.6°C in the cold, dry season (May–August) and 8.7°C in the warmer season.

The population of the department of Cajamarca is 1,273,696 inhabitants, representing about 5.8% of the total population of the country, 22,128,408, 29% of whom reside in the capital city, Lima (Censo

Nacionales, 1994). Of the total population, 15% are under five years of age and 22% are women of fertile age. The city of Cajamarca is situated on the western range of the Northern Andes at an altitude of 2,750 meters above sea level. The estimated total population of the city is 104,810. The rural area of the province of Cajamarca is divided into 496 settlements (*caserios*).

The principal activity of the area is agriculture. It is a major milk producing area, primarily by large transnational companies who also buy the local peasants' production. Recently mining (mainly gold) has become an important activity and is affecting the economic profile of Cajamarca.

Culture

The population of the region of Cajamarca was originally nomadic, gradually changing to a sedentary agricultural way of life. Between the years of 1000 and 500 BC, the inhabitants came under the influence of the pre-Colombian Chavin culture of northern Peru, known for their work in stone and ceramics. This culture continued for many centuries until it was dominated by the rule of Cuismanca around 1250 AD. The Cuismanca rule lasted for about 200 years when it was conquered by the Incas who came from the south (Cusco) in 1470 AD. The population accepted the language, religion, and subservience to the Incan empire until the arrival of the Spaniards in 1532 (Medcalf, 1990).

The Spanish conquest of South America began in Cajamarca. Today all *Cajamarquinos* have a mixture of Spanish and indigenous blood. Perhaps for this reason most but not all of this rural population speak Spanish, in contrast to other rural, sierran peoples of Peru, the majority of whom speak the local indigenous languages, Quechua or Aymará.

During the colonial period the Cajamarcan peasant was further exploited, the land was divided into estates (*haciendas*) owned by the Spaniards and the indigenous Indians were treated as slaves, in many cases within the feudal system. More Spaniards came to settle as animal production, clothmaking, and the mines were productive. The Indians began to learn Spanish, and in 1802 it was documented that Quechua was being spoken only outside of the city.

The Republican period, after Independence in 1820, was characterized in this part of the country by constant wars and disputes between different families who were descendent of the Spaniards. In 1854, Cajamarca was created as a department and organized by municipalities. The twentieth century has seen the development of communication systems, primarily

along the coast. Toward the end of the 1950s, the division of lands began which became effective with the Agrarian reform of 1969 and the return of land to the peasants (Censo Nacionales, 1993; Medcalf, 1990).

In spite of this history, the peasants of Cajamarca are recognized for the organizational ability they demonstrated with the formation of peasant patrols (*rondas campesinos*) in 1976. This organization developed from the traditional need to defend property and protect lands and communities from theft and abuses. The patrols were formed on the initiative of the peasants and supported by the local authorities (Rojas, 1989). In recent years these *rondas campesinos* have been a source of protection from terrorist movements; although Cajamarca is one of the poorest and most rural departments, few areas have been infiltrated by terrorist groups.

Health and Nutrition Status

A recent national nutrition and health survey indicated that the infant mortality rate during the decade 1981 to 1991 was sixty-four per 1000 live births, and the childhood mortality rate, ninety-two per 100 (ENDES, 1992). This was greater in rural areas (ninety and 131, respectively) than urban (forty-eight and sixty-seven). In Lima the infant mortality rate was thirty and the childhood rate forty per 1000 live births. For the Nor Oriental region these rates were sixty-one and eighty-nine, respectively.

The prevalence of infectious diseases in the country is high. The above-mentioned survey indicated that the prevalence of respiratory infection in children under five years of age was 23.4% during the two weeks prior to the survey, and that in the Nor Oriental region, 26.1% (ENDES, 1992). Similarly the prevalence of diarrheal disease was 18.4%; that of the Nor Oriental region, 16.5%. Diarrhea is generally more prevalent in urban than in rural areas.

The major nutritional problem in the country is growth retardation or stunting, occurring primarily during the first two years of life. Table 7.1

TABLE 7.1

Prevalence of Malnutrition by Anthropometric Indicators

Percentage of Children Under 5 Years of Age More than 2SD Below the NCHS Median, (ENDES 1992)

	Height-for-Age	Weight-for-Height	Weight-for-Age
National	36.5	1.4	10.8
Nor Oriental Region	43.7	2.6	13.4

shows anthropometric indicators and that the nutritional status of the population of the Nor Oriental region is inferior to the national average.

Vitamin A Situation

In Peru the situation with respect to vitamin A deficiency is not clear, but specific, localized studies indicate a public health problem in certain areas. Serum levels of retinol were measured in Piura (northern coast) where 37.8% of children under six years had levels below 20 $\mu\text{g}/\text{dL}$ (Del Aguila et al., 1991). In a study of the urban population in the southern highlands, 24% of children under four years old had serum retinol levels below 20 $\mu\text{g}/\text{dL}$ and 1.4% below 10 $\mu\text{g}/\text{dL}$ (Anon. 1993). Similar results were found in Lima shanty towns and other coastal towns. Clinical manifestations (Bitot's spots, corneal scarring) have been reported infrequently: in Piura the prevalence of corneal scarring was 0.4% (Del Aguila et al., 1991). Other clinical manifestations including nutritional blindness have not been described.

Dietary surveys revealed vitamin A intakes well below recommended levels in several areas of the country. Household surveys conducted between 1963 and 1971 documented intakes between 20% and 86% of recommended values in different populations of the highlands and northern coast (Collazos Chiriboga et al., 1985), whereas in Lima shanty towns mean intakes covered recommended values, although some age groups consumed inadequate amounts. A study of children two to eighteen years old in Lima shanty towns, conducted between 1972 and 1974, reported a mean intake of 76% of requirements (Creed and Graham, 1980). The consumption of β -carotene was related to the achieved height of the children (Graham et al., 1981).

A two-day individually weighed dietary intake study, conducted in 1991 in a representative sample of Cajamarca cities including San Vicente, showed that mean intakes were 40% to 50% of recommended values (López de Romaña et al., 1991). In comparison a study in Lima showed mean intakes of 95% of recommended levels. The principal sources of vitamin A in urban Cajamarca were carrots (25% of vitamin A) and green vegetables and herbs (21%), followed by milk (13%). Other food groups that contributed to vitamin A intakes were legumes (10%), fruit (7%), and eggs (7%). For children zero to six months of age an estimated 65% of the vitamin A consumed was provided by breastmilk thus permitting higher intakes; in the age group six to thirty-six months breastmilk contributed approximately 20%. The effects of seasonality were not evaluated in any of these studies.

Methodology

In each community natural food sources of vitamin A were assessed using the guidelines for ethnographic studies. Interviews were conducted with eight key-informants, selected in each community during the first visits to the village, and were recommended by community authorities, community leaders, health workers, and market vendors.

Structured interviews and the application of the modules were undertaken with a randomly selected sample of mother-respondents during several visits. To select the sample in Chamis the area was divided into three clusters. Houses that were more than a forty-five minute walk from the center of Chamis were excluded (about 20%). In each cluster an initial house was selected randomly and if the family met the required criteria and was willing to participate, an interview was conducted. As the houses were considerably dispersed in Chamis, each successive one toward the right was visited and included in the sample if the criteria were met and the mother was at home. The criteria for Chamis were at least one child between six months and six years of age, no close family link with another respondent (e.g., sister), and willing to participate. Twenty-six mothers were interviewed and completed most of the modules.

San Vicente was divided into three clusters of six blocks each. In each cluster an initial house was selected randomly and if the family met the criteria and was willing to participate, an interview was conducted. Subsequently each fourth house was approached for inclusion in the sample. If the criteria were not met, the next house was approached. The criteria for San Vicente were at least one child between six months and six years of age, come from an area ecologically similar to Chamis, (i.e., not from a fertile, fruit-producing valley), live in San Vicente (not a visitor), and willing to participate. The sample included women who participated in community kitchen programs as well as those who did not, and women of different religious beliefs. Twenty-seven mothers were interviewed in San Vicente.

In both Chamis and San Vicente the information obtained from the interviews was complemented with continual observations during the two-month study period. The evaluation took place during the months of October and November, 1993.

All plants mentioned or observed during the study were identified with the aid of local documentation and specialists of the Botany department of the National University of Cajamarca (Sanchez Vega and Briones Rojas, 1992; Sanchez Vega and Tapio Nuñez, 1992).

Chamis

Ecology

The comunidad campesina of Chamis is situated on the sides of the valley of the river Manzanas, on the western slopes of the eroded hillsides that surround the city of Cajamarca. The area is situated between 2,850 and 3,750 meters above sea level (mas). Within this zone there are three agro-ecological levels: the zone of maize or Ladera baja (2,850–3,150 mas), the zone of tubers and cereals or Ladera alta (3,150–3,600 mas), and that of natural pastures of the Jalca (3,600–3,750 mas) (Kholer and Tillmann, 1988). Each of these ecological levels have distinct climatic characteristics. In the Ladera alta and Ladera baja, the climate is temperate with temperatures higher than 8°C whereas the Jalca is colder, experiencing temperatures below 8°C.

The soil is exposed to constant water erosion, provoked by strong, irregular rains, and exacerbated by the reduction in the natural vegetation. Previous landowners showed little interest in protecting the land from erosion and as a consequence it is not very fertile.

The area consists of eighteen settlements and three comunidades campesinas of which Chamis is the largest. The center of Chamis is nine kilometers from the city; it covers each of these ecological areas although the major part of the population lives in the two lower zones. There is only one dirt road passable to motor vehicles leading to the communal center of Chamis, from here access to the widely dispersed houses is by foot. There is no public transport to Chamis; it takes one hour on foot to reach Cajamarca.

Population

The total population of the comunidad campesina of Chamis is 612 (48.5% male, 51.5% female) distributed among 131 families living in 112 houses, an average of 5.46 people per household (Anon. 1993).

The principal activity is farming. Eighty percent of the husbands of the mothers interviewed were agricultural workers. The size of the lands owned by the families varies between 0.1 and 6 hectares. In addition the population of Chamis has collectively-owned land in the Jalca and Ladera alta.

Most of the produce is grown for the family's own consumption; a certain amount is stored for seed. Produce is also used for the payment of services, such as to the owner of land that is worked by tenant farmers and for the work by neighbors who help with sowing and harvesting (*mingas*). Some produce is interchanged and some is sold in the market,

the latter estimated to be 4% of the production (Sanchez Vega and Tapio Nuñez, 1992).

The amount of money available for expenditure on goods ranged on average between \$2 and \$14 US per week. This varied between families and time of year.

Education

A relatively high proportion of the population has had no formal schooling and does not read or write. Fifty-five percent of females and 26% of males over five years of age, have had no formal education (Anon; 1993). These levels are higher than those for the total rural population of the department of Cajamarca, 37% and 17%, respectively.

At the time of the study there was a primary school in Chamis with a capacity for sixty pupils and two teachers. In Peru the official age for starting school is six years, however, a number of children do not attend or attend irregularly depending on the need for work in the house or fields. Those who attend secondary school walk the nine kilometers to Cajamarca and back each day.

Housing

Typically parents, children, and grandchildren live together in a group of two to three rooms, including a separate kitchen, built around a central patio. Each house has a corral nearby for the animals and small constructions for storing grains and tubers.

Water is a scarce commodity. At the time of the study, a dam was being built that should improve the water supply considerably. Water for domestic use comes from springs that are channeled to family's taps, or from the irrigation channels, in which case it may be stored in wells constructed for this purpose.

Health services

There is one health post in Chamis, situated in the community center that has functioned since 1988, and is under the jurisdiction of the health post *Atahualpa* in the city of Cajamarca. A voluntary health auxiliary from Cajamarca attends once a week. She coordinates with the local health promoter of Chamis. The service offered is principally preventive rather than curative, and includes care of the newborn, growth monitoring, immunizations, family planning, pre- and post-natal controls, and treatment or referral of clinical cases.

There are two types of local healers in Chamis. One is an empirical healer who exclusively fixes bone fractures or dislocations (*huesero*), generally using animal fats in the treatment. However, the health resource most used is the traditional healer (*medico de campo*), who is generally recognized by the community as having the capacity to eradicate illness, thanks to a special quality given by God. His main function is to determine the cause of the problem and recommend the appropriate treatment, whether it be cleaning with herbs or compresses of traditional medicine, or the use of pharmacological products. If the illness is due to something he recognizes he is unable to cure, he recommends the health promoter, medical post, or hospital, accordingly.

An empiric midwife attends complicated births. The people commented that she does not have much work as most of the births are normal and are attended by the female relatives of the woman giving birth, usually her own mother. She sometimes "positions the baby correctly" toward the end of pregnancy.

The most common health problems mentioned by the mothers were respiratory infections, colds, coughs, and fever (76%), digestive disorders, such as stomachache and diarrhea, or *empacho* (16%), and the effects of heat from the sun (16%). Measles occur, although there are immunization programs organized through the health center in Cajamarca; intestinal parasites and skin afflictions were also mentioned.

Social organization

The community authorities are the Mayor, Lieutenant Governor (*Teniente Gobernador*), and President of the Peasant Patrols responsible for the physical protection of the community.

There are two community kitchens supported by different nongovernmental (NGO) or governmental organizations and used by different groups of people. In addition, there is a municipal milk distribution program for children and pregnant and lactating women, a school breakfast program, a mother's club, and a literacy program of the Ministry of Education; all of these distribute donated food. A United Nations NGO has been working with the community in recent years in agricultural development.

Religion

Although the majority of the population of Peru is Catholic, there has been a strong influence of the Evangelical denominations in Cajamarca. In Chamis, the women reported that half the population belong to Evangelical denominations, and 35% of the mothers interviewed were practic-

ing members. This may influence feeding patterns with respect to some vitamin A-rich foods as they do not eat animal blood, readily available in the market, nor guinea pig meat, commonly consumed in the highlands.

San Vicente

San Vicente, a periurban suburb or *barrio*, is situated on one of the steep slopes surrounding the center of Cajamarca. It was created in 1976 when it was legally designated as belonging to a group of peasants. Originally it consisted of 153 hectares, principally for agriculture. The land was divided into plots for each of the peasant families during the Agrarian reform of 1970. With these divisions people began to move into the lower parts to build houses, but the peasants maintained that San Vicente was essentially agricultural land. In 1973 the University evaluated the land for its agricultural potential, finding it to be extremely poor. Consequently, it was designated for urban development. San Vicente is currently estimated to cover an area of thirty-three hectares.

There is a frequent small bus service between the lower part of San Vicente and the central market of the city. Otherwise, it takes twenty minutes by foot.

The population of San Vicente

The present inhabitants of San Vicente were either born in Cajamarca or migrated from other parts of the department, including the higher pasture areas and the warmer valleys, as well as from the coast. Of those who migrated, the majority (or their parents) came to find work in the city. Half of the population has lived in San Vicente for more than ten years. At the present time the population of San Vicente is estimated to be 4,000 inhabitants.

Although a precise description of the inhabitants of San Vicente is not available, interviews with the sample of twenty-seven mothers indicated that the most men (80% of those interviewed) are construction laborers. The majority of women interviewed were housewives, although some also sold food in the market or as street vendors, and others did laundry.

The average amount of money available for purchasing goods ranged between \$20 and \$35 per week; 60% is spent on food (López de Romaña et al., 1991).

Education

The level of education is higher in the urban population. There is no specific data for San Vicente, however, illiteracy rates of the urban popu-

lation of the department of Cajamarca are 5.9% for men and 36.8% for women (Censos Nacionales, 1993).

There is no school in San Vicente; children attend schools in adjacent suburbs of Cajamarca. Attendance at school for children over six years of age is almost universal.

Housing

The houses are constructed of adobe and situated on the steep hillside. Many have small home gardens and areas for small animals. The water supply and sewage has recently been installed, although connections to each house are still incomplete.

Health services

Healthcare is under the jurisdiction of a health post in the adjacent shanty town. Many go directly to the city hospital where they report the attention is better. There is no community health promoter in San Vicente. The people also seek the services of the local traditional healer and empiric midwives.

All mothers reported that children suffer from respiratory disease and half noted diarrheal and intestinal diseases—higher levels than in Chamis. These are the illnesses that were reported most frequently and are of major concern to the mother.

Social organization

The authorities in San Vicente are the Mayor, the Lieutenant Governor (Teniente Gobernador), and the President of the Committee of Self-defense and Development, equivalent to the President of the Peasant Patrols in a rural community.

There is a communal center, supported by the local parish, where a mothers' club functions. There are two community kitchens, as well as municipal milk distribution programs for children, and pregnant and lactating women.

Religion

In San Vicente, 15% of the mothers interviewed belonged to Evangelical denominations.

Food Sources of Vitamin A

Foods Available

Through interviews and observations all foods available during the year were listed for each of the study populations. Thus a total of 103 foods were listed for Chamis and 169 for San Vicente, the latter having access to a wider variety of foods through the city market and greater economic resources. This list included thirty-seven vitamin A-containing foods for Chamis and forty-six for San Vicente.

Key foods were selected for further exploration on the basis of frequency, use, and potential as sources of vitamin A. Thirty-one foods were selected for Chamis and twenty-nine for San Vicente as listed in Table 7.2. In each case, nineteen potential vitamin A-containing foods were selected, both animal and vegetable sources: those currently in the diet as well as those less frequently used. Local staple foods were included in the list of key foods as were the more common protein and fat sources. Thus the list of key foods represented around 90% of the usual diet for each of the populations.

The principal difference in the key foods between these two populations is that Chamis depends primarily on home-produced and inexpensive foods, such as locally grown and processed grains, compared with the greater use of more refined products, such as rice, sugar, and pasta in San Vicente, where there is also a wider variety of animal products available. In Chamis cheaper, alternative sources of fat are used. Imported vegetables, such as Swiss chard or squash are used in San Vicente, whereas more wild-growing green leaves and herbs are used in Chamis. The flavoring agents and herbal infusions are similar for both communities.

Chamis

Locally produced food

More than 75% of the foods consumed in Chamis are grown locally and most are used for the family's own consumption (Rebaza Campos, 1993). The thirty-one key foods were referred to as locally produced 59% of the times they were mentioned. The study was conducted at a time of low availability; food stores were depleted and there would be no harvest for a number of weeks. The population was therefore more dependent on purchased food than at other times of the year.

TABLE 7.2

Selected Key Foods for Chamis and San Vicente

	Chamis		San Vicente	
		Latin name		Latin name
Staples	Barley	<i>Hordeum vulgare</i>	Barley flour	<i>Hordeum vulgare</i>
	Wheat	<i>Triticum aestivum L.</i>	Pasta	<i>Triticum aestivum L.</i>
	Maize	<i>Zea maiz L.</i>	Maize flour	<i>Zea maiz L.</i>
	Potato	<i>Solanum tuberosum L.</i>	Potato	<i>Solanum tuberosum L.</i>
	Oca	<i>Oxalis tuberosa Molina</i>	Oca	<i>Oxalis tuberosa Molina.</i>
	Quinoa	<i>Chenopodium quinoa Willd.</i>	Rice	<i>Oryza Sativa L.</i>
		Sugar	<i>Saccharum officinarum L.</i>	
Vegetable Protein Source	Dried peas	<i>Pisum sativum L.</i>	Lentils	<i>Lens culinaris Medik</i>
Animal Products	Breastmilk	<i>Homo sapiens</i>	Breastmilk	<i>Homo sapiens</i>
	Egg	<i>Gallus domesticus</i>	Cow's milk	
	Hen's meat	<i>Gallus domesticus</i>	Egg	<i>Gallus domesticus</i>
	Salted fish		Chicken's offal	<i>Gallus domesticus</i>
		Fresh fish (jurel)	<i>Trachurus Murphi</i>	
		Sheep's blood	<i>Ovis aries</i>	
Fats	Oil	<i>Various</i>	Oil	<i>Various</i>
	Sheep's fat	<i>Ovis aries</i>		
	Linseed	<i>Linum usitatissimum L.</i>		
Fruits	Mango	<i>Mangifera indica</i>	Mango	<i>Mangifera indica</i>
	Orange	<i>Citrus sinensis</i>	Papaya	<i>Carica papaya</i>
Vegetables	Carrot	<i>Daucus carota var. sativa DC</i>	Carrot	<i>Daucus carota var. sativa DC</i>
	Sweet potato	<i>Ipomaea batatas Lam.</i>	Sweet potato	<i>Ipomaea batatas Lam.</i>
	Algae	<i>Amaranthus chlorostachys W.</i>	Squash	<i>Cucurbita maxima Duchesne</i>
	Quinoa leaves	<i>Chenopodium quinoa Willd.</i>	Quinoa leaves	<i>Chenopodium quinoa Willd.</i>
	Amaranth leaves	<i>Amaranthus chlorostachys Willd.</i>	Atago leaves	<i>Amaranthus hibridus</i>
	Chiclayo	<i>Cucurbita fisifolia</i>	Swiss chard	<i>Beta vulgaris L.</i>
Herbs	Cilantro	<i>Coriandrum sativum L.</i>	Cilantro	<i>Coriandrum sativum L.</i>
	Rue	<i>Ruta chalepeusis L.</i>	Rue	<i>Ruta chalepeusis L.</i>
	Parsley	<i>Petroselinum sativum L.</i>	Parsley	<i>Petroselinum sativum L.</i>
	Dill	<i>Tagetes eliptica DC</i>	Paico	<i>Chenopodium ambrosioides L.</i>
	Huacatay	<i>Tagetes minuta L.</i>		
Wild Herbs	Chamcua	<i>Minthostachis mollis Griseb</i>		
Wild Flower	Nyapush	<i>Brassica rapa L.</i>		
Flavoring	Dried hot pepper	<i>Capsicum frutescens L.</i>	Dried hot pepper	<i>Capsicum frutescens L.</i>
	Camomile	<i>Matricaria recutita</i>	Camomile	<i>Matricaria recutita</i>

Cultivated fields

Most of the staple foods are grown by the families in fields near their homes or on land higher up in the Jalca. These include limited vitamin A sources, such as peas, broad beans, and yellow maize.

Animal products

Locally produced animal sources of vitamin A are primarily hen's eggs and to a lesser extent, chicken. Seventy-eight percent of the mothers own hens that are used principally for egg production. They are consumed almost entirely by the family, although they are occasionally sold to purchase other foods. One egg is added regularly to the soup when the hens are laying. Eggs are never purchased from the market. Meat is usually consumed only on special occasions.

Breastmilk, consumed by all children, was described as being "from ourselves." Cow's milk is consumed by a minority of the families (30%), half of whom obtain it from their own cows. However, for economic reasons, most of the milk is sold to the large companies in Cajamarca or to neighbors. Sometimes curds are made from the milk or obtained from the Jalca. Those families who consume milk usually distribute it among the children, but it is consumed irregularly.

Some families raise pigs, guinea pigs, rabbits, turkeys, and ducks. However, the meat from these animals is consumed infrequently and the animals are usually sold.

Home gardens

In Chamis 52% reported that they have home gardens adjacent to their houses. These were promoted by agricultural institutions in recent years. However, 40% of the mothers do not have them and some gardens were extremely small and unproductive, due both to a lack of water and seeds. The time of the study was poor for the home gardens, and production that year was poor in general.

Spring onions are grown by all of the respondents, and oregano by most. Mint, cilantro, and carrots were grown in 40% of the gardens, as well as a variety of other herbs and vegetables, including some plants used for medicinal purposes. Some other vegetables grown occasionally include cabbage, beetroot, cauliflower, yacon, lettuce, and radish. Most of these were introduced to the community in recent years and their use is limited. An example of this is the dark green, leafy vegetable, Swiss chard, that the women did not know how to use and gave to their animals. Only

four of the key foods were mentioned as grown in the gardens by more than one respondent.

Most families use the plants they grow for their own consumption (82%), the rest are sold. Families grow different varieties of herbs so there is frequent interchange among neighbors.

Leafy green vegetables among the staple crops

The leafy green vegetables grown among the staple crops are mainly quinoa and amaranth leaves. Ulluco leaves are picked and eaten by the children, usually raw, however, this is an infrequent practice. The orange turnip flower is occasionally cooked with potato, as are amaranth leaves. Sometimes the stalks of oca are picked and sucked by the children. The leaves of the garlic plant are used for seasoning, particularly for soup.

Foods gathered from the wild

Among the plants gathered from the wild, chamcua (*Minthostachis mollis* Griseb.) was mentioned most often; 50% of the respondents reported collecting it. This is used principally in green soup, consumed universally when in season. Other potential vitamin A sources are the leaves and yellow flower of ñapush (*Brassica rapa* L.) mentioned by 15% of the mothers, and amaranth leaves (11%). However, these are eaten infrequently and are considered poor man's food. A number of other herbs mentioned by a few people are used in infusions for medicinal purposes. Certain fruits are picked from the wild when in season, including mulberry and cape gooseberry.

Foods from the market

The nearest market is in the city of Cajamarca. It has a wide variety of foods and is open every day. Food, brought twice a week from the coast and jungle, as well as from the Jalca and the environs of Cajamarca, is sold in the market. Most people in Chamis go to the market on Mondays, for the animal market. Thirty-two percent of the respondents reported going to the market once or twice a week, 56% once a fortnight, and 12% once a month.

The market is the major source of purchased food; 32% mentioned purchasing thirty-one key foods that include vegetable oil and fat, garlic, salt, tomato, and sugar. Most carrots and condiments, including hot peppers, are also purchased at the market. Other vitamin A-rich foods, such as herbs used in soups, are usually homegrown but are bought when out of season.

Certain vitamin A-rich foods are only acquired from the market. These include yellow sweet potato, mango, oranges, fish, algae, and occasionally papaya, none of which are produced in Cajamarca. Fish, usually dried and salted, is consumed more often than other animal products, except eggs. Sweet potato, although one of the cheapest foods in the market, is considered expensive by the population of Chamis.

A number of foods are bought depending on the amount of money available (*cuanto hay*). This can influence the quantity and frequency of certain foods, such as carrot or hot pepper, the type of food selected, such as cooking oil or the cheaper mutton fat, or whether certain foods considered as extras are bought at all, such as pasta, rice, sweet potato, fruit, or fish.

Food distribution programs

Food donated through food programs represents 3% of the sources of the key foods. Most of the foods donated can also be obtained from other sources. Of the twenty-six respondents, 80% participated in one or more food programs. This is fairly typical of the population in different parts of Peru at the present time.

In Chamis 25% of the respondents participated in a breakfast program that has been operating for more than ten years and receives food through the Catholic Church. The donated foods are principally staples and vegetable oil and do not include vitamin A-rich foods. They are prepared in soup, complemented with foods brought by the mothers. There is a lunch program that receives food from the government and that prepares the main meal twice a week. Food is also distributed through the literacy program. Similarly, the donated foods are not sources of vitamin A.

The program in which most mothers (32%) participated is the municipal milk distribution program for children, six months to thirteen years, and pregnant and lactating women. Mothers were given oats and sugar monthly for each child; at the time of the study no milk was distributed, although this was given periodically. Seven percent of mothers reported that their children participated in a recently implemented school breakfast program: a nutritious, fortified drink (with vitamins and minerals) and biscuits were given daily to the pupils of the primary school of Chamis. Maize flour soup was also given at midday.

Other sources

The acquisition of food through interchange of produce was mentioned as a relatively insignificant practice. Perhaps this was due to the time of

year, or because it is done informally, as neighbors share herbs or other produce spontaneously when available or necessary.

The exchange of food for work among neighbors is important at certain times of the year, although this also does not amount to much in terms of total food, nor does it involve vitamin A sources, except for algae that is customary to include in the meals cooked for the workers. This is most common at harvest time when the peasants help each other and payment is in produce.

Seasonality

A number of vitamin A sources are available all year. These include carrot, squash, animal products, green peas, spring onions, and hot peppers. Similarly most of the more commonly used herbs are available year round; when they are not grown in home gardens they can be obtained from neighbors or inexpensively from the market.

Nevertheless a major group of vitamin A-rich foods are seasonal for this community. Of the fruits, mango is available only during February and March. Although sweet potato is available in the market all year, it is cheaper, and therefore consumed only during the summer months, January through March. The leaves of the ulluco, quinoa, and amaranth, and the wild ñapush flower are available in February and March. When they are harvested these leaves are consumed several times a week, but only young leaves are eaten and the season is short, two to four weeks for quinoa leaves.

A local delicacy is green soup (*caldo verde*), prepared with a mixture of green herbs, potato, and sometimes egg. In this form, larger quantities of these herbs are consumed than are normally added to soups, including the wild herb chamcua. This is a popular dish and is prepared early in the morning. Half of the mothers reported consuming green soup two or three times a week during the rainy season, when the ingredients are available. Even when the ingredients need to be bought, 44% prepare it once or twice a month, as the herbs are not expensive and the combination used is flexible according to availability.

San Vicente

Food purchased

Most foods consumed by the population of San Vicente are bought from local sources: the thirty-one key foods were referred to as purchased 75% of the times they were mentioned by the respondents. The population is

primarily dependent on the market located in the center of the city for most of their food (57% of mentions). Twenty-three percent of the mothers interviewed shop every day, 50% once or twice a week, and the remainder less frequently. The weekend is the preferred time for the market, coinciding with the arrival of fresh produce and fish from the coast.

The market is the major source of vitamin A–rich foods, in fact all the selected foods are purchased from the market, with the exception of green quinoa and amaranth leaves that are collected from the fields. Cow's milk is consumed by 81% of the families. Half of this milk comes from the municipal milk distribution program, yet 42% mentioned purchasing milk in the market or in San Vicente, and 10% is brought directly from the countryside. Fish is eaten regularly, sometimes more than once a week; it is not considered an expensive food. In general, vegetables, particularly sweet potatoes, are not considered expensive foods in contrast to Chamis. However, the purchase of most of the foods depends upon the price at any given time, except for carrot and red pepper which are used daily.

Local shops are another resource for some of the dry food items (14% of mentioned sources), although they are purchased less frequently there, as they are sold at a higher price than in the market. Some eggs, chicken offal, and carrots are purchased from local shops. Some staple foods are bought in larger quantities directly from the peasants who bring produce down from the Jalca on Mondays.

Home-produced food

In contrast to Chamis, only 19% of the key food sources mentioned are home produced. This includes 11% from the fields, 7% from home gardens, and 1% home-bred animals, mainly sheep's blood on the rare occasions when an animal is killed and eaten.

Home gardens

Thirty-seven percent of respondents had home gardens in which a variety of herbs and vegetables were grown, mainly the herbs used for green soup and for flavoring other dishes. Some people had a fruit tree in their garden, others produced small amounts of carrot or squash.

There is a some interchange of herbs between neighbors when preparing the main midday meal. A few who produce larger amounts of herbs or spring onions sell them to neighbors, although most (92%) use them for their own consumption.

Green leafy vegetables among staple crops

Some members of the community own fields on the higher slopes of the hill behind San Vicente. Among the staple crops, quinoa and amaranth leaves are used by only some in San Vicente in contrast to Chamis; they are considered an inferior food. Wild herbs such as chamcua and paico (*Chenopodium ambrosoides* L.) grow among the maize crop and are used in soups.

Foods gathered from the wild

Apart from chamcua few herbs are collected from the wild. They are mainly those prepared as infusions so are not important sources of vitamin A; others are used as flavoring in sauces. Occasionally wild fruits, such as mulberry and Indian fig, are gathered.

Food programs

As in Chamis, participation in donated food programs is high with 67% of the respondents receiving food from these sources. Forty-four percent of mothers reported participating in community kitchens and 41% in the municipal milk distribution program for children six months to thirteen years of age and pregnant and lactating women. There are no sources of vitamin A among the donated foods, with the exception of milk from the milk distribution program. At the time of the study fresh milk was distributed daily to the children through this program in the city of Cajamarca and this was an important source of vitamin A.

Other

Many inhabitants of San Vicente retain close ties with their families who live in their places of origin and send food from time to time, depending on local production. These are mainly staple foods, mentioned as 3% of the food sources.

There is a some sharing of produce between neighbors, particularly herbs and the green leaves collected from the fields.

Seasonality

Some of these potential vitamin A sources are available all year, partly due to local production but principally because much of the produce is brought to the market from the coast twice a week, and from other nearby ecological zones. These include fish, many vegetables, such as lettuce, spinach, carrot, red pepper, and some fruit.

Some vitamin A-rich foods that are purchased from the market and yet are seasonal include fruits such as mango, that is available in February and March. Sweet potato, although available all year is cheaper in the summer months, November to April, as is papaya during September and October. Locally produced green peas are available mostly in the winter, August and September. Other seasonal vitamin A sources include the green leaves of the quinoa plant, consumed only when young in February and March, and ulluco and other wild leaves available in April and May.

Most of the herbs used to flavor main dishes are available all year round and when they grown in the home gardens are purchased inexpensively from the market. Green soup is consumed regularly, particularly during the rainy season when it is eaten two to three times a week; during the rest of the year half of the mother-respondents reported preparing it once or twice a month.

Principal Differences Between Chamis and San Vicente

The major difference in the source of food between San Vicente and Chamis is that the vitamin A-rich foods are purchased primarily from the market by the urban population of San Vicente, where economic resources and fluctuations in prices influence the selection and amounts of food bought. The rural population of Chamis is dependent primarily on home production, thus consumption is determined by availability. It is markedly affected by seasonality for many foods that are available at the same time during the summer months, including major vitamin A sources that are purchased. Whether these seasonal patterns of consumption permit sufficiently high levels of intake and storage in the body to protect during the leaner times remains to be determined. The vitamin A intake of the population of San Vicente is less affected by seasonality, as a wide variety of food is available in the market all year.

Family and Individual Food Patterns

Chamis

In Chamis the day starts with the main meal, termed dinner (*almuerzo*), consumed between 5 a.m. and 8 a.m., depending on the season and type of agricultural work to be done. This meal consists primarily of a cereal-based soup, generally maize or wheat, usually with potato. It is accompanied by dry roasted barley or maize flour, or cooked wheat, maize grain, or boiled tubers, such as potato or oca if in season. An herbal tea is usually consumed with this meal.

The midday meal is light in comparison with the morning meal and usually consists of cereal-based soups. Less frequently rice with a stew of peas, beans, or lentils is prepared; this is considered "dry" food. Again, dry flours or boiled tubers may be served with the soup. The evening snack, generally soup, is consumed around 5 p.m. to 6 p.m. Toasted flours or boiled cereal grains may be served.

At mealtimes the wife serves her husband and other menfolk first. Each person has his or her own plate, the size of which depends on age. The flours are placed in a central bowl from which each person helps himself. This also applies to the green, mixed herbal component of the green soup, so that the amount consumed depends on the taste of each person; small children are served little of this herbal preparation.

Half of the families consumed snacks between meals, children more frequently than adults. Snacks are usually dry, toasted flours with sugar (*machica*) although they are not given to children under one year for fear that they will choke. Sometimes children eat leftovers and in the summer, fruit or sweet potato.

San Vicente

The majority of the urban population of San Vicente start the day between 6 a.m. and 7 a.m. with breakfast, usually consisting of coffee made from toasted barley grain, tea, herbal infusion, or an oat-based drink eaten with bread. About one-third of families prefer and maintain the rural custom of soup with toasted cereal or cereal flours; this breakfast menu is cheaper than bread.

The main midday meal, (*almuerzo*), consists of a soup, mostly cereal, but sometimes vegetable-based, and usually a second course. The latter is almost always rice and may or may not be accompanied by a stew of beans, lentils, or fish. Half of the population prepare salad (onion with tomato, hot pepper, or lettuce) instead of beans to accompany the rice when economic resources are limited.

The light evening meal, consumed around 6 p.m., usually consists of soup with an herbal tea or barley coffee; one-third of the population consumes bread or leftovers from the midday meal. Members of the family eat together, with the husband and menfolk served first. Each person is served individually.

Seventy-eight percent of mothers reported offering snacks between meals, mostly for the children. Half the families mentioned fruit; toasted flour with sugar (*machica*), toasted or boiled maize, and bread are other snacks mentioned.

Feeding Patterns by Age and Gender

Chamis

Infant feeding patterns

All mothers breastfeed their infants. Breastfeeding is initiated when the infant begins to cry and wants to suck, and this varies with the child. This can be two hours after birth or up to two to three days if the child sleeps constantly. This illustrates that infant feeding is child-driven in this population; the initiative of giving the breast, or other food later on, is in response to the perceived demands of the child.

Most mothers (92%) reported that breastmilk is the first item given to the infant after birth. In general, colostrum is given by 88.5% of mothers, although some commented that the first milk is extracted as it is thick and yellow and could sit in the stomach and cause digestive problems (*empacho*). However, only 11.5% reported not giving colostrum.

The reasons for giving breastmilk are actively positive: so that the child grows and is strong (44% of mothers), or passive: that “this is the custom,” “there is nothing else to give,” “no money to buy anything else,” “so the child doesn’t die,” or “because the child cries” (44%). In fact, breastmilk is frequently not considered a food; it is natural, an extension of the mother’s body, and is given on demand frequently during the day.

Infants are mostly exclusively breastfed up to four to six months of age when herbal infusions are introduced by the majority of mothers (42%). Twenty-seven percent reported giving infusions earlier, between one and three months, and 19% not until after seven months (see Table 7.3). In general, the preferred infusions are those classed as “warm” (*caliente*) to protect the infant from the cold, stomachache or *empacho*, usually camomile, salvia (*Salvia oppositiflora* R. & P.) and/or boiled water. These are mostly given with a spoon or cup; 30% of mothers reported using a feeding bottle.

The introduction of complementary foods does not usually begin until after the child is six months of age; this is typical of the rural populations of the highlands (see Table 7.3). Mothers start giving foods when they perceive the child has developed hunger, indicated by the child opening his/her mouth, stretching his hand toward the food, or accepting food that is offered. Frequent crying could be an indication that the child is not satisfied by the mother’s milk and can be a reason for introducing other foods.

No special foods are prepared for children, they eat from the family pot with the rest of the family. The broth or juice of the soups is selected

TABLE 7.3

Infant Feeding Patterns in Chamis and San Vicente

	Mother-Respondents (%)	
	Chamis	San Vicente
<i>Feeding practice 0-4 months</i>		
Breastmilk	100	100
Infusions	27	81
Cow's milk	8	52
<i>Age received first solid food</i>		
Before 6 months	11	48
6-8 months	77	48
After 8 months	12	4
<i>Age breastfeeding terminated</i>		
0-12 months	0	48
13-18 months	8	19
19-24 months	38	29
After 24 months	54	4

for children from about six months; 77% of mothers started with soups between six and eight months. The solid ingredients of the soups (rice, maize, maize flour) are considered too strong for infants at those ages. Solid food is usually not introduced until eight months of age, sometimes after one year; the mother considers that the child might choke if it is given earlier, and the timing coincides with development of teeth. The foods given at this age are selected according to what the child likes. The first solid foods are mashed maize, potato, oca, or ulluco in the soup.

Few vitamin A-rich complementary foods are given to the child during the first year. Sweet potato is considered appropriate to give between six and eight months of age by half the population, although in practice it is given infrequently. Half of the mothers give the child small quantities of egg starting at this age, and half believe that egg can prevent the child from talking, and so do not give it until around eighteen months. One-third of mothers include carrot in the soup at six to eight months, although 46% reported that they did not give this until the child was one year old. Other vitamin A-containing foods are not given until the child is one to two years old. These include green leafy vegetables (which could cause empacho if given earlier), green soup (the herbs are considered "hot" in the humoral system), and fish (because of the bones).

The incorporation of the child into the typical family diet is delayed; 11% percent reported that children eat the same as the rest of the family starting between one-and-a-half to two years, 54% from two to two-and-

a-half years. It is recognized by some, however, that children between one and two years need to eat more frequently than other members of the family and if not, they have not learned to eat enough and are in danger of becoming malnourished.

Continued breastfeeding is the norm in this population: more than half of the mothers reported breastfeeding into the third year of a child's life (see Table 7.3). There is a belief that if the child is weaned before two years of age he or she will become malnourished and be unprotected against illness. If breastfeeding goes on too long, however, the child will become perverse as he or she is sucking blood, not milk. Mothers stop breastfeeding when they become bothered by the continual feeding or pregnant again. Those who continued to breastfeed into the third year commented that the child does not want to be weaned.

Children between two and six years old eat with the rest of the family, although they are given smaller portions depending on age. Older children may be served two or three plates of food at a meal. However, certain preferences are given to children in this age group: mango, oranges, and sweet potato are often bought with children in mind because they are sweet and they like them.

A young child is not encouraged to eat, the initiative must come from the child. If the child does not accept offered food it is perceived that he or she does not need it. Those who cry or demand more eat more. There are no apparent gender differences in feeding children in these age groups.

Some mothers (38%) reported their children do not eat when ill, due to a lack of appetite; others give soups or the liquid parts of the food preparations (27%). However, certain foods are considered good during illness, including potato (15%), mutton (15%), legumes (12%), and rice (12%). Foods considered "hot" or "fresh" in the humoral system may not be given depending on the illness.

Pregnant and lactating women

In general there is little recognition that nutritional needs are greater during pregnancy, although certain foods are considered good for the optimum growth of the baby. In practice women generally do not modify their diet except for those foods they associate with not feeling well or nausea.

Mothers reported that lactating women modify their diet, particularly during the first days postpartum. Certain foods that could adversely affect the infant through the milk may be avoided, but in general the mothers eat "what there is," similar to the rest of the family. The consumption of vitamin A-rich foods is the same as other members of the family.

San Vicente

Infant feeding patterns

All the mother-respondents in the urban barrio of San Vicente breastfeed their children (Table 7.3). Breastmilk is considered good and nutritious and is given on demand. The majority of mothers reported giving colostrum to their infants (84%); it is generally considered good for the child, and two mothers commented that it helps to eliminate the meconium. Nevertheless 16% said they do not give colostrum as it can cause empacho. However, 50% reported giving an herbal infusion to their infants as the first item after birth, to avoid flatulence and colic or to clean the stomach.

Exclusive breastfeeding during the first months is rare in this population. Infusions are introduced at an early age as shown in Table 7.3. Eighty-two percent of mothers give infusions within the first three months, mainly aniseed water, primarily to cure and prevent colic (52%), or clean the stomach or prevent constipation (44%).

In addition to infusions, half of the population gives nonhuman milk to children during the first few months, 50% of these from the first month, as the mothers consider their milk insufficient and that fresh cow's milk (the most commonly given) satisfies their child's hunger. In San Vicente 72% of the mothers use a feeding bottle to give milk and infusions.

Complementary foods other than milk are introduced mostly between four and six months (63%), although 14% reported giving foods at three months and 22% maintained the rural practice of not introducing food until seven months or later (see Table 7.3). The main reasons for introducing foods were that the infant asks to eat, is hungry, and does not fill up with breastmilk. Purees were reported as the complementary foods given to children, although 30% also mentioned soups.

Vitamin A-rich foods are introduced progressively during the first year. Squash is given from an early age, and carrot at six months by one-third of the population, at eight months by another one-third, and at one year of age by the rest, coinciding with the development of teeth. Each of these foods are given in small quantities, mashed in soup. Eggs are given at six months by 50%, and at one year by 25%. Chicken liver is considered an appropriate food at six months of age by 60% of the mothers. Fruits, such as mango, are not introduced until one year, as is the green herbal soup since it is considered too strong for the child's stomach.

Mothers had different perceptions as to the age their children can eat the family diet: one-third mentioned one year, eighteen months, and two years, respectively.

Breastfeeding into the second year of life is less frequent than in Chamis. Half of the mothers discontinue breastfeeding by one year, the other half between eighteen and twenty-four months (see Table 7.3). Reasons mentioned for weaning are primarily related to the child eating other foods: either that the child is eating foods and breastmilk is no longer necessary or he or she will not eat other foods and weaning is necessary to encourage the child to eat. Twenty-six percent continue breastfeeding because the child does not want to wean.

Children from two to six years eat the same food as the rest of the family, but in smaller quantities. However, they eat more snacks than other family members. This community has access to the municipal milk program for children six months to thirteen years of age, thus these children receive one cup of fresh cow's milk a day. Some families give preference to the child when eggs or fruit are available.

Children are not encouraged to eat more; their appetites determine how much they eat. There appears to be no gender difference in serving food at this age.

Twenty-seven percent of mothers reported giving normal food to their children when they are ill, although a similar number give liquids or soft foods. Foods mentioned that are not given during illness include milk (19%) and beans (15%).

Pregnant and Lactating Women

Although women recognize that certain nutritionally good foods are necessary for a healthy baby, in practice, pregnant women usually eat everything that is normally prepared, except for foods that may make them feel ill. Women reported that they should only eat what is necessary during pregnancy to avoid a difficult birth.

All respondents agreed that there are special foods that the mother should consume during the postpartum period. However, in practice, lactating mothers eat the same as the rest of the family, perhaps drinking more liquids that are perceived as producing more milk.

Vitamin A-Rich Food Patterns

Chamis

The population of Chamis consumes a limited variety of foods. An evaluation of food frequency for one week indicated a mean of eleven of the thirty-one key foods were consumed as shown in Table 7.4. The frequency of consumption of foods varies little within families and between

TABLE 7.4

Mean Number of Key Foods Consumed per Week by Age Group

	6-11 Months	1-3 Years	4-6 Years	Women	Total Mean	%
Chamis	8	10	12	11	11	35.5
San Vicente	11	12	14	13	13	44.8

age groups, with the exception of children under one year, who consume a mean of eight of the key foods during the week, including breastmilk. Older children and women have a slightly greater variety. Mothers commented that the distribution of food within the family is fairly equal, "we eat what there is," although the amount varies according to age and the perceived needs of each member. However, the range in the variety of foods between families is great: in two families children as well as adults eat as few as four foods during the study week, and two as many as twenty-four. This limited variety was confirmed with a 24-hour recall in a subgroup of twelve families. Due to the seasonality of food availability, more foods will be consumed at other times of the year.

The amount of vitamin A-containing foods consumed also varied more between families than between age groups within a family, although the younger children have greater vitamin A intakes than other age groups due to breastmilk. Other vitamin A sources are eaten in similar amounts by each family member, at least at that time of year. The vitamin A intake (excluding breastmilk) was very low for each group when estimated through food frequency and 24-hour recall, with mean values of 10% to 24% of recommended intakes. An evaluation during the season of greater availability of vitamin A-rich foods is needed to determine the levels of intake reached.

Breastmilk provides most of the vitamin A for children under three years of age. The foods providing most of the vitamin A for the other family members were principally carrots, consumed in small quantities in the soup, followed by eggs, green herbs, peas, and sweet potatoes. Families with higher intakes consume more carrots, sweet potatoes, herbs, and green leaves.

San Vicente

The number of foods consumed by the population of San Vicente is slightly higher than in Chamis, with a mean of thirteen of the twenty-nine key foods during the week of evaluation as shown in Table 7.4. Similarly the intrafamily distribution is equitable. Children six to eleven

months old have a slightly wider variety of foods than those in Chamis with a mean of eleven including breastmilk. The number of foods consumed by the different families range from nine to twenty during the week. These results were similar to those of the 24-hour recall conducted in a subgroup of twelve families. As in Chamis, the variation is greater between than within families.

The total vitamin A intake is higher than in Chamis. The major sources for the small children were breastmilk followed by cow's milk; the milk distribution program made a significant contribution. Other important sources are carrot and squash, both consumed in small quantities in soups, with egg, sweet potato, green herbs, Swiss chard, and fish contributing smaller but significant quantities. Children and adult women consume a mean of 70% of the daily requirement for vitamin A (excluding breastmilk), as estimated through a 24-hour recall.

Comparisons in Feeding Patterns Between Chamis and San Vicente

The population of San Vicente incorporates urban feeding practices while maintaining some of the practices common in rural communities, such as Chamis. With respect to breastfeeding practices, the tendency is to adopt less beneficial practices as shown in Table 7.3; moving away from exclusive breastfeeding during the first months with consequent negative effects on health and nutrition. Complementary foods are introduced prematurely in the urban population and late in the rural. The ideal age is five to six months; yet a wider variety of foods is given in San Vicente and vitamin A-rich foods are introduced earlier. Both populations need to improve the energy and nutrient densities of the complementary foods offered to children over six months of age, as well as to increase the frequency of feeding.

The higher vitamin A intake observed in San Vicente, compared with Chamis, is due principally to the consumption of more carrots and milk. Carrots are eaten mostly in soups. It appears that the regular use of carrots contributes more to the total vitamin A intake than the less frequent consumption of larger portions of other sources, such as sweet potato.

Milk is an important source of vitamin A in San Vicente. Eighty percent of respondents consume milk, 67% daily, compared with 30% in Chamis, where it is consumed irregularly. Milk is purchased by half of the mothers in San Vicente, and half obtain it from the municipal milk distribution program, whereas milk does not reach the rural community, probably due to the difficulties of distribution.

Clinical Deficiency of Vitamin A

No clinical deficiencies of vitamin A were observed in either area, even with the low intakes observed in Chamis at this time of the year. Nevertheless when asked if they knew anyone with nightblindness, 46% of respondents in Chamis and 16% in San Vicente answered positively. In Chamis one woman related nightblindness to pregnancy and mental illness, another to childbirth, and others to the sun, eye pain, and headaches. Two children in one family were described as “not seeing in the dark.” Four people referred to older gentlemen in the community. In San Vicente one mother referred specifically to nightblindness. On further exploration there was no clear or general recognition of this condition in either population and no specific name given to describe it. However, this suggestion of nightblindness, particularly in Chamis, needs to be explored.

Cultural Beliefs

Chamis

Foods are perceived by the mothers in relation to availability, source and form of preparation, as well as to health and growth. A picture of how these foods were grouped, as analyzed by multidimensional scaling and superimposed clustering using Anthropac software, is seen in Figure 1.

Food sources and forms of preparation

Mothers grouped the key foods according to their source and regularity of use. For example, cereals and peas were grouped together as they are cultivated locally. Other foods were grouped if they were prepared or consumed together, for example, hot pepper, carrot, and lard are fried together as flavoring. Green herbs were grouped together as used in the green soup, and foods that are prepared with potato was another group. Foods that are eaten separately, such as fruit or sweet potato, is another example of how foods were grouped. The storing capacity of foods was another criteria for classification.

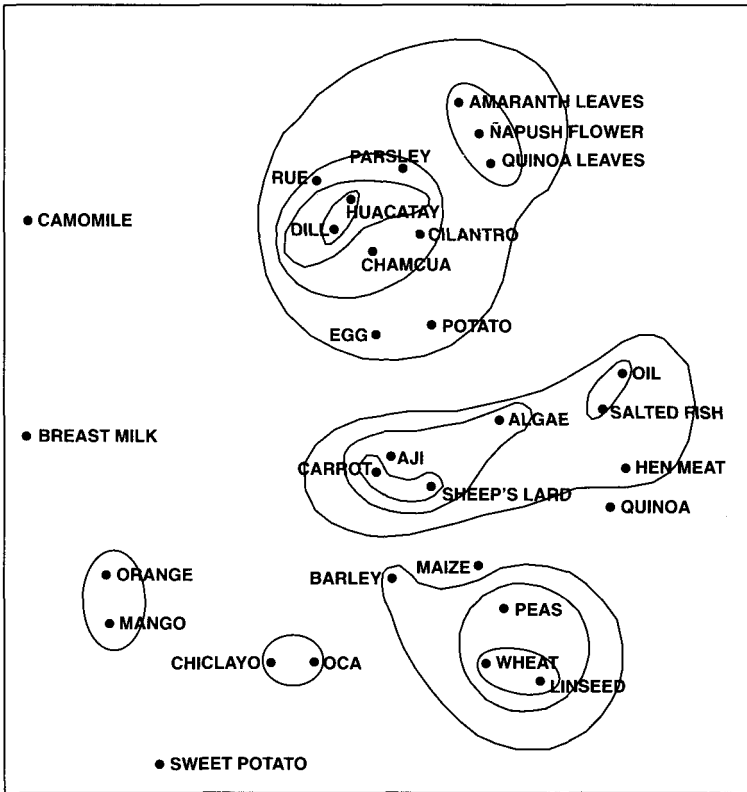
“Hot” (caliente) or “cold” (fresco)

Foods are perceived according to their attributes or properties in relation to nutrition and health. A prime classification is related to the humoral system of “hot” (*caliente*) and “cold” (*fresco*), predominant in the Andean culture. These attributes are applied to all age groups but are particularly important in certain circumstances, mainly to compensate changes in the

FIGURE 1

Chamis, Cajamarca

Pile Sort: Multidimensional Scaling of Foods



body due to external effects or illness. There are particular circumstances, such as after childbirth, when certain foods that are caliente are required and fresco can be harmful.

Herbs are caliente as are cereals processed with ash. Tubers and fruits are considered fresco unless they have been left in the sun. Foods such as sweet potato and carrot are fairly neutral. However, these states are not static and much depends upon their use and circumstances.

Foods to give strength

The ability to “give strength” and “combat weakness” is an important attribute of food. This is particularly relevant for growing children and mothers after childbirth, although they can be applied to all ages and

both sexes. Wheat, peas, potatoes, and animal products, such as eggs, chicken, and mutton, are examples. Certain foods are classified as being good for children, to help them to grow well, be healthy, and good for thinking and for the memory. Eggs particularly, as well as wheat, quinoa, and potato, fall in this category. Among the vegetable sources of vitamin A, carrot is perceived to give strength yet green herbs and green leaves are not.

Good tasting

Good tasting is a quality appreciated by all members of the family and is one of the first mentioned in the classification of foods. Potato and animal products, including breastmilk, are considered good tasting, as well as sweet potato, rice, beans, and fruit. The wild green leaves of amaranth and flower of ñapush are among the least attractive tastes. All respondents reported that children particularly like fruit; sweet potato, potato, meats, and rice are other foods mentioned.

Cheap

The relative cost of food is important in this population with limited monetary resources and determines the selection of foods purchased. The foods that are considered cheapest are chamcua, gathered from the wild, breastmilk, green leaves collected from fields or the wayside, and herbs. Hen's meat and staple foods, when they have to be bought (as at the time of the study), are the most expensive items. Sweet potato and eggs are more expensive, and carrot, mango and, oranges the cheaper foods.

Foods not suitable for children

A number of mothers (60%) considered that certain foods are not suitable for small children; maize, wheat, or beans can harm the child since they are heavy and can cause digestive problems or impair memory. Similarly dry flours could choke a small child. Certain tubers (oca, ulluco) could cause diarrhea in some circumstances as they are fresco. The "hairy bits" of mangoes can "stick to a child's stomach" and cause diarrhea. If mango has been in the sun it becomes caliente and can cause a stomachache and diarrhea. Green soup is not given to children until they are one year old as it is considered caliente. These are widespread perceptions.

Foods for pregnancy

There is a belief that a woman may not eat during the first three months of pregnancy because the infant impedes her wanting to eat, in contrast

to when she is “empty” (not pregnant) and eats whatever she wants. Too much work or effort could cause a stomachache or diarrhea.

Certain foods, such as meats, legumes, some cereals, tubers, fruits, and vegetables are considered beneficial during pregnancy by 55% of mothers. These foods primarily protect the infant from being malnourished and the mother from weakness. Thirty percent of mothers consider that certain foods should not be eaten during pregnancy. These are primarily wheat and maize flour as they can be harmful and heavy and are a poor man’s food; certain foods that are fresco should be avoided.

Foods for the postpartum period

The most attention is placed on a women’s diet after birth. Most respondents (88%) considered certain foods were necessary during the postpartum period to help a woman regain her strength. Broth made from mutton, the sheep’s stomach (as well as the meat itself), or chicken, is necessary to replace the woman’s strength and blood lost during childbirth. These foods, together with potato, sweet potato, pasta, and rice should be given for eight days, by which time the woman will have her strength back. Foods that are fresco should not be consumed as they “cool the blood which is retained,” nor those that could irritate the stomach or the wound including fish, particularly salted fish, hot pepper, and onion. In some circumstances foods that are caliente should not be consumed as they “can give heat” or “cook the body.” In other circumstances they are considered necessary to protect the mother from illness. A balance between warm and cold is required particularly at this time.

Foods to give milk

An important attribute of foods is related to their perceived ability to stimulate milk production in lactating women. The liquid obtained from boiling sweet potato is considered particularly good for producing milk, as is mutton, and to a lesser extent herbal infusions and sweet potato itself. These liquids enable “the milk to come together;” dry foods such as boiled cereals and stews do not help milk production.

San Vicente

The mothers of San Vicente grouped foods in relation to type, how they are used and prepared, taste, and cost. Attributes are also related to perceived nutritional value with a number mentioning vitamin content.

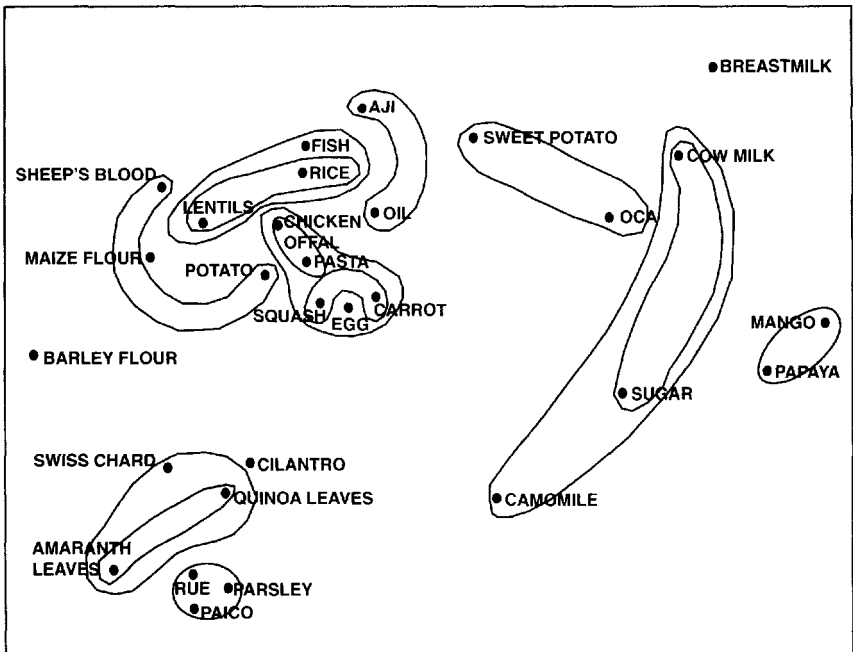
Types of foods and preparation

Foods are grouped primarily according to how they are combined or prepared. Those that are prepared and eaten together either in soups, as a main course, or fried together as flavoring are grouped together, rather than foods that can be prepared in a similar way. Thus noodles and chicken giblets are combined in soup, as are carrots, squash, and eggs. Lentils and rice are eaten together and oca and milk are prepared together as a sweet. Foods are also classified according to type: green plants are grouped together as are fruits. The diagram of the analysis using Anthropac software of the grouping through the multi-dimensional scaling and clustering for San Vicente is shown in Figure 2. It can be seen that food groups varied from those shown in Figure 1.

Nutritious

Mothers in San Vicente perceived foods according to nutritional qualities. Breastmilk and cow's milk, followed by other animal foods, particu-

FIGURE 2
San Vicente, Cajamarca
 Pile Sort: Multidimensional Scaling of Foods



larly fish are considered most nutritious. Legumes, especially lentils, and yellow vegetables such as squash and carrots are also considered to be nutritionally good. Of the staple foods potato and maize flour are considered the most nutritious.

Herbs, including those used in green soup as well as other flavoring agents, are not considered particularly nutritious; nor are sugar, oil, rice, noodles, sheep's blood, and green quinoa and amaranth leaves. In fact these green leaves are not highly valued and are eaten "because they are there," and "when we don't have other food."

Good for children and babies

Those foods considered good for children are similar to those mentioned as nutritious, with breastmilk, fish, eggs, cow's milk, and chicken's offal heading the list. Yellow foods including squash (although little used), carrots, sweet potato, and fruits, such as papaya and mango are also considered good. Sweet potato is considered filling and soft. Pasta and potato are the preferred staples in this aspect. They are considered good for children because they contain vitamins and are nutritious.

Only a few foods were mentioned as inappropriate for small children. These include legumes that are considered heavy in that the skin can cause diarrhea. Maize, particularly the toasted grain, was considered "heavy" and caused empacho.

For weakness

Foods considered good to combat or prevent weakness are those associated with vitamins. They are similar to those mentioned above, with milk, eggs, chicken's offal, and carrots mentioned the most, along with papaya and some green leafy vegetables.

Good tasting

Animal products, particularly milk and fish, are considered the most delicious foods. Pasta, potato, and legumes are the most liked staple foods, and papaya among the fruits. Herbs and sheep's blood are the foods least liked. Children are reported to like fruit more than other foods, followed by meats and legumes.

Calido or caliente (hot)

Foods are perceived in relation to the humoral system although much less defined and applied than in Chamis with wide variations in the classification. In general, the foods are classified similar to that described for

Chamis, with green herbs, such as rue, and beef examples of foods considered as calido, and eggs and papaya as those considered fresco. Other animal products and carrots are considered fairly neutral. However, these states are not static; much depends on the treatment of the different foods, particularly their processing or time left in the sun to sweeten.

Expensive

The cost of a food is an important quality that determines choice. Pasta and legumes are the key foods considered most expensive, followed by oil, eggs, potato, and sugar. Carrots, squash, and fish are intermediate in price, and herbs and leafy vegetables are among the cheapest. Sweet potato is one of the cheapest foods in San Vicente, in contrast with Chamis.

Pregnant women

Thirty percent of mother-respondents mentioned that certain foods should not be eaten during pregnancy. These included flours that can cause empacho and can be harmful to the baby; similarly, oil was mentioned in this context. Heavy foods were mentioned by some as not good during pregnancy. Women reported that they should eat only what is necessary during pregnancy to avoid a difficult birth.

However, 86% considered that some foods, such as cow's milk, fruits, vegetables, fish, eggs, and beans should be consumed, so the infant will grow well, have the necessary vitamins, and be born healthy. Drinking plenty of liquid during pregnancy is perceived as facilitating more milk after birth. Nevertheless it is probable that actual practices do not change much as they eat "what there is."

Foods for the postpartum period

As in Chamis the postpartum period is considered to be a critical time for the nutrition of the mother. During the first three to five days after giving birth a woman needs to recuperate energy and blood lost. All the women interviewed reported that mutton or chicken broth is necessary to facilitate a quick recovery; broth is perceived as "giving blood." Broths were considered nutritious and good to help her recover from the "weakness."

Seventy-three percent of the mothers commented that certain foods should not be eaten during this period. Those mentioned most were legumes, as these can cause a stomachache and gas, hot pepper, as it is fresco and can irritate, fish, since it can cause an infection and irritate the wound, as well as other foods perceived as fresco, such as orange. Dry foods and flours should not be consumed as these could limit milk production.

All mothers considered that some foods stimulate milk production, predominantly liquids such as, vegetable or meat soups. Drinks made with oats, juices, chocolate, or boiled sweet potato water are also considered beneficial.

Vitamin A and Health

Chamis

Clinical symptoms of vitamin A deficiency, as described in the manual, are not recognized in these two communities. An exploration of hypothetical case scenarios of mothers and children with symptoms of vitamin A deficiency led to the description of their suffering from “weakness” in Chamis, related to insufficient consumption of foods that “give strength.” Another diagnosis proposed by mothers was that the child suffered from “fear of the spirits;” an “eye illness” and “a mental problem” were also mentioned.

Mothers said that they would first try treating this type of problem themselves. If home treatments (encouraging the child not to be afraid, or bathing the eye in the case of a recognized eye problem) were not effective, the hospital or local traditional healer (*medico del campo*) would be sought. For an eye problem hospital treatment seemed to be an appropriate first resource.

Certain foods are considered “good for eyesight” by 36% of the respondents. Carrots were mentioned by three mothers (11.5%); the other foods mentioned did not contain vitamin A. Thirty-five percent of the mothers had heard the word vitamin and associated it with giving strength to children, enabling them to think or study, and protecting them against weakness.

San Vicente

In the exploration of hypothetical case scenarios of women and children with symptoms of vitamin A deficiency, the more common description was that the child was “afraid” (in general or specifically of the dark), that he or she was “affected by the spirits,” suffered from “weakness” from not eating adequately, had a vision problem or was tired. Improved food intake, including carrot juice, was a recommended treatment, and if not effective the child should be taken for medical care. For women suffering from weakness, which could “darken the eyesight,” the consumption of more vegetables, meat, milk, and juices was recommended. If the condition did not improve medical care should be sought.

Most respondents (81%) cited carrot or carrot juice as good for the eyesight. Other foods mentioned also contained vitamin A, with the exception of apple. In contrast to Chamis 89% of the mothers had heard of vitamins that were described as nutritional substances that give energy, strength, and health to the body.

Comparisons Between Chamis and San Vicente

The perceptions of the population of San Vicente towards food and health reflect a process of urbanization. In Chamis foods are grouped according to their source, whether locally grown or not, and whether prepared in similar ways. In San Vicente foods that are prepared and eaten together are grouped together.

Classification and use of foods according to the humoral system is more pronounced in Chamis. In San Vicente this is less defined and applied, at least among those who have lived in the city for a longer period of time. The qualities of "giving strength" and "combating weakness" and thus being "good for children" are important to both communities; in San Vicente this is associated with nutritious foods. Most of the population in San Vicente has heard of vitamins and associates them with the nutrient value of foods, however, only a minority of those in Chamis have heard this term.

Undoubtedly "good-tasting" is an important food attribute for both communities, as is cost. Nevertheless the perceptions in this regard are relative: sweet potato, considered a cheap food for the urban community is expensive in Chamis. Herbs and the gathered green leaves are not valued in San Vicente and are considered a poor man's food; in Chamis they are considered good-tasting and add variety to the diet when in season.

Apart from the green leaves and herbs, vitamin A-containing foods are generally well-positioned in relation to the perceived attributes in both populations and thus have a potential for promotion through interventions.

There is no clear recognition of vitamin A deficiency in either community, yet the diagnoses of the hypothetical case scenarios are not dissimilar. There were, nevertheless differences in the health-seeking behavior of both populations as shown in Table 7.5.

In Chamis there is greater reliance on home treatments recommended by "people who know" within the family, particularly the grandmothers, whereas the major resource for those in San Vicente is the city hospital. Attention from the health post and traditional healer was reported similar for both populations.

TABLE 7.5

Health-Seeking for Illness—Chamis and San Vicente

	% of Respondents (each respondent could give more than one answer)	
	Chamis	San Vicente
Medical post	50	48
Hospital	31	88
Home treatment	50	7
Traditional healer	27	33
Other	12	19

Summary and Conclusions

Signs and symptoms of vitamin A deficiency in these populations are not clear, but there may be indications of some effects, such as nightblindness, that have not been demonstrated previously in Peru, particularly in the rural community of Chamis. These need to be explored further with the diagnosis of vitamin A status and a closer examination of symptoms to elucidate these possible manifestations of deficiency. Rates of infectious diseases among children are high in both communities. The seeking of healthcare is related to the perception of the severity, duration, and cause of illness with a mix of local traditional and modern resources used.

Vitamin A intake is very low in Chamis, markedly less than in San Vicente at the time of the study, yet mean intakes did not meet recommended levels in either population. The diet in Chamis is monotonous and less varied than in the urban community where a wider variety of foods are available from the market, the major food source. The study was conducted during a season of low availability of foods.

Breastmilk is the major source of vitamin A for small children in both communities and particularly protected children in Chamis for two years or more. For other members of the family carrots were a major source of vitamin A at the time of the study. Other vegetable sources included green herbs, also squash and sweet potato in San Vicente. It appears that carrots, although consumed in small quantities yet frequently, contributed more total vitamin A to the diet than the larger portions of foods consumed less frequently, such as sweet potato.

In Chamis very few animal products were consumed; eggs are the major contributor of vitamin A. Cow's milk, eggs, and fish are important animal sources in San Vicente. The higher vitamin A intake in San

Vicente is due to a larger consumption of milk and carrots compared with Chamis; the milk donation program in San Vicente contributes significantly. Although fat intake was low in Chamis, there appears to be sufficient in the food preparations to permit absorption of vitamin A.

The rural community is more affected by seasonal variation in food availability than the urban population that has access to many foods all year through the city market, although choices are influenced by seasonal fluctuations in price. In Chamis food intake is primarily determined by local production; thus vitamin A intake is higher during the summer months when green leafy vegetables and herbs are more available. This period coincides with availability of sweet potato and mango in the market. It is necessary to conduct evaluations during these times of the year to determine seasonal vitamin A intakes and whether the higher levels are sufficient to provide adequate body stores for the leaner periods.

The vitamin A-rich foods are generally well-positioned in terms of attributes and qualities, which gives potential for their promotion. Foods that could be increased in terms of intake are those perceived as "giving strength" and "good for children" in Chamis, and those considered "nutritious" and "prevent weakness" in San Vicente.

Intrafamily distribution of foods did not appear to be an issue influencing vitamin A intake for vulnerable members of the family in either community. The food prepared is consumed by each member, although the amount depended on age. Nevertheless, certain foods, including vitamin A-rich items, are not given to small children. In Chamis consumption of vitamin A foods is limited in children during the weaning period, with the exception of breastmilk. Infants in San Vicente are given a wider variety of complementary foods, although breastfeeding is stopped earlier. The availability of food to the family is more important than the distribution within it.

This study highlighted the problem of nutrition during the weaning period that is especially severe in the rural population. Low food consumption lead to inadequate intake of energy and nutrients, particularly during the six- to twelve-month age period and continued to two or three years of age. Mothers are extremely passive in the rural communities, responding only to the perceived demands of the child for food.

In both Chamis and San Vicente a variety of vitamin A-rich foods are available throughout the year and perceptions toward many of these are favorable. Thus dietary modification is a possible strategy to improve vitamin A status.

Policy Recommendations

- An intervention strategy to improve nutritional status of vitamin A through dietary modification in these communities is feasible and should be implemented. The availability and perceptions of the population towards vitamin A-rich foods provide a potential for increasing dietary intake. An educational campaign can be developed using the information obtained in this study, both in the selection of the foods to be promoted and the formulation of appropriate messages for urban and rural populations of this region.
- Vitamin A status and deficiency symptoms, especially nightblindness, require closer examination, particularly in the rural populations, so that the severity of deficiency can be defined adequately.
- Seasonal variation in vitamin A status and food intake needs further exploration. Times when vitamin A-rich sources are available can be exploited. This includes foods such as sweet potato, vitamin A-rich fruits, and green leafy vegetables.
- Increased frequency and amount of carrots used in food preparations can be promoted, particularly in rural populations, as can squash where it is available. These foods consumed regularly in common food preparations can contribute important amounts of vitamin A to the diet during the year.
- Ways to increase the intake of animal products, such as eggs and fish in Chamis, and eggs, fish, and offal in San Vicente, need to be explored, particularly for small children. If food distribution programs are an alternative micronutrient-rich foods, such as milk, must be included.
- The modification of perceptions towards little-used potential vitamin A sources through a carefully designed communications campaign can be explored. This could be applied to green leafy vegetables or sheep's blood where appropriate.
- The promotion of home gardens with greater availability of seeds is an appropriate intervention for increasing local production of vitamin A-rich foods in rural communities. This can potentially provide more variety as well as increasing intake of vitamin A and other nutrients.
- The promotion of improved infant feeding practices is necessary in both populations, particularly complementary feeding from six months

of age. Solid foods need to be introduced at six months and the quantity, quality, and frequency need to be improved for better nutrition, health, and growth. The preparation of appropriate, nutrient-dense foods for this age group, using ingredients from the family pot and including micronutrient-rich foods, needs to be promoted. Children should be given priority for certain nutrient-dense foods, such as eggs. Dietary intake between six and eighteen months is inadequate particularly in rural areas, and ways of stimulating mothers to adopt a more active behavior towards feeding children need to be explored and promoted.

- Exclusive breastfeeding during the first six months and breastfeeding into the second year need to be promoted in urban populations and reinforced in rural areas.
- The development of nutritious preparations acceptable to the different groups of the population, particularly young children, can be conducted through a participatory process of recipe trials with mothers, focusing on selecting vitamin A-rich foods. The feasibility of these dietary modifications can be evaluated through household trials in each of the communities.

Recommendations for Research

- The vitamin A content of many of these foods needs to be determined. The amount in the mixture of herbs as served in green soup and other preparations needs to be analyzed.
- The bioavailability of vitamin A from the local preparations of green leafy vegetables, herbs, and other cooked and processed vegetable dishes, needs to be determined.
- Whether the higher intakes of vitamin A food sources, at the time of greater availability, provide sufficient body stores to prevent deficiency for the rest of the year needs to be explored.
- Breastmilk vitamin A levels and its variation in the different seasons need to be determined.

Acknowledgments

I wish to acknowledge the dedication of the field teams under the supervision of Rocio Narro, the secretarial support given by Aida Miranda and Mirtha Narro, the assistance in the compiling of data by Ira Heidemann,

and the generous participation of the authorities and members of the Comunidad Campesino Chamis and of the Barrio San Vicente. Dr. Isidoro Sanchez gave valuable advice in the identification of the local plants.

India: The Rural Community of Sheriguda in Andhra Pradesh

Shahnaz Vazir, Uma Nayak, Vinodini Reddy, and P. Pushpamma

Introduction

Several reviews of programs to improve the nutritional status of at-risk groups pointed out that traditional methods of nutrition education do not have the desired impact. In recent years, attempts were made to use techniques and methods hitherto confined to the behavioral sciences or other disciplines, such as anthropology and ethnography. In order to achieve effective nutrition interventions an extensive understanding of the existing sociocultural matrix of the community is necessary. This study was undertaken, in a rural community of Andhra Pradesh, to obtain information on availability and use of food sources of vitamin A. Culturally appropriate techniques were used.

Team Members and Task

The team consisted of four investigators with a team leader, a programmer/statistician, a stenographer, and a field assistant as follows:

- Dr. Shahnaz Vazir, Ph.D. (Psychology): Team leader and Senior Research Officer, National Institute of Nutrition, Hyderabad.

Investigators:

- Dr. Anjali, Ph.D. (Nutrition), Lecturer, Women's College, Osmania University, Hyderabad.
- Ms. Uma Nayak, M.Sc. (Nutrition), Research Assistant, National Institute of Nutrition, Hyderabad.

- Ms. Anita, M.Sc. (Nutrition), UAS, Bangalore.
- Ms. Saroja, M.Sc. (Nutrition), APAU, Hyderabad.

Data entry and analysis:

- Mr. P. Vidyasagar, M.Sc. (Statistics), Technical Research Officer, National Institute of Nutrition, Hyderabad.
- Mrs. P. Prashanthi, Stenographer, National Institute of Nutrition, Hyderabad.
- Mr. K. Narasimha Reddy, B.Com, Field Assistant, National Institute of Nutrition, Hyderabad.

The ethnographic protocol described previously and outlined in the Appendix was implemented in Sheriguda Village by this team. The protocol and report took approximately eight weeks to complete.

Current Status of the Problem

Vitamin A deficiency is recognized as a significant health problem in India. Severe forms of the deficiency lead to irreversible blindness and death in children. Surveys conducted in different parts of the country showed that 2% to 5% of children in poor communities have mild xerophthalmia, like Bitot's spots and nightblindness. Prevalence rates are higher in school age children than in younger groups, but severe forms of deficiency resulting in corneal xerophthalmia and blindness are confined to those under three years of age. A national blindness survey carried out earlier showed that 2% of the total blindness in the country was due to vitamin A deficiency, while in a 1989 survey this was reduced to 0.04%. Hospital studies also showed few admissions due to corneal xerophthalmia. However, milder forms of vitamin A deficiency are still widely prevalent.

Vitamin A deficiency has been viewed largely as a medical problem that can be controlled with periodic doses of vitamin A. Under the National Vitamin A Prophylaxis Programme, in operation in several states in India, bi-annual doses of vitamin A are given to preschool children at risk. Although this was envisaged as an interim measure to reduce the incidence of vitamin A deficiency, it has been going on for the last twenty years. Experience shows that the efficacy of this medical approach is limited by the inefficient delivery system. The ultimate solution to the problem lies in improving the diet and increasing the intake of vitamin A.

In the current strategy, greater emphasis is placed on food-based interventions. Since vitamin A-rich animal foods are expensive, attention is

focused on plants containing provitamin A and carotenoids. One of the limitations in developing food-based strategies for combating vitamin A deficiency is the lack of reliable information on the carotenoid content of foods. Most of the values given in food composition tables represent total carotene and not β -carotene, which is the major source of vitamin A.

Another limitation is a lack of understanding of the dietary factors influencing the bioavailability of carotene, and the effects of cooking and preservation techniques on carotene losses. Recently, the National Institute of Nutrition (NIN) carried out a number of studies to obtain information on these aspects. Food analysis showed that traditional varieties of green leafy vegetables, like amaranth and spinach, and the leaves of a large number of plants that grow wild in the countryside are rich sources of β -carotene. These bushes and trees include *agathi*, drumstick (*moringa*), and *channangi*. *Basella* is a creeper that can grow along a fence or roof top when space is limited. These plants are relatively easy to grow, require little water, and more importantly, are perennial sources of leafy vegetables. Efforts are being made to propagate such plants through home gardening programs.

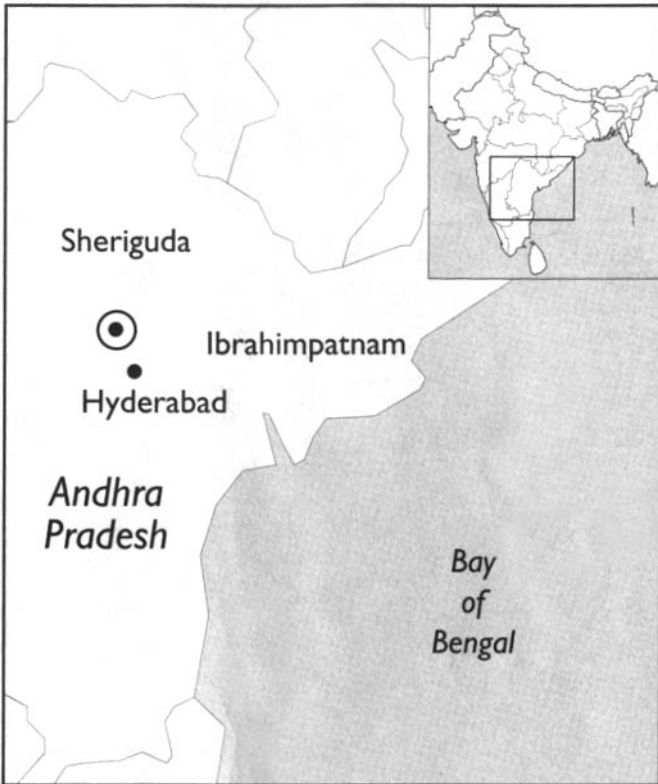
NIN's experience with horticultural projects in several villages of Andhra Pradesh, shows that the villagers can be persuaded to grow vegetables in their backyards or on the farms where they work. This was combined with an education program to create awareness and to encourage consumption of locally available vitamin A-rich foods. In the past, education without community involvement failed to have any impact. The emerging field of social marketing has opened new vistas for meaningful nutrition education imparted to the community through culturally accepted ways. NIN's experience shows that a social marketing approach can be used effectively to learn about community needs, beliefs, and attitudes in order to produce desirable changes in dietary behavior. Effective implementation of programs using social marketing strategies on a large-scale can help eliminate vitamin A deficiency.

Study Population

The selected area for the study was the village of Sheriguda in the Ibrahimpatnam block of the Ranga Reddy district in Andhra Pradesh state (Map 6). This state is in the midsouthern part of India, known as the rice-bowl because of its fertile soil in certain areas. However, in many villages in the Ranga Reddy district, such as Sheriguda, the lands are dry and mostly staples, such as sorghum (*jowar*) and pearl millet (*bajra*), that do not require as much water as rice are grown. Crops commonly grown

M A P 6

Sheriguda Village in Andhra Pradesh State



in this area include *paddy*, jowar, *sajja* (pearl millet), red gram, castor, and sunflower. Other vegetables such as okra, tomatoes, and green leafy vegetables, such as *palak* and *gogu* are grown seasonally.

Sheriguda is a typical village of Ranga Reddy district where all religion and caste groups are represented. Looking at the caste distribution of the village, it was found that about 40% of the families belonged to the forward communities, such as Reddys and Vysyas (merchants), and 30% to the backward castes, that include skilled occupational castes like blacksmiths, carpenters, goldsmiths, and others such as shepherds, *muthrasi*, *munnurukapu*, and *chakali*. The *harijan* households (scheduled castes) comprised about 21% and the scheduled tribes about 8%. Less than 1% were Muslims.

The better-off families are either large landowners, possessing more than 100 acres of agricultural land, tenant cultivators, or the business community who buy produce from smaller landowners and sell it in the city. The poorer families are involved in one or two of the following occupations:

- agricultural laborers, who are paid either money or staples and vegetables as wages;
- other laborers, such as workers in a nearby poultry farm and those who work in the Ibrahimpatnam block headquarters;
- petty shops owners and vendors who sell vegetables and other food items;
- artisans, such as pot makers, blacksmiths, goldsmiths, tailors, and masons, etc.;
- professional occupations, such as electricians, teachers, postmen, etc.

The traditional joint family system is still common in this community. However, a large number of families follow the nuclear family system. The average family size varies from five to seven members including children in the nuclear families, and eight to ten members in the joint families. The joint family structure is of particular benefit in rural areas because the total wages earned by all the members make up the family budget. On average, men employed as agricultural laborers earn a wage of twenty to twenty-five rupees (\$1 US dollar is currently equal to thirty-one rupees) per day and women earn around ten to fifteen rupees per day. However, agricultural laborers are out of work for three months during summer. For the remaining nine months they work an average of twenty days a month which totals to about six months of continuous work. These landless laborers constitute about 25% to 30% of the total population. Agricultural work is the main source of livelihood for these families. Some laborers are employed in a nearby poultry farm owned by the *sarpanch* (village headman), and they occasionally get free eggs or poultry.

A recent study of vitamin A deficiency, undertaken by the National Institute of Nutrition, Hyderabad, found a prevalence of 4.5% for Bitot's spots in preschool children and a few cases of nightblindness in villages around Ibrahimpatnam block. This figure is comparable with other regions in Andhra Pradesh where such studies have been conducted. The prevalence of Bitot's spots in Sheriguda was found to be 4.2% in preschool

children. This figure far exceeds the WHO cut-off level of 0.5%, indicating that vitamin A deficiency is a significant health problem in this area.

Since the auxiliary nurse midwife (ANM) and the *anganwadi* worker (the grassroots functionary of the Integrated Child Development Services Programme (ICDS) operating nationwide) are expected to impart health and nutrition education to young mothers and interact with preschool children, they were interviewed for information regarding vitamin A deficiency. Neither had ever seen a child with Bitot's spots, nor they had come across any case of nightblindness. Since the survey by the NIN demonstrated a high prevalence of Bitot's spots (4.2%) in preschool children in Sheriguda, it is possible that these children did not participate in the ICDS program.

Community Food Sources

Members of the community either cultivate their own land or purchase food in weekly *shandies* and from vendors, local petty shops, and subsidized ration shops. People also buy food in the nearby towns and cities during occasional visits. They also hunt and gather certain foods, and a few families grow greens, such as spinach, or fruits, such as papaya. Most of the low-income groups avail themselves of the opportunity to get subsidized staple food from the fair price shops, but this is limited to wheat, oil, rice, and sugar.

Some wild greens are collected during the rainy season. Their common local names are *ponnaganti*, *kodijutukura*, *chenchalaku*, *gangavailaku*, *koyikura*, *pindikura*, *duggalkura*, and *bankotikura*. Some wild berries and fruits are also locally harvested, however, they are not significant sources of vitamin A or β -carotene.

On the whole the consumption of green leafy vegetables and other vitamin A-rich food was seasonal, and depended upon availability. It was highest in the rainy season (when they were plentiful) and lowest in summer. However, certain households did not consume green leafy vegetables, even when they were available in their own fields. These households mostly sold their produce in the city.

Home grown vegetables are mostly greens, such as *bachali* (Indian spinach), fruits, such as papaya and guava, and other vegetables, such as gourds and broad beans. Vegetables, mostly creeper varieties, are grown around the homes. Some families trade the staple food available in the home for vegetables. Both animal and plant foods are purchased by many families depending on availability and season.

The following foods are regularly grown locally: paddy, jowar, sajjā, kandi, cow peas, pesaru, castor, sunflower, and tomato. No foods are imported from outside the country.

Market Days

Market days are held once a week. Every Thursday, there is a shandy in the nearby town six to eight kilometers away. Locally grown vegetables and fruits are available, but onions, condiments, spices, tamarind, chilies, and perishable foods, such as meat and dry fish are predominant.

People from Sheriguda travel to the market and 70% to 75% of them purchase one or two day's supply of perishable foods. All villagers purchase spices from the shandy. Vendors and petty shop owners buy non-perishable foods for the entire week, and sell them at a profit in the village to people who subsist on daily wages.

Vitamin A-Rich Foods

Greens, the main source of vitamin A, are bought more frequently from the nearby town, as there are no storage facilities. For this reason, the availability of greens in the village petty shops is comparatively less than other vegetables that can be stored longer. This is the main reason for the poor availability of greens, especially during the dry season.

Greens, pumpkin, mango, papaya, and carrots are the major non-animal sources of vitamin A in this region. Papaya is available and affordable. All other foods are seasonal, including some varieties of greens. Carrots and pumpkin are available but expensive, even in season. Mangoes, on the other hand, are available only in summer and some of the local varieties are inexpensive, and are consumed particularly during this season. Although people can afford greens all year round, the smaller quantities are consumed in summer, when they are more expensive. Pumpkins and carrots are purchased only for festive occasions and as snacks for children. Drumstick leaves are the richest source of vitamin A and plentiful, but they are not consumed because of their unpopular taste. Pumpkin leaves are considered inedible.

Eggs are available all year because there is a poultry farm nearby. However, they are mostly not affordable. Also, the local community believes that eggs are "hot." Those who consume eggs prefer those from free ranch birds rather than from the poultry farm. Milk, fish, liver, and eggs are comparatively more expensive and not affordable by most families at risk for vitamin A deficiency.

Home Gardens and Gathering

Very few people have home gardens, even though most have open yards. People have a poor concept of home gardens and feel that foods such as vegetables and fruits should only be grown in or around the fields. Except for perennials, greens, gourds, and broad beans are grown in the rainy and winter seasons. Most of the home grown produce is consumed by the family or shared with neighbors. Some people grow green leafy vegetables, such as *gogu*, among their staple food crops during the rainy season.

People gather foods from the wild, especially greens, berries, and fruits. They occasionally hunt small birds and animals, such as rabbit. During the rainy season ponnaganti, kodijuttukura, chenchalaku, gangavailaku, koyakura, pindikura, duggalkura, and bankotikura are gathered once or twice a week.

Food Consumption Pattern

A three meal pattern is followed. Breakfast includes tea, rice, or jowar roti, or leftover foods from the previous day, such as rice and curry. During summer, *ragi* porridge or *kalli* (fermented washings of rice) or *conjee* (excess water drained after boiling the rice) is consumed by some families who feel these foods are “cooling.” Such practices are prevalent mostly among lower socioeconomic groups. Higher socioeconomic groups prefer to consume items like wheat *roti* (unleavened bread) or *idli* (fermented and steamed cereal-pulse preparations), buttermilk, curds, and other foods.

For lunch and dinner cereal and/or millet preparations are the major items. The accompanying dish is either a chutney (ground red chilies, ginger, garlic, and salt with or without tamarind), a vegetable curry, a pulse preparation, or occasionally a meat dish. Curds or buttermilk is seldom consumed by lower socioeconomic groups. On weekends animal food is generally prepared for dinner, which is a larger meal than lunch.

Food is cooked twice a day, for lunch and dinner at the convenience of the housewife, who is generally an agricultural laborer or who looks after her farm. While the mother is at work the children consume the leftover food from lunch, whenever they are hungry between meals. All members of the family meet and share the food at dinner time. Seasonal variations in availability and preferences occasionally determine the food choice and preparation. Vegetables and fruits are consumed more frequently during October to February when they are abundant. At other times of the year consumption declines. Jowar is consumed extensively during the lean period from April to October. During festive occasions,

calorie-dense sweets, snacks, and other pulse and vegetable items predominate. Animal foods, such as meat and chicken, are a must during festivals, especially for lower socioeconomic groups like Harijans.

The female head of the family distributes the food among the members. Staple food preparations with cereals and millets are distributed without any restrictions, as they are cooked in large quantities. The more nourishing foods such as vegetables, meat, and fruits are served in smaller quantities to reduce costs. The male head of the family is given liberal helpings of all food items, especially meat and chicken. No such distinction in distribution of food is made among the other family members.

In the low-income groups, there is no set place for eating. Meals are eaten either inside or outside the house. Food is served on individual plates with spoons, and family members squat on the floor while eating. Members of the higher income families eat inside the house, at a set place, and some of them even sit at a table. Irrespective of economic status all families use their fingers for eating, which is a tradition in India. Lower income groups use an aluminum bowl, but if they can afford it, they use a stainless steel plate (which is a status symbol). Aluminum vessels or earthenware pots are used for cooking in all communities.

Boiling and frying are two common methods used for cooking legumes and vegetables. Certain greens are cooked in excess water and the water discarded. Rice is cooked with *kalli* (fermented rice washings) or with plain water and the excess water discarded. Very few women reported cooking rice in just sufficient water. Some foods like raw custard apple, sweet potato, and dry fish are smoked or roasted.

Food taboos are widely prevalent. Beliefs center on hot, cold, and *vatham* (wind or gaseous) properties of food, that prevent their use as regular dietary items. However, certain processing methods are said to alter properties in food and render it suitable for consumption. There are some beliefs that some foods cause joint pains, cold and cough, excessive bleeding, indigestion, diarrhea, etc. These beliefs restrict the consumption of some nutrient-rich foods. Some dislikes are also related to negative health attributes, whereas likes are related to taste, availability, and familiarity with the food.

Cultural/Ecological Pattern

Food Habits in pregnancy. Food restrictions are observed during pregnancy. Papaya is believed to cause miscarriages, and therefore is avoided. Certain other foods are promoted. Fresh *toddy* (local liquor made from palm sap) and *kalli* (fermented rice washings) are believed to facilitate

intrauterine movement of the fetus. This practice has declined, as it is considered to indicate low status, and tea is consumed instead. If women crave specific foods, they are permitted to eat them. It is believed that if the mother does not eat the food she craves, the umbilical cord may heal slowly and the infant will drool excessively.

Food Habits During Lactation

Among many traditional families, the diet during lactation has three distinct stages. A severely restricted diet, consisting of cooked rice mixed with spice powder (mixture of roasted ginger, garlic, pepper, and red chilies), is eaten during the first three days of lactation. It is believed that this practice stimulates lactation and prevents numbness of hands and feet. From the fourth to the twenty-first day, a semi-restricted diet of only a few plant and animal foods is allowed. After twenty-one days, there are no diet restrictions. On the other hand, the lactogenic effect of certain foods such as meat, dry fish, and garlic are recognized, and efforts are made to consume as much of these foods as one can afford during lactation. Some families who used allopathic medicines had no dietary restrictions from the day of delivery. Boiled water is given to the women until twenty-one days following childbirth. This is believed to prevent infection in the mother and cough and cold in the infant.

Food Habits Related to Children

Initiation of breastmilk within twenty-four hours of delivery was reported by those who had a hospital delivery (a small group of the total). The majority initiated breastmilk on the third day and most of the older mothers rejected the colostrum. Contrary to this, some younger mothers fed colostrum to their newborns. It is generally believed that milk is not secreted before the third day after delivery and hence the newborn is put to the breast only then. Severe food restriction immediately after delivery may be a major factor responsible for this belief.

The common prelacteal food is wet nursing among the low socioeconomic groups. Sugar water, honey, diluted cow's milk, and glucose water are the prelacteal foods used by those having hospital deliveries, and by higher socioeconomic groups. Prelacteal foods are given in minute quantities mostly in an unhygienic way. Prolonged breastfeeding is a common practice in this region. The duration ranges from twelve to more than thirty-six months. Prolonged breastfeeding therefore acts as a natural contraceptive method. The weaning age ranges from five to twenty-five

months or more. Those with a higher income and educated mothers tend to wean as early as six months.

The common liquid supplements given are milk (often diluted with water), coffee, tea, or thin cereal gruels. Solid foods given are well mashed plain rice, pieces of *roti* (unleavened bread), seasonal fruits, locally available inexpensive biscuits or other snack items. Small quantities of the adult diet are introduced once the child can eat alone and withstand hot, spicy foods. The lower income groups tend to give tea or coffee in addition.

No special supplementary foods are prepared and the child is fed either on demand or at the mother's convenience. Reasons for discontinuing breastfeeding are subsequent pregnancy, the ill health of the mother, the child naturally stops breastfeeding, or the mother's conviction that the child has grown sufficiently.

Green leafy vegetables are the major vitamin A sources available and consumed. Others include pumpkin and fruit, such as papaya and mango. All are consumed seasonally in small quantities by children.

Summary and Policy Strategies

Dietary Modification

Although vitamin A supplementation is a simple and effective intervention, it is only a short-term measure. It should be combined with dietary modification for long-lasting effects. Education, although an important component of all health and nutrition programs, has been one of the weakest linkages, mainly because the health functionaries are not properly oriented and do not have the necessary tools to impart nutrition education. There is a need to strengthen information, education, and communication strategies using a multimedia approach to bring about desirable changes in dietary practices. Special attention must be paid to pregnant and lactating women to ensure adequate intake of vitamin A-rich foods. Promotion of breastfeeding is important as it protects infants against all nutritional deficiencies during the first four to six months. Appropriate weaning foods based on locally available carotene-rich foods can be developed for young children between six and twenty-four months of age.

Horticulture Intervention

Nutrition education programs will be more successful if they are combined with horticultural interventions to increase the availability of carotene-rich foods at the community level. Although India is one of the leading producers of vegetables, green leafy vegetables constitute only

16% of the total vegetable production. Horticultural crops must be increased to meet the requirements. Promotion of home gardening is important to increase availability at the household level. Emphasis should be put on perennial varieties of green leafy vegetables that are relatively easy to grow, such as *basella* and *agathi*. Efforts are being made in this direction by the Department of Agriculture and Social Forestry. The Indian Council of Agriculture Research has established a number of Krishi Vigyan Kendras or Farm Science Centres in various parts of the country to train farmers in agriculture technologies to improve production. There is a need to develop a mechanism of coordination between the various departments involved in horticultural and educational activities for optimum benefit of the community.

Part IV

**Understanding
Vitamin A Deficiency
in the Community**

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9

The Contexts of Culture, Environment, and Food

Harriet V. Kuhnlein and Gretel H. Pelto

Overview

The root of the problem of vitamin A deficiency is lack of sufficient vitamin A in community food supplies. While all members of families in communities where vitamin A is limited are potentially at risk of deficiency, infants, young children, pregnant, and lactating women are the most vulnerable. In order to understand how food systems can be supported to ensure adequate intake for all the population, the environmental and sociocultural mechanisms through which food is provided must also be understood. This understanding begins with answers to a set of basic questions: what vitamin A-containing foods are available? What are the nutrient levels in these foods? How much is consumed by the individuals who are vulnerable to deficiency? Why are these foods selected or not used? How do people identify and treat symptoms of vitamin A deficiency? The answers to these questions are the product of determinants that reside in the physical and social environment, broadly defined, and in culture. Answering these questions at the local level is a necessary step in the development of interventions aimed at remedial actions and prevention of vitamin A deficiency.

In the sections that follow, we begin with some comments about the overall performance of the protocol as a field tool. We then review findings from the studies in relation to the “key questions” to which the protocol is directed. This is not intended to be a definitive analysis of the

dietary, environmental, and cultural features of the five sites. The purpose is to summarize the types of information that are produced through the application of the procedures.

Overall Performance of the Protocol

To assess the ability of the manual to assist national investigators to obtain answers to the key questions, it was necessary to test it in diverse environments and cultures. Specifically, the following different systems were selected:

Location	Environment Type	Cultural Group
Canawan, Philippines	Humid, tropical	Aetas (indigenous)
Henan, China	Temperate, riverine	Han
Filingué, Niger	Arid, desert	Hausa
Andhra Pradesh, India	Dry, upland	Hindu
Cajamarca, Peru	Highlands, semi-arid	Mixed Spanish and indigenous

All procedures in the manual were applied by research teams in the five study sites. All team leaders (or main investigators) had backgrounds in health professions (nutrition, nursing, community medicine, public health). In several cases they also had anthropological training. Regardless of background and previous experience, the investigators agreed unanimously that the initial training workshop was a valuable preparation for carrying out the study.

The teams completed the studies within the projected time frame of six to eight weeks. In two areas (China and Peru) the manual was translated into the national language; in the other three areas, the teams worked directly from the English manual, using local translators as needed to maintain literal translations of concepts.

The investigators and their field teams generally found it easy to apply the specific techniques that they attributed to the detailed, step-by-step instructions in the manual. A number of modifications in the instructions have been made as a consequence of the thoughtful suggestions from the teams, and the post-field test revisions are based on extensive discussions with the investigators. For example, the field teams made suggestions for identifying the most appropriate time to conduct the studies and provided creative suggestions concerning the use of specific examples in the local culture to help respondents understand questions.

In some cases the teams found it advisable to adapt the dietary assessment modules—Modules 4 and 5 (Part II-C) in the manual. In the

Philippines, respondents were asked to give a 24-hour recall before they were questioned with the food frequency procedure. The investigators instituted this change in order to orient the respondents to the concept of daily quantities. In India the team experienced some difficulty in recording portion size and preferred not to use the 24-hour recall in this manner. One investigator suggested that the food frequency procedure developed by IVACG (IVACG, 1989) could be substituted for Module 5, provided it was modified to use the food list developed from the other modules. Thus, the field test experiences suggested that it is possible to modify the dietary assessment section of the protocol to fit local circumstances, as long as the data yielded by the procedures can be used to rank-order the key-foods in the market survey.

The community food system data tables were successfully applied in all the test sites. The tables are also useful in clearly highlighting where further research on food composition and species identification is required. In the study among the Aetas, the list of foods contained 128 items of which twenty-seven had no scientific identification and forty-two had no recorded values for carotene or retinol. Food items for which no composition data could be found also occurred in the Cajamarca study and in Filingué, Niger. Complete data were reported for all of the food items in the community food system data tables of Doumen, China and Sheriguda, India.

To determine the ability of the protocol to document seasonal variation in food availability, and cultural perceptions of food selection as these relate to seasonality, the investigators in the Philippines repeated the study in both wet and dry seasons among the Aetas. The team found that in order to describe the variety of local vitamin A-containing food, it was necessary to have data from the wet season. They suggested that conditions in the dry season could have been obtained through interviews, without observation, by carefully interviewing key-informants. The data on cultural perceptions about food attributes and qualities remained stable. Thus, they concluded that a single study, carried out in the wet season, would have obtained all the necessary information.

To determine how sensitive the protocol is to differences in food availability and selection in rural and periurban communities within the same geographic area, the investigators in Peru conducted studies in two locations. The team documented substantial differences between the two sites, with greater use of animal foods and wild plants in the more rural site. Families in the periurban communities relied primarily on purchased foods, and the food list was much longer. On the other hand,

there were many similarities in food items and food beliefs, although food beliefs appeared to be more diverse in the periurban area, in part because of in-migrants from other regions.

Keys to Finding Local Community Food Sources to Prevent Vitamin A Deficiency: What Foods are Available and How Much Vitamin A Do They Contain?

Keys to understanding the available foods that can be used to prevent vitamin A deficiency are found in the key-informant interviews and the free list of foods, in the market surveys, and in the community food system data tables. In addition, information is found in the background materials on the historical, ecological, and cultural setting for the community food system.

In addition to an examination of vitamin A content (retinol or carotene), food resource data needs to include information on preservation and preparation methods, as these affect nutrient levels. The manual facilitates collection of this type of information. For example, the study report from Niger includes the description of the long cooking processes for leafy vegetables, information that is important for evaluating the food supply as consumed. Studies also should note the sources of data on nutrient composition. Thus, it is useful to find in the report on Sheriguda village that the information in the food system data tables is based on food composition studies that were conducted with the current, advanced method of analysis (HPLC) in national laboratories.

In the field studies, the community food system data tables proved to be a valuable means of summarizing the local situation. Among the Aetas in the Philippines, the table contained 128 food items. One hundred sixty one species are on the list for the periurban site in Peru, with seventy-four in the rural area; thirty-seven species are listed for Filingué, Niger; thirty-five in Doumen village, China; and forty-five for Sheriguda village in India. Although some areas had unidentified species with unknown vitamin A content, vitamin A-rich foods were identified in all the systems. The data tables also provided information on key sources of protein, fat, and other nutrients that are important in the prevention of vitamin A deficiency.

Information on seasonality is obtained from the community food system data tables, market surveys, and key-informant interviews. For example, the study revealed that in Sheriguda village, pumpkin is available only during one short period during the year, while *bachali* (*Basella alba*), that is cooked with *dahl*, is available all year in local gardens, does

not have to be purchased, and is an excellent source of carotene. Mango is popular with young children but is available for only two to three months. Papaya has a longer period of availability, but there are cultural barriers to its use (see following section, "Keys to Beliefs and Perceptions About Food").

Several field study reports pointed out the importance of paying special attention to how wild greens and leafy green vegetables are used. These species may be locally regarded as substantive food items or as condiments that are used in much smaller quantities. Greens may be dried and reserved as emergency or famine foods or preserved for use in herbal remedies. It is important to note preparation and preservation techniques. In Sheriguda village, another factor that affects use of greens is whether they are subject to infestation by insects or worms, in which case the food is rejected.

The market survey reports provided a valuable source of data on both availability and price of important food items. As discussed further below, excellent sources of vitamin A-containing foods are found in local markets, but their prices may be prohibitive for those most at risk of deficiency. By including calculations of price-per-serving and the price per 1000 RE, the study provided a perspective on true availability, particularly when the average family daily wage or food expenditure total was known. Liver is a good example; in all five research areas, it was recognized as an excellent food, good for the eyes, and for protecting health. However, it was not available regularly from home animal production, and was not purchased often because of its cost.

Keys to Understanding Consumption Patterns of Vulnerable Groups

In this section we discuss food selection and consumption of pregnant and lactating women, and infants and young children. Information on consumption patterns was obtained from the food frequency and 24-hour recall modules, key-informant interviews, and the modules on food categories, attributes, and concepts.

The general food pattern of families is a necessary first step in order to understand food patterns of vulnerable individuals. In Doumen village, China and Sheriguda village, India, and in Filingué, Niger, families eat three meals a day. The first meal of the day often consists of the leftovers from the previous night. In Filingué meals are built around a grain with a sauce, that often contains greens and pumpkin, providing good potential for vitamin A. In Sheriguda, evening meals occasionally contain meat.

For the Aetas, meals usually consist of rice and a sauce of greens; fat and animal protein is limited in the family meal pattern.

There is little evidence from any of the sites that consumption patterns change during pregnancy. In Peru and Niger, pregnant women deliberately avoid eating too much because they do not want to gain too much weight, leading to a difficult delivery. While some food items are noted in each area as being good for pregnancy, there is no general pattern with respect to their vitamin A content.

A change in diet during the postpartum period is characteristic in all areas. In Doumen village, many hen's eggs are given to women, who are also encouraged to eat dark-colored foods (such as black rice, red jujube) to regain their strength. In both sites in Peru most women interviewed reported that special foods, selected for their qualities with respect to the humoral medicine system, are consumed. In Sheriguda, three stages of postpartum diet are recognized: in the first three days, only rice with spices is eaten; from day four to twenty-one the diet is semi-restricted, with few animal and plant foods; a regular diet is resumed after twenty-one days.

During lactation, women's dietary patterns may also be different from the rest of the family. In all areas, more liquids are taken, often as cereal gruels. In Niger women actively try to gain weight to recover their strength, and they seek more meat, liver, and richer sauces. While eggs are encouraged on a daily basis in Doumen village, they are rejected during lactation in Filingué, and are recognized as lactogenic foods in Sheriguda village.

Breastfeeding is practiced in all areas, but for varying durations. Cessation of breastfeeding varies widely, from an average of six to thirty months. Rural areas (Chamis, Peru, and Filingué, Niger) have longer average periods of breastfeeding than urban areas. In Filingué and Doumen the first colostrum is discarded. Water with sugar is often given to newborns. Breastfeeding is supplemented with various foods, some of which have potential for providing vitamin A. For example, mashed vegetables and eggs are the first foods in Doumen village. Soups and purees are given in the Peruvian settings. In Peru herbal infusions are given to infants, but sweet potato, eggs, and greens are thought to be too strong for children under one year of age.

Young children's eating patterns gradually assimilate to that of the family. Eggs are considered an ideal food for young children in Doumen village. In most areas, young children are reported to eat more snacks, including fruits and vegetables. In Sheriguda village, for example, carrots are regarded as a food only for children's snacking and are eaten raw.

As the foregoing summaries suggest, the application of the procedures produced descriptive summaries of the dietary patterns of vulnerable groups. The modules on food beliefs provided information about the cultural factors associated with these patterns.

Keys to Beliefs and Perceptions About Food

Except under conditions of extreme scarcity, food beliefs play an important role in food selection. The main techniques used in the manual to describe food beliefs are open-ended, key-informant interviews and structured interviews with mother-respondents that use formal ethnographic methods to discover emic categories, food attributes, and qualities.

Some of the food beliefs identified are found across wide culture areas, although they often show considerable intragroup variation as well as locally introduced variation. An example of a widely held belief is the finding from Sheriguda concerning papaya. Throughout southern India, papaya is seen as a food that causes dysmenorrhea in women and impotence in men. Although it is rich in provitamin A, it is usually not accepted as a suitable food for pregnant or lactating women, infants, or young children. In Sheriguda, papaya is generally available, but consumed only by children four to fifteen years of age. Other beliefs related to vitamin A consumption included: liver is bad for children as it will cause indigestion; eggs are a "hot" food and should be used with caution; and pumpkin is a *vatham* food, a feature that can cause swelling and indigestion. The attributions or qualities of food in Sheriguda emphasized taste, goodness for health, hot/cold, *vatham*, giving strength, used for festivals, causing diarrhea or cough, increases blood, and generally not good for the body.

In the Peruvian rural area (Chamis) and in periurban San Vicente, the hot or cold humoral system continues to be important in structuring food beliefs. Foods are designated as *caliente* (hot) or *fresco* (cool). *Caliente* foods include vitamin A-rich items, including green herbs, while fruits are generally *fresco*. Sweet potato and carrot are neutral. Other important attributes of food in Chamis include giving strength, good taste, causing indigestion, and causing diarrhea. In San Vicente the attribute of good nutrition is recognized, and for children included such foods as eggs, cow's milk, breastmilk, carrot, sweet potato, papaya, and mango. Other attributes included "combatting weakness" and "good taste."

While the sites differed with respect to the literacy level of the mother-respondents, the techniques for identifying food attributes and qualities performed well in all of them. In Filingué, Niger, the attributes of animal

foods included the concepts of strengthening, fattening, healthful, and blood-rich. Some foods were designated that make children feel good, are tasty, or vitamin-rich. In Doumen village people identified food as tasty, prestigious, nutritious, healthful, and filling. In selecting vegetables, beans, and meats, the main attributes of concern were price and taste. For staple foods (noodles, rice, steamed bread), filling and taste were both important. Commonly-held beliefs included the capacity of foods to impart their characteristics to the individuals who consume them. For example, it was thought that eating rabbit meat might cause a child to have a mouth and lips like a rabbit.

Among the Aetas, the concept of richness emerged as a quality of concern with respect to food. People suggested that if one eats rich food they will become spoiled and want it all the time; therefore, moderation is encouraged, except during feasts. Other food attributes included: strength-giving, filling, tasty, healthful, expensive, and prestigious. Some foods are characterized as delicious, nutritious, good for mother/child, good for the eyes, good for the blood, and for increasing breastmilk.

Keys to Cultural, Ecological and Socioeconomic Factors That Constrain Consumption of Vitamin A-Rich Food and Prevention of Deficiency

The manual directs investigators to obtain data on microlevel (local) factors that affect food availability, health, and the potentials for family food selection. Some of this information is found in reports and interviews with persons in regional government agencies and is included in the background material in the section on the setting of the food system. Information is also obtained in key-informant interviews, market surveys, food system data tables, and food frequency data.

Two key areas of local-level information included in the manual are land availability and local markets. If families have limited land resources to grow or harvest their own food and have limited income, the data on local food prices from the market survey are critical for determining accessibility of vitamin A-rich food. This issue was noted in investigators' reports from all the study sites. Often it is not possible for families to purchase animal food and vitamin-rich seasonal plant food because of their costs.

The accessibility and use of fat and animal foods are closely related problems. If fat and zinc are limited, and there is evidence of protein-energy malnutrition in the population, these factors may be more critical to the development of vitamin A deficiency than the amount of carotene or retinol in the food supply. For example, the shortage of fat and protein

in the Aetas' food system was identified by the investigators as a significant feature.

Market accessibility for the sale of home-produced food is another factor that requires attention in the ethnography. Home-produced animal food (especially eggs and milk) and seasonal fruits and vegetables may be sold rather than fed to family members. Decision-making within the family with respect to allocation of home-produced food, as well as food purchasing, is a subject of inquiry in these studies because they have important implications for intervention planning. The study in Filingué documented the role of the male household head in structuring the accessibility of vitamin A-containing foods to vulnerable household members.

Elders in the community often know the recent history of food sources of vitamin A, including where plants and animals can be grown or found, how these were preserved and prepared, and any health properties they may cause. With increasing wages, families often choose food that is most easily obtained, while wild food sources or those requiring greater effort to harvest or prepare may be discontinued. The rise of industrial agriculture in an area is another force that encroaches on home food-harvesting resources. In this circumstance as well, the elders will know what kind of food was previously successful in the environment and where the nearest places are that provide the food resources. The Aetas have been relocated several times during the memory of the community elders, and food resources in the other areas were still remembered and occasionally brought to the village.

The nature of seasonal patterns is, of course, critical information for assessing the availability of vitamin A-containing foods. In all the study sites, seasonality strongly affected the picture. These effects may be seen in relation to home production, market availability, and purchasing power. In Filingué a poor millet harvest will trigger a critical decline in purchasing power for vitamin A-rich sauce ingredients, thus constricting the household's ability to purchase vitamin A-containing foods at a time when home production also falls.

The ethnographic instructions also direct investigators to examine whether there are any historical or cultural reasons for rejecting foods containing vitamin A. In Doumen village, the use of carrots declined because of their association with a rejected social policy, as well as their negative features as a cash crop. The association of some foods with poverty, or their designation as starvation foods, may also affect consumption, as appears to be the case for carristel fruit by the Aetas and certain leafy greens in Sheriguda village.

Keys to Explanations and Understandings of Vitamin A Deficiency Symptoms

Data on cultural interpretations and responses to vitamin A deficiency symptoms are most important in areas with clinical deficiency, where they are needed to design effective means to reach the population. However, it is also useful to collect data in areas where frank deficiency is rare, as they provide insights into cultural perceptions about health that have value in relation to intervention development. The sources of these data in the study manual are the case scenario interviews with mother-respondents and interviews with key-informants.

The results of the studies show that nightblindness is clearly recognized as an affliction that can affect women and children in Filingué, among pregnant Aeta women, and among children in Doumen village and Sheriguda village. The fact that nightblindness is identified with a specific term or terms (“bird fuzzy” or “chicken eye” in Doumen village, dundumi in Filingué) suggests that it is a long-standing problem. More advanced symptoms of xerophthalmia were rarely recognized, although local language terms for Bitot’s spots and corneal xerosis were found in Filingué and in Sheriguda village. In Filingué, women recognized these as serious conditions that could degenerate rapidly into blindness.

The study protocol effectively elicited the explanatory models of vitamin A deficiency symptoms, including cultural views of etiology and treatment. Food remedies were associated with treatment in most of the sites. Liver was specifically recommended in Doumen, Filingué, and Sheriguda. By comparing cultural perceptions with medical recommendations, it would be possible to identify similarities and differences between them, and from such an analysis it may be possible to develop recommendations for culturally appropriate actions to improve home management and care-seeking for vitamin A deficiency.

Looking to the Next Steps: From Ethnography to Intervention Design

The field studies demonstrated that data on the key questions can be efficiently collected by using the procedures in the manual. The purpose of the studies was to generate a valid description of the local diet, environment, and culture as these relate to vitamin A. This, in turn, is based on the assumption that local level information is essential for the design and implementation of interventions aimed at instituting and sustaining food-based prevention of vitamin A deficiency. In declaring local level information essential, we want to emphasize that it is a *necessary* compo-

ment for action. But it is obviously not a *sufficient* one, even for intervention planning, it must be part of a process. That process starts prior to the study and continues beyond it, and includes the prioritizing and designing of interventions.

The history of intervention efforts in health, agriculture, economic development, and other domains of modern society is strewn with examples of failures that occurred because the *microlevel* situation was not understood by the people charged with developing and implementing change. At the same time, the list of failures that can be traced to inadequate consideration of the *broader* systems involved in such enterprises, is equally long, if not longer. These include issues of administrative and bureaucratic structures, competing agendas, and competing demands for resources. Hence, the local description this manual is designed to obtain must be matched with information from the other systems that are involved in change.

Intervention planning requires knowledge about the resources that can be mobilized to address problems; the culture of the administrative organizations that have a stake in the actions for change, as well as features of the political and economic processes at macrolevels that affect the proposed actions. It is important to point out that this is not a call for full-scale political and economic analysis of food, agriculture, health, and transportation systems. Just as the ethnography of the microlevel must be focused on key questions if answers are to be obtained within a realistic time frame and budget, key questions about other important systems also must be limited and focused. Although general guidelines about the sectors of information can be established, many of these are context-specific, and the specification of the relevant information emerges, in part, directly from the planning process itself.

In many fields, a great deal of effort is being devoted to setting up effective planning and implementation processes for interventions that integrate sectors of knowledge *about* the community, *from* the community, and about the *broader systems* involved. With respect to food-based vitamin A interventions, the insights and suggestions made by the investigators are a valuable component for planning. Examples of strategies suggested by the field teams included the promotion of growing leafy greens on a year-round basis on fences and rooftops, improving the intake of fat and animal protein by expanding chicken production, promoting the use of coconuts, peanuts, and other nuts as acceptable sources of fat, reinforcing the value of liver in education messages, promoting pumpkin as an ingredient for sauces where it is available year-round, and

promoting the consumption of soups made with leafy greens during pregnancy and lactation.

At the same time, it should be recognized that the suggestions in the chapters are not intended as programs for action. The investigators were not charged with this responsibility, nor should they be. However, it may be the case that the people who carry out these studies are individuals who have responsibilities for intervention development. What needs to be made clear is the distinction between the two functions. The thoughtful and insightful suggestions made by the investigators point to direction for action that needs to be examined in relation to other factors and other stakeholders. The role of the community in the development of interventions is also essential.

We hope the guidelines for “*Community Assessment of Natural Food Sources of Vitamin A*,” and the illustrative case studies in this book, will contribute to the larger effort by facilitating the acquisition of one component of essential data for problem-solving. The goal to which interventions must be directed is the building of sustainable systems with the capacity to provide all members of all societies with that essential nutrient we refer to as vitamin A.

Appendix

Community Assessment of Natural Food Sources of Vitamin A: Guidelines for an Ethnographic Protocol

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Table of Contents

page no.

Background and Acknowledgments	1
Introduction	3
A. Users and Purpose	3
B. Goals	3
C. Program Benefits	4
D. Using this Manual	4
Part One: The Protocol	
I. Context	7
A. The Primary and Secondary Questions Addressed by the Protocol	7
1. What are the Key Foods (Staples, Fruits, Vegetables, Animal Food, Fats/Oils)?	7
2. What are Cultural Beliefs about Key Foods?	7
3. What are Patterns of Food Use?	7
4. How is Food Prepared and Stored?	8
5. What are the Signs and Symptoms of Vitamin A Deficiency?	8
6. Are There Other Important Issues?	10
B. Overview of Design and Timing	10
II. Steps in the Protocol	13
A. Site Selection	13
B. Historical, Ecological, and Cultural Setting for the Food System	13

- C. Field Activities 14
 - 1. Key-Informant Interviews 14
 - 2. Family Food Lists and Selecting the Key Foods 15
 - 3. Market Survey 1 and 2 15
 - a. Task on Food Costs 16
 - b. Procedures for Analysis 18
 - 4. Constructing Food System Data Tables 18
 - a. Preliminary Data 18
 - b. Completion of the Community Food System Data Tables 18
 - c. Search for Little-Used or Unused Vitamin A-Rich Food 24
 - 5. Structured Interviews with Mother-Respondents 25
 - 6. Research Modules 27
 - M1. Pile Sort 28
 - M2. Food Attributes and Differences 31
 - M2a. Optional Directed Free List with Attributes 37
 - M3. Rating Food Attributes 40
 - M4. Household Food Acquisition 46
 - M5. 24-Hour Recalls and Food Frequency 52
 - M6. Hypothetical Health Case Scenarios 60
- D. Preparing the Assessment Report 77

Part Two: Managing the Project

III. Organizing 81

- A. Personnel 81
 - 1. Qualifications and Training 81
 - 2. Translation 82
- B. Administrative Preparation 83
 - 1. Networks and Interactions 83
 - 2. Facilities, Equipment, and Supplies 83

IV. How To 85

- A. Select Key-Informants and Conduct Key-Informant Interviews 85
- B. Conduct a Free List of Foods 86
 - 1. Creating the List 86
 - 2. Expanding the List through Observation 87
 - 3. Analyzing the Free List Data 88
- C. Select Key Foods 88

D. Identify Food Plant and Animal Species	92
1. Plant Identifications	92
2. Animal Identifications	93
E. Determine Nutrient Content of Food	93
F. Select the Sample of Mother-Respondents	94
G. Manage the Data	94

List of Appendices

1. Examples of Research Site Selection	99
2. Checklist of Important Background Information	101
2A. Example of Background Information from the Actas of Canawan, Morong District, Philippines	103
3. Some Reminders about Data-Gathering: Do's and Don'ts	109
4. Notes on Working with Key-Informants	111
5. Recording and Organizing Fieldnotes	113
6. Notes on Translation from Local to National Languages	117
7. An Example of Selecting Key Food Items from Peru	119
8. Vitamin A Content of Food	121
9. Notes on Selecting the Field Data-Gathering Team	123
10. Selecting Representative Samples	125
11. Notes on the Credibility of These Data	129
12. Comments on Using Microcomputers	131
13. Glossary	135

List of Data Forms

1.1 Free List Record Form for Food Names by Individual Key-Informant	89
1.2 Food List by Number of Key-Informants Who Mentioned the Foods	90
1.3 Food List from Most to Least Often Mentioned by Key-Informants	91
2.1 Market Survey Table	17
2.2 Rank Order of Food Prices for Vitamin A-Rich Food from Most to Least Expensive for 1000 RE	19
3.1 Community Food System Data Tables: Food Data Sheet	20
3.2 List of Little-Used or Unused Vitamin A-Rich Foods	26
4.1 Pile Sort Table for Individuals (M1)	30
4.2 Summary of Responses to the Pile Sort (M1)	32

5.1	Attribute Form for Individuals (M2)	35
5.2	Summary of Responses of Food by Attributes (M2)	36
5.3	Individual Form for Food Differences (M2)	38
5.4	Summary of Responses to Food Differences (M2)	39
5.5	Individual Form for Free List by Attribute (M2)	41
5.6	Times Each Food Item Was Mentioned by Attribute (M2)	42
5.7	Summary of Food Most to Least Often Mentioned by Attribute (M2)	43
6.1	Rating of Food Attributes by Individuals (M3)	45
6.2	Summary of Responses to Each Concept/Attribute (M3)	47
6.3	Summary of Responses (M3)	48
7.1	Food Acquisition Form for Individuals (M4)	50
7.2	Summary of Food Acquisition: Source (M4)	53
7.3	Summary of Food Acquisition: Person, Price (M4)	54
7.4	Summary of Food Acquisition: Seasonality (M4)	55
8.1	24-Hour Recall by Individual (M5)	57
8.2	Food Frequency for Individuals (M5)	58
8.3	Summary of Calculated Food Medians by Age Subgroup (M5)	61
8.4	Summary Ranking of Food by Age Subgroup with Attribute Comparison (M5)	62
9.1	Scenario Form for Individuals (M6)	66
9.2	Summary Scenario Form (M6)	69
9.3	Summary Case Scenario Tabulation Sheet: Home Care (M6)	71
9.4	Summary Scenario Form—Healthcare System (M6)	74

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