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The Food and Nutrition Bulletin *encourages letters to the editor regarding issues dealt with in its contents.*

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Editorial

Change in editorship of the *Food and Nutrition Bulletin*

The first volume of the *Food and Nutrition Bulletin* appeared in 1978. Its first editor was Dr. P. S. Venkatachalam of India, Senior Program Officer for the World Hunger Program of the United Nations University (UNU), initiated in 1975 by Dr. Nevin Scrimshaw as acting vice-rector. When Dr. Venkatachalam retired in 1979, Dr. Maria Angelica Tagle of Chile became editor.

When the UNU was reorganized in 1981, Dr. Tagle returned to Chile, and the World Hunger Program became the Food and Nutrition Program for Human and Social Development. Dr. Scrimshaw continued to direct and administer the program from his office at the Massachusetts Institute of Technology (MIT). In 1981 he became editor of the *Bulletin* and has continued in this capacity for 22 years, through the June 2003 issue (Vol. 24, No. 2).

Until this year, nearly all editorial and printing costs were paid by the UNU to the International Nutrition Foundation (INF). The UNU deserves the appreciation of all of the *Bulletin*'s readers for its long-term and continuing support, which has made possible extensive free distribution throughout the developing world. When Dr. Scrimshaw retired from MIT in 1989 and moved to Harvard University, Ms. Edwina Murray became assistant editor. In 1992, the INF and the *Bulletin*'s editorial offices were moved to Charles Street in Boston. Ms. Murray was designated Managing Editor, a responsibility that ended with the March 2003 issue (Vol. 24, No. 1). During her tenure, the *Bulletin* published more pages and occasional supplements, and always mailed on time, which facilitated acceptance of the *Bulletin* for indexing in *Index Medicus* beginning with the March 2002 issue (Vol. 23, No. 1). The *Bulletin* owes a great deal to her competence and dedication. Ms. Susan Karcz became Managing Editor in November 2002, and her first issue was the June 2003 issue (Vol. 24, No. 2).

Until 1997, the *Bulletin* was designed, produced, printed, and distributed in Tokyo; in 1998, the INF assumed full responsibility, and Digital Design Group of Newton, Mass., became responsible for design and production. The current format and timely publication owe much to the skills of this group and its owner, Marc Kaufman. The quality of the text greatly depends on the manuscripts editor, who for many years was James Ricketson in the Tokyo headquarters of UNU. When production was moved to Boston, Mr. Jonathan Harrington, who had worked at the UNU Press, became the manuscripts editor and will continue in this capacity.

Some readers may notice a discrepancy between the year the first volume was published and the current volume number. This is because in 1993, unavoidable production delays at UNU Press resulted in the combining of two years into a single volume (Vol. 15, 1993/1994).

The transition to a new editorial team begins with the current issue. Dr. Scrimshaw, having guided and shaped the journal for 22 years, will provide continuity and contribute as Senior Associate Editor. His most recent contribution has been a campaign to double the subsidized distribution of the *Bulletin* in developing countries, which is progressing well.

Dr. Scrimshaw expresses great satisfaction in having edited the *Bulletin* to be useful to nutrition and health workers in developing countries, and in publishing the majority of its articles describing studies from developing countries.

We hope to continue the capacity-building editorial mission started by Dr. Scrimshaw and will make it a priority to add to the usefulness, distribution, and reputation of the *Food and Nutrition Bulletin*, which remains the best way of reaching the widest distribution of nutrition scientists and leaders throughout the world.

Irwin H. Rosenberg
Editor

A note from the outgoing editor

The United Nations University and the *Food and Nutrition Bulletin* are extremely fortunate in the new Editor, Dr. Irwin Rosenberg. From 1965 to 1970 he served on the faculty of Harvard Medical School, and from 1971 to 1986 he was Professor of Medicine (Gastroenterology and Nutrition) at the University of Chicago. Dr. Rosenberg returned to Boston in 1986 as Director of the USDA Human Nutrition Research Center on Aging at Tufts University. He now serves as the Dean of the Friedman School of Nutrition Science and Policy, Tufts University.

Dr. Rosenberg has just completed 13 years as Editor-in-Chief of *Nutrition Reviews*. He has also served as Chairman of the editorial board of *Nutrition and Clinical Care* from 1997 to 2001, and as Editor-in-Chief of *Nutrition in Clinical Care* since 2002. He has also served on the editorial boards of the *Journal of Nutrition*, *American Journal of Clinical Nutrition*, *Journal of Laboratory and Clinical Medicine*, *ISI Atlas of Science: Medicine*, *Age & Nutrition*, *Nutrition Today*, *Journal of Nutrition, Health & Aging*, and *Integrative Medicine*.

Dr. Rosenberg is senior vice president of the International Nutrition Foundation and vice-chairman of its governing board. He chairs its Advisory Committee to the Ellison Foundation–International Nutrition Foundation Fellowship Program for Advanced Training in Nutrition and Infection. He is also a member of the Institute of Medicine of the National Academy of Sciences. He is an authority on folic acid metabolism and was influential in the decision to add folic acid to flour fortification in the United States as a member of the Folic Acid Subcommittee of the U.S. Food and Drug Administration (FDA). In 2000 he received the FDA Commissioner's Medal. He is a past president of the International Homocysteine Meeting, and is author or coauthor of more than 300 scientific articles and author or editor of nearly 100 books or chapters of books.

Dr. Rosenberg's international experience began with a fellowship to the Dacca Cholera Laboratory, now the International Centre for Diarrhoeal Disease Research, Bangladesh. He has chaired the US/Japan Malnutrition Panel of the U.S. National Institutes of Health and on many World Health Organization (WHO) committees. As a member of the Food and Nutrition Board of the U.S. National Research Council of the National Academy of Sciences, Dr. Rosenberg served as chair of the Board subcommittee on the Interactions of Nutrition and Infection. He is a Fellow of the International Union of Nutritional Sciences.

Nevin S. Scrimshaw
Senior Associate Editor

An epidemic of scurvy in Afghanistan: Assessment and response

Edith Cheung, Roya Mutahar, Fitsum Assefa, Mija-Tesse Ververs, Shah Mahmood Nasiri, Annalies Borrel, and Peter Salama

Editorial note

The following article describing an epidemic of scurvy in mountainous Afghanistan emphasizes the contemporary risk of this ancient deficiency disease, especially in settings of complex emergencies and social-agricultural disruption. Such a setting is, sadly, all too common for serious nutritional emergencies. We intend to give greater emphasis in this journal to assessment and interventions in complex and extended emergencies related to drought, conflict, and cultural disasters.

Abstract

In March 2002, there were reports of a hemorrhagic fever outbreak in western Afghanistan. It was later confirmed that the hemorrhagic symptoms and increased mortality were actually due to scurvy. Most aid workers did not include scurvy in the initial differential diagnosis because it is uncommon throughout the world and has mainly been reported in refugee populations in recent times. A rapid assessment confirmed the cases clinically, estimated a prevalence rate of 6.3% (a severe public health problem), and determined that the attack rates peaked each year in January and February (the end of the winter). Many Afghans have limited dietary diversity due to isolated locations, lengthy winters, the continuing drought of the last four years, asset depletion, and loss of livelihood. After numerous food and fortification options to prevent future outbreaks had been considered, vitamin C tablet supplementation was selected because of the relatively rapid response time as compared with other prevention methods. A three-month course of vitamin C tablets was distributed to 827 villages in at-risk areas. The tablets were acceptable and compliance was good. No cases of scurvy were reported for the winter of 2002–03. The case study from Afghanistan demonstrates that scurvy can occur in nonrefugee or nondisplaced populations; vitamin C supplementation can be an effective prevention strategy; there is an urgent need to develop field-friendly techniques to diagnose micronutrient-deficiency diseases; food-security tools should be used to assess and predict risks of nutritional deficiencies; and the humanitarian community should address prevention of scurvy in outbreak-prone areas.

Key words: Afghanistan, emergencies, micronutrient deficiency, scurvy, vitamin C

Scurvy is caused by insufficient consumption of vitamin C. The normal human body stores of vitamin C last two to three months [1, 2], and scurvy can appear when these stores become depleted, as it did during the six-month winter period in Afghanistan. The typical Afghan diet is limited and monotonous, consisting of wheat bread and tea, occasionally supplemented with dairy products and wild green leaves. In remote, mountainous areas, there is little or no consumption of fresh fruits and vegetables during the winter, which has been compounded by the four-year drought and armed conflict that have depleted assets and limited the variety of possible livelihood strategies. Early signs of scurvy include lassitude, weakness, irritability, dull pains in the muscles or joints of the legs and feet, and weight loss. The main function of vitamin C is to maintain collagen formation and wound healing, so the main clinical symptoms of scurvy are follicular hyperkeratosis, hemorrhagic manifestations, swollen

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joints, swollen bleeding gums, and peripheral edema [3]. Concurrent anemia may occur more frequently in emergency situations due to the effect of vitamin C on blood formation, folic acid metabolism, undernutrition, and concurrent infections. Older persons are at increased risk of scurvy if diet diversity is limited, as are people who do physically demanding work and women of reproductive age, especially during pregnancy due to increased needs for fetal development [4]. Scurvy can be prevented by meeting the recommended daily requirement of 30 mg of vitamin C [5]; however, lower doses of 6.5 to 10 mg per day have been found to prevent scurvy [1, 3, 6, 7].

There are three main criteria for the diagnosis of scurvy: dietary history, clinical manifestations, and biochemical indices. The serum level of ascorbic acid, which has a linear relationship with vitamin C intake [8], appears to be the most sensitive indicator of current diet. According to the World Health Organization (WHO), the presence of a single clinical case of scurvy constitutes a public health problem (table 1).

Scurvy has been historically associated with lengthy sea voyages, when sailors did not have access to fresh sources of vitamin C. In recent times, the only documented outbreaks have been in refugee populations in the Horn of Africa that were dependent for extended periods on limited food rations or had limited access to fresh food (Ethiopia [11], Kenya [12], Somalia [11, 13] and Sudan [10, 14]). Recently, scurvy was found outside of Africa among Bhutanese refugees in Nepal [15]. Refugee populations that are completely dependent on general rations for months or longer are at risk, given that a typical daily ration does not contain sufficient vitamin C. Effective, feasible, and affordable interventions to address scurvy outbreaks have been difficult to identify. The World Food Programme (WFP) and the Office of the United Nations High Commissioner for Refugees (UNHCR) have provided fortified blended foods [14] or increased the ration size to allow for the exchange of staple foods for fresh fruits and vegetables in the ration [16]. Outbreaks of scurvy are less commonly reported among nonrefugee populations; however, scurvy has been reported in the general population in rural parts of Afghanistan since 2001.

The complex emergency in Afghanistan, consisting of devastation from armed conflict, sudden political and economic changes, and natural disasters, has had severe consequences for food security, with a serious impact on nutrition. Numerous nutrition surveys in Afghanistan have found prevalence rates for stunting of 40% to 60% (height-for-age Z-score <–2), prevalence rates for wasting of 6% to 12% (weight-for-height Z-score <–2), and a high prevalence of micronutrient deficiencies (iodine, vitamin A, iron, and vitamin C). In addition, some studies have reported rates of mortality in children less than five years of age as high as 2.51 to 5.9 per 10,000 per day [17]. A main underlying cause of malnutrition in Afghanistan is chronic food insecurity leading to lack of dietary diversity, which has an effect on micronutrient status, acute malnutrition, chronic malnutrition, and mortality among children under five years of age [18].

The capacity of populations to diversify their diet in Afghanistan is affected by four significant factors to varying degrees, depending on the area:

» Location. Many areas are isolated due to the mountainous terrain and lack of roads. The snow in winter makes many areas completely inaccessible at times, even by helicopter. This affects opportunities for trade, access to markets, and access of the international community to provide aid.
» Climate. The winter can last up to six months, with cold weather and significant snowfall inhibiting most fruit and vegetable cultivation for half the year.
» Loss of productive capacity due to drought. The four-year drought has resulted in a reduction of cultivable land and thus agricultural production, with the main staple, wheat, being prioritized over diversified food production. Moreover, the drought has also significantly reduced fruit trees, nuts, and other vegetation that families customarily used to preserve for the lengthy winters.
» Loss of livelihoods and asset depletion. Drought and conflict have resulted in loss of assets, which decreases household purchasing power and ability to diversify the diet. In addition, the reduction in livestock, such as goats, sheep, and camels, has decreased available animal labor to cultivate land and also dairy and meat consumption.

Scurvy is believed to be widespread in Afghani-

TABLE 1. WHO provisional criteria for the severity of the public health problem of vitamin C deficiency

Indicator	Mild	Moderate	Severe
Clinical	1 clinical case; < 1% of population in age group concerned	1%–4% of population in age group concerned	≥ 5% of population in age group concerned
Biochemical/serum ascorbic acid (mg/100ml)			
< 0.2	10%–29%	30%–49%	≥ 50%
< 0.3	30%–49%	50%–69%	≥ 70%

Source: refs. 9, 10.

stan and was first documented in Kohistan District in April 2001. This outbreak affected at least 10% of the population [19], demonstrating that scurvy may also exist unreported in other areas of Afghanistan. This under-reporting was later further supported by the WFP Vulnerability Assessment Mapping (VAM) (see fig. 1) and the UNICEF Nutrition Survey Database for Afghanistan (table 2), both tools revealing that scurvy can be found across the country, being endemic in some areas, especially in northwest Afghanistan. Scurvy may have gone unnoticed because there was no functioning health system with a surveillance system prior to September 11, 2001.

Assessment and investigation of the outbreak

Taiwara District in Ghor Province of western Afghanistan has a population of 79,000. Taiwara is a one-day car journey from the nearest town and hospital, has few functioning health facilities, and is usually completely inaccessible throughout the six-month winter period.

In early March 2002, Action Contre la Faim (ACF) reported 20 deaths and 47 cases of scurvy in Taiwara, all with similar symptoms, consisting of pain in the joints leading to inability to walk, bleeding gums and loss of teeth, swollen joints, edema of the lower limbs, and ecchimosis (bruising) on the legs. Because of the hemorrhagic symptoms and sudden deaths, a hemorrhagic fever outbreak was suspected and reported by the media [21, 22]. Expatriates were evacuated and an investigation team from ACF, the Ministry of Health, and WHO arrived to confirm the outbreak.

Scurvy was diagnosed through dietary histories and clinical confirmation. Biochemical testing was not feasible because of the fragility of the samples needed for ascorbic acid testing. In addition, because of the lack of health and nutrition infrastructure and services before September 11, 2001, there was no health and nutrition sentinel surveillance system and no vital registration in most of Afghanistan, especially in remote areas. The only available records were through interviews with key informants such as village chiefs, heads of households, and national health staff, who provided information about a regularly occurring disease called *sialengi* or "black legs," characterized by bleeding gums and death. Because of the lack of an existing case definition, that used by the investigating team consisted of the presence of one of three clinical criteria: painful legs and/

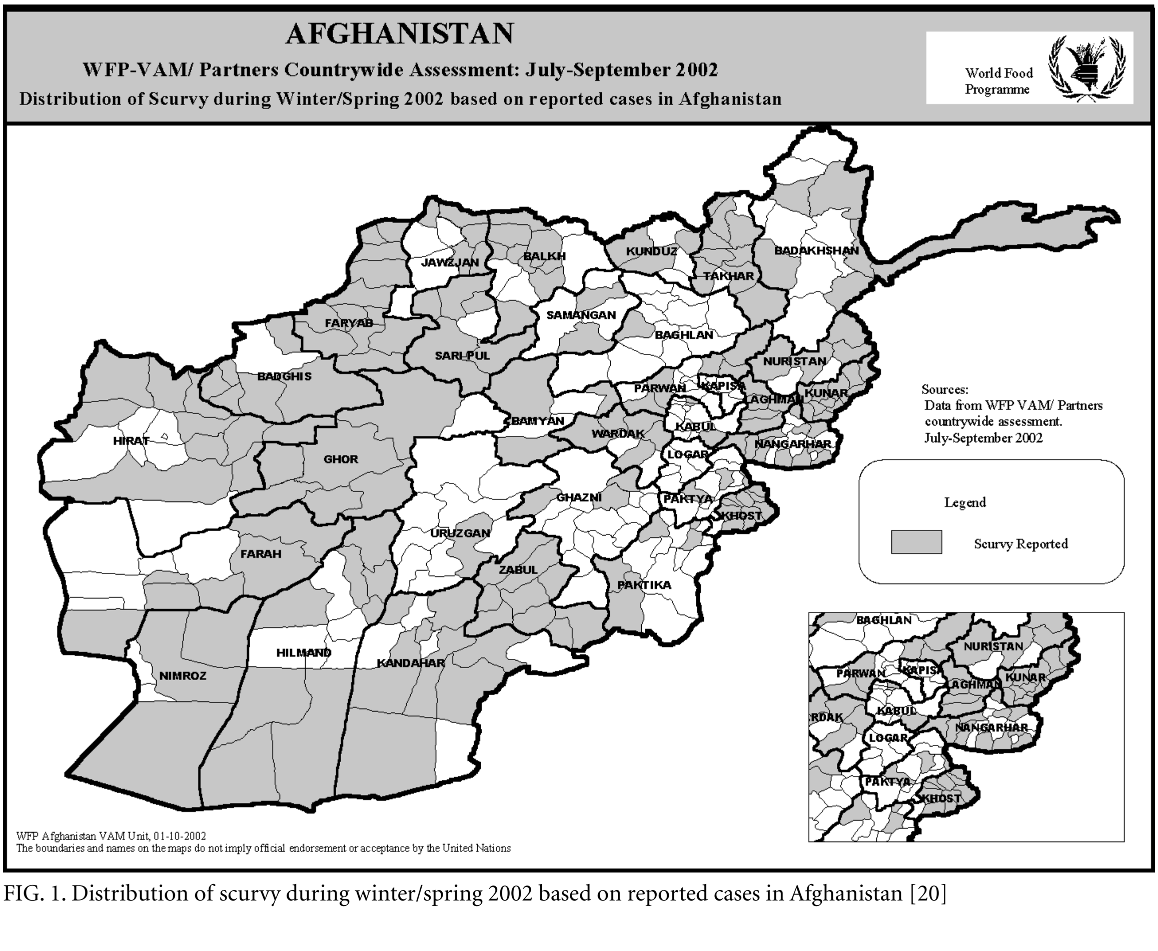

FIG. 1. Distribution of scurvy during winter/spring 2002 based on reported cases in Afghanistan [20]

TABLE 2. Nutrition surveys of vitamin C status in Afghan populations, extracted from UNICEF's Nutrition Survey Database for Afghanistan

Title	Sampling method	Sample population	Scurvy findings	Organization
Malnutrition and Mortality in Kohistan District, Afghanistan, April 2001	2-stage, 30-cluster survey	3,165 people in 278 households	6.5% (7/108) death due to scurvy	Save the Children US, CDC
Report Number 2, GOAL Samangan Province, Nutrition Survey, May 29–June 24, 2002	2-stage, 30-cluster survey	Total, 1,493: 676 children 0-59 mo, 817 women 15–49 yr	0.1% of children 0–59 mo had signs of deficiency	GOAL
Nutrition and Health Survey, Badghis Province, Afghanistan, February–March 2001	2-stage, 30-cluster survey	Total, 1,100: 545 children < 5 yr, 555 women 15–49 yr	3.1% of children < 5 yr had at least 1 sign of deficiency	UNICEF, CDC
Report Number 1, GOAL Jawzjan Province, Nutrition Survey, April 9–24, 2002	2-stage, 30-cluster survey	Total, 1,627: 717 children 0-59 mo, 910 women 15–49 yr	0.6% children 0–59 mo had at least 1 sign of deficiency	GOAL
Vulnerability survey in Northern Afghanistan (Faryab Province and IDP camps), January 2001	Clinic population and nearby inhabitants only	813	8.7% reported cases of scurvy	MSF Belgium
Nutritional Survey Report, Kohistan, Faryab Province, April 4–10, 2001	2-stage, 30-cluster survey	708 children 6–59 mo	250 cases of scurvy found and treated	Save the Children US
Nutrition and Health Survey, Maslakh IDPs Camp, Herat, Afghanistan, April 2002	Systematic random sampling	Total, 379: 178 children < 5 yr, 201 women 15–49 yr	4.5% of children < 5 yr had at least 1 sign of deficiency	UNICEF

CDC, US Centers for Disease Control and Prevention; GOAL; MSF, Médecins sans frontières. The development of the vitamin C map and inclusion of vitamin C status in nutrition surveys were propagated and supported after a widely publicized outbreak in Taiwara District, Ghor Province, in March 2002.

FIG. 2. Close-up of perifollicular hemorrhaging on the legs of an Afghan woman

FIG. 3. Bleeding gums, a sign of scurvy, on an Afghan boy

or joints, hemorrhagic gingivitis (bleeding gums), and ecchimosis on the legs. (See figs. 2 and 3.)

After determining the case definition, the investigation team provided scurvy education to 25 village health workers, including signs and symptoms, treatment protocols, and morbidity and mortality data collection. The investigations were based on counting of recent deaths at graveyards, verbal autopsy for recent deaths, search for cases and collection of case histories, clinical examinations, and interviews with patients and their families and village inhabitants and elders. The recall period for investigating mortality was for the previous three months beginning after *Eid* (the period from December 16, 2001, to March 16, 2002). Because there was limited secondary source material, data were collected primarily through focus groups and key informants. Community health workers then used a questionnaire to collect data in order to calculate prevalence and fatality rates.

During the investigation period, the team found 18 suspected cases of scurvy in Zarbid Village, Taiwara District; 8 patients (44%) were male and 10 (56%) were female. The median age was 35 years. Twelve of the suspected cases were clinically confirmed by the team, and 10 of these 12 (83%) had first developed signs two months before, in January and February 2002 [23]. In addition, four children between three and five years old were observed who could not stand up because of pain in their joints. It was also reported that six deaths in January and February were attributed to scurvy. The range of time between the onset of symptoms and death was 6 to 31 days. All persons with scurvy who were over 50 years old died. In Taiwara District, over a period of three months, the scurvy attack rate was 6.3% (4,588 cases in a population of 72,835), which, according to WHO standards, constitutes a severe health problem (table 1). Among those with scurvy, a 7% case fatality rate (323 deaths among 4,588 scurvy cases) was reported. Overall, during this period, 20% of all deaths (323 of 1,615) were due to scurvy [23]. By early March, the prevalence of scurvy had decreased to 3.9%. None of the people in Zarbid Village in Taiwara District who died had eaten *seech* (a local wild food, one of the few vegetables that becomes available in March, the beginning of spring), but 50% of survivors reported that they had consumed this green plant [23]. Key informants reported that *sialengi* regularly occurred in the area in previous years; however, *sialengi* had afflicted more people with increased severity that year.

In bordering Chaghcharan District, hundreds of cases of scurvy were also reported during the same period [23]. WHO and Médecins du Monde investigated the Chaghcharan outbreak and found that the prevalence of scurvy began to decline when the end of winter was near, and that the availability of various wild plants and some vegetables and fruits may have prevented new scurvy cases.

In March 2002, it was confirmed clinically that the outbreak was not hemorrhagic fever but scurvy. In addition to the presence of contributing factors for scurvy, the signs and symptoms according to the case definition were apparent in reported and clinically confirmed cases. The distribution of cases also followed vulnerable group patterns, as described by WHO, affecting more women than men and more older people. Scurvy also responded to treatment with vitamin C.

Intervention: design and approach

As an immediate short-term intervention, UNICEF, in partnership with ACF, treated 5,000 people for scurvy by distributing 252,000 vitamin C tablets in Taiwara and neighboring Passaband [24]. The curative treatment regime used was 200 mg/day for two weeks for children and 1 g/day for two weeks for adults. The symptoms began to subside after the vitamin C tablets were consumed. Unfortunately, the scurvy outbreak and findings were identified too late for timely prevention. The first cases were reported locally in November 2001, and the epidemic peaked around January and February 2002. In addition, standardized protocols and photographs of cases were developed and distributed to assist in searching for cases.

Food options were investigated for medium- and long-term interventions to prevent future winter outbreaks. Distributing fresh foods was not feasible, because some areas are inaccessible during the six-month winter season. Germination of pulses was also considered, but the acceptability and understanding of germination in Afghan populations had not been tested, raising the risk of a repeated outbreak of scurvy. ACF analyzed canned tomato paste and found that the vitamin C content was significantly less than that reported on the label. In addition, cooking and taste preferences had not been investigated, and moving canned goods to large populations was expected to be difficult and expensive. Home gardening was not an option because of the significant amount of time required to implement a program, the lack of water resulting from the four-year drought, and the long, cold winters. Fortification was also considered, but no suitable vehicle was found that would protect vitamin C from being oxidized in the presence of heat or light [25]. The inclusion of fortified cereals in all rations was advised but was practiced only in selected areas. Thus, after more sustainable options of preventing scurvy had been investigated and ruled out, supplementation with vitamin C remained the only option. Even here, compliance was clearly a problem because of the need for regular doses [10]. In other emergency situations, distribution of vitamin C tablets has had limited success because of problems with logistics and compliance [10].

After investigating the above intervention options as part of a national prevention campaign targeting over 1 million people in high-risk areas, UNICEF and ACF decided to provide blanket distribution of vitamin C tablets and health education to all children and adults in 827 villages (168,598 adults and 42,952 children, for a total population of 211,550) in Taiwara and Passaband Districts in Ghor Province. Adults received 10 tablets (1 tablet per week), each containing 250 mg of vitamin C; children under five years of age received 20 tablets (2 tablets per week), each containing 50 mg of vitamin C. The tablets were sufficient to prevent scurvy for two and a half months. The risk of toxicity was considered to be extremely low [26, 27]. In addition, to increase the micronutrient content of the regular ration of wheat, lentils, vegetable oil, and iodized salt, children under five received fortified blended food (10 kg of UNIMIX and 2.5 kg of vegetable oil) distributed by ACF and other organizations. Unfortunately, the vitamin C content of fortified blended food such as UNIMIX or CSB (corn soy blend) (40 mg/100 g) can be reduced by 50% to 82% after cooking losses [28]. Moreover, the amount of vitamin C actually ingested by the intended beneficiary would then be further reduced even more due to normal intrahousehold sharing.

Making use of the existing community networks, one representative of each village, accompanied by a few villagers, came to the distribution spot to receive the one-time food distribution, the 3-month supply of vitamin C, and nutrition and hygiene education, along with specific information on vitamin C dosing (the quantities per week for adults and children). Each representative was in charge of redistributing the items among the heads of families in his village and instructing them about the frequencies and quantities of vitamin C dosing.

Because of the need to identify outbreaks early, the need for project monitoring, and the inaccessibility of Taiwara and Passaband by road during the winter months, UNICEF, ACF, and the Ministry of Health undertook a helicopter mission to Ghor Province in February 2003. The monitoring team designed a two-page questionnaire to assess the presence of scurvy, the use and acceptability of vitamin C tablets, access to vitamin C–rich foods, and knowledge of scurvy. The team was divided into two pairs of women and one group of three men, and each group conducted same-gender focus-group discussions in different areas of each village. The men on the monitoring team led a focus-group discussion with the village leaders, and the women led a discussion with the available women in each village. A total of 15 focus-group discussions were conducted, and information was cross-checked for analysis. A major constraint was that the areas visited were determined by the flying conditions, and the focus groups could run for only approximately 20 minutes because of poor weather and visibility for the helicopter (see fig. 4).

According to the focus groups, there were no cases of scurvy reported that winter, but there had been an outbreak in the previous winter during March 2002. Most of those interviewed said that scurvy was "there every year" in the winter; however, this was the first year that there were no scurvy cases in their villages (box 1). Most reported that they felt better the past winter than in previous winters.

All those interviewed stated that vitamin C tablets were received at the household level during December 2002 or January 2003. Most of the focus groups reported that children received 100 mg and adults received 250 mg of vitamin C per week, according to protocols. No tablets were reported to have been sold or traded. Although some higher intakes were reported (300 mg/week for children and 750 mg/week for adults), they were still at nontoxic levels. Some reported that they did not receive enough vitamin C to last through the winter because of this increased rate of consumption. Only one person out of the more than 120 participants in the focus-group discussions presented large quantities of vitamin C when the participants were asked to show their remaining household doses. All of those interviewed found that vitamin C tablets were acceptable with regard to taste and dosing schedule, even for children.

With regard to food sources of vitamin C, most discussants had access to a few fruits and vegetables (cultivated or wild) during all seasons except winter, with their last consumption of fresh fruits or vegetables around October. Only one focus group reported that there were fruits and vegetables in a nearby bazaar (brought in from Herat); however, these were considered to be unaffordable. Because vitamin C is water-soluble and heat-labile, raw fruits and vegetables are

FIG. 4. Due to winter isolation, flying in by helicopter was the only method of reaching beneficiaries in most villages in Taiwara and Passaband Districts of Ghor Province

BOX 1. Reports of local people of prevalence of *sialengi*

"*Sialengi* has been here since the adults were children, but not this winter."

Woman from Yegin Village, Taiwara District

"Except for this year, there is *sialengi* here each year at the end of winter."

Man from Tourma Village, Passaband District

"This is the first year without *sialengi*."

Woman from Chesma Khoni Village, Taiwara District

"I feel less body pains and no more leg pains. Older people and children have not had *sialengi*."

Man from Kali Khon Bula Village, Passaband District higher in vitamin C; however, only fruits, onions, tomatoes, and carrots were consumed raw. Wild vegetables with possible high vitamin C content were reported to be inedible when eaten raw because of their bad taste (*seech*, a small green and white plant; *sertak* and *hushein*, green plants; and *sheresh*, a wild plant prepared as tea and used topically to treat scurvy).

Nutrition education was planned and conducted in many areas but was not provided in the villages visited because of poor accessibility. Consequently, most of the participants in the focus groups did not know that scurvy (*sialengi*) was caused by lack of vitamin C due to inadequate consumption of fresh fruits and vegetables. Most people said that *sialengi* was caused by cold weather, and some thought that it was contagious. The participants in the focus groups knew that there was a relationship between *sialengi* and vitamin C. They knew that *sialengi* could be treated with vitamin C, but they did not know that vitamin C could also be used preventively. The majority also did not know that vitamin C could be obtained from fruits and vegetables as well as from tablets.

The prevention of scurvy during this past year may be attributable to the distribution of vitamin C tablets. The cost of the tablets required to prevent scurvy in one person for one month was US$0.003 (about one-third of one cent). Addition of the cost of experienced staff and transportation to deliver supplements and fortified food to such remote areas increased the cost to US$1.28 per person per month.

Conclusions and recommendations

Afghanistan has chronic nutrition problems, including micronutrient-deficiency diseases such as scurvy, demonstrating that scurvy is not confined to Africa or to refugee populations. Drought, conflict, geography, and climate are contributing factors to the lack of dietary diversity. Thus, sustainable long-term strategies to address scurvy in large, nonrefugee populations need to be developed. There is also a need for more documentation on micronutrient-deficiency diseases in emergencies, despite possible methodological constraints. Organizations and aid workers should be aware that regions of Afghanistan are prone to micronutrient-deficiency diseases, and scurvy outbreaks have occurred annually in parts of Afghanistan from December through February. Food and nutrition projects should be prepared to address micronutrient needs.

Distribution of vitamin C tablets successfully prevented scurvy in an area where a winter outbreak typically occurs. There were no reported outbreaks of scurvy this past winter in western Afghanistan. Using tablets as a prevention strategy is clearly not a sustainable solution. However, because this was an urgent situation, it was determined that it would be more ethically correct to implement an immediate prevention strategy rather than to wait to use a more sustainable strategy for delivering vitamin C. Noncompliance, which is typically a major problem, was not apparent in this case, possibly because of health education provided at the time of distribution and/or lack of access to a marketplace to sell the tablets. Another problem often associated with vitamin C supplements is the need for at least weekly distribution, which was not applicable here because sufficient amounts for three months were distributed to the villages, along with education on dosing, and because there were reliable community distribution structures. Thus, during the three-month target period, concerns about low cost effectiveness due to poor coverage and compliance were not apparent, because proper distribution was ensured through the established community networks and village leaders. The use of National Immunization Days to deliver vitamin C to remote areas with no other distribution mechanism should also be considered for the future.

The establishment of surveillance systems to detect micronutrient-deficiency diseases is essential for their control [29]. However, food and nutrition surveillance systems take a lot of time to become established and usually require a functioning health and nutrition structure to be in place first. An early-warning system in high-risk areas, using clear definitions, should be coordinated at the district, provincial, regional, and national levels and should be adaptable to regions with few or no health facilities. Regular food-security assessments would also be useful to predict outbreaks of micronutrient-deficiency diseases. In addition, nutrition education and training on feasible methods of preventing scurvy in future winters should be provided to all at-risk populations. Although scurvy was prevented in this population in this particular season, people should receive nutrition education so that they can make the wisest possible choices for themselves and their families on the basis of knowledge of what exactly causes scurvy and how it can be prevented through food choices, production of durable food sources of vitamin C that can be saved and consumed during long winters, and vitamin C–saving preparation and cooking techniques.

The situation in Afghanistan supports previous findings [14] that if scurvy is present, there are likely to be other micronutrient-deficiency diseases, and any sustainable response needs to take this into account. Iron deficiency is a widespread problem globally. Vitamin C can increase the bioavailability and absorption of nonheme and heme iron in a meal by 200% to 600% [30], demonstrating the synergistic benefits of multi-micronutrient strategies. Although it is important to provide fortified blended food in rations, this may be inadequate for meeting vitamin C requirements, and therefore supplementation may also be needed. Multiple micronutrient supplementation would help address the many micronutrient diseases in Afghanistan, but it is unsustainable in the long term. Multimicronutrient fortification of a food for more sustainable prevention of scurvy and other deficiency diseases is being considered and investigated. In the meantime, attempts to improve the quality of food aid rations should continue, since some Afghan populations are dependent on food aid during the winter and have little opportunity to vary their diet with fruits, vegetables, and fortified foods that contain vitamin C.

The case of Afghanistan demonstrates the need to develop sustainable vitamin C strategies for scurvy-prone areas. Scurvy in refugee camps has been addressed, and guidelines exist for the prevention and management of scurvy in such settings [16]. There is now a need to develop strategies to address micronutrient-deficiency diseases in large, geographically remote regions. Clearly this is much more difficult and complex, and the humanitarian community will need to go beyond some of the interventions that work well in camps. Home gardening has low feasibility during the long winter months unless it is done in plastic greenhouses. Germinated wheat, a good source of vitamin C, is familiar to Afghans, but it is usually consumed cooked as *samanak*; investigations are needed to see whether people are willing to consume it raw.

Although rapid assessments can be used to identify high-risk areas for targeting, field-friendly methods of confirming micronutrient-deficiency diseases are also urgently needed. There is a need to validate a standard clinical case definition and to include it in surveillance of endemic or outbreak-prone areas. The clinical case definition and treatment protocol was found to be useful and effective, but both need further testing in future outbreaks, and the sensitivity and specificity of case definitions need to be evaluated by comparing them with the gold-standard laboratory definition. Biochemical tests require sanitary conditions in a controlled environment, which is difficult when taking samples in the field, transporting samples within a country, and sending samples to internationally specialized laboratories for analysis. Moreover, the time required to do all this can affect the sample results. Biochemical analysis and diagnosis requires laboratory skills and knowledge of laboratory methods that are uncommon in emergencies. There is also a need to introduce and mainstream the clinical assessment and diagnosis of micronutrient deficiencies into common assessment tools, such as nutrition surveys, possibly by training field survey staff to identify micronutrient-deficiency diseases. There is a great need for field-friendly methods and protocols to detect micronutrient-deficiency diseases in emergency situations where there is no existing health structure. This often makes it difficult to predict outbreaks and plan for biochemical analysis. Micronutrient-deficiency diseases can also be addressed or prevented by training surveyors, field staff, and clinical staff about how to identify micronutrient deficiencies and how to actively seek cases. In addition, there need to be good food-security assessments of food diversity to assist in predicting potential outbreaks of micronutrient-deficiency diseases in emergencies.

There were many significant limitations in the attempts to address scurvy in Afghanistan. An important limitation is the difficulty of doing biochemical testing of scurvy in the field. Although clinical diagnosis and key informant interviews with village leaders and local clinical staff demonstrated scurvy, biochemical confirmation would have strengthened the evidence. Another limitation posed by geography and climate was the restricted time available to implement and conduct monitoring of the project. Because of the limitations of time and geography, we could not employ population-based methods. However, the success of the project is supported by the fact that there have not been any reports of scurvy this past winter. Another major issue was the lack of nutrition information and surveillance systems, which strongly impeded the provision of adequate and timely services and assistance to the people of Afghanistan.

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Food patterns during an economic crisis among pregnant women in Purworejo District, Central Java, Indonesia

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Abstract

A cross-sectional study was conducted between 1996 and 1998. Six 24-hour recalls were performed during the second trimester of pregnancy among 450 women in Purworejo District, Central Java, Indonesia. The objectives of the study were to assess the food intake and food pattern among pregnant women before and during the economic crisis. Before the crisis, rich women had the highest intakes of animal foods, fats and oils, and sugar. Food intake among the urban poor and the rural landless poor subgroups was influenced by the emerging economic crisis. Although the price of rice increased, the intake of rice also increased among all subgroups. Rural poor women with access to rice fields increased their intake of rice and decreased their intake of nonrice staple foods ($p < .05$*). There were significant decreases in the consumption of chicken by rich women and rural poor women with access to rice fields (*$p < .05$*). Rice was a strongly inferior good and remained an important supplier of energy, protein, and carbohydrate. Nuts and pulses were important suppliers of calcium and iron, and vegetables were an important supplier of vitamin A. Rich women increased their intake of nuts and pulses, vegetables, fats and oils, and sugar when their intake of rice increased (*$p < .05$*). The food patterns were based on rice, nuts and pulses, and vegetables, i.e., plant food. All but the rich women decreased their intake of nutritious foods such as meat, chicken, and fruits. The intake of nuts and pulses and of vegetables increased, whereas the intake of cooking oil and sugar remained constant.*

Key words: Economic crisis, food intake, food pattern, Indonesia, pregnancy

Introduction

During the past three decades, Indonesia's economy has improved substantially. The per capita gross national product (GNP) grew by 4.5% per year in the 1980s, and by 1990 per capita income had reached US$570. The incidence of rural poverty declined from over 40% in 1976 to about 14% in 1997 [1]. During the period from 1995 to 1997, the nutritional requirements of 2,550 kcal/day could still be met [2]. Although economic development in Indonesia brought higher standards of living and better diets, four important nutritional deficiency conditions still exist in Indonesia. These are protein–energy malnutrition (particularly in children under five years of age), anemia, vitamin A deficiency, and iodine-deficiency disorders [3]. Even so, a national survey showed that there was a significant decline in the prevalence of iron-deficiency anemia in pregnant women, from 63.5% in 1992 to 50.9% in 1995 [1]. Further, the national prevalence of iodine-deficiency disorders decreased from 37.5% in 1980–82 to 23.2% in 1988–90 [2].

Nutrition policies, programs, and activities in Indonesia have developed stage by stage. In the long term, the most appropriate strategies to reduce nutrient deficiencies among pregnant women and children include improvement in dietary intake and fortification of foods with nutrients [3]. The latter is necessary despite an abundant supply of nutritious foods, because, as described above, micronutrient deficiency,

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especially anemia, remains common.

Starting in August 1997, Indonesia unfortunately experienced a radical and rapid deterioration in its economic situation as part of the financial crisis that severely affected many Asian countries [4]. The prices of food and other basic necessities rose sharply amidst rapidly increasing unemployment, thus seriously eroding the purchasing power of large segments of the population. The value of the Indonesian rupiah in June 1998 was a mere one-sixth of its precrisis value in July 1997 [5]. The Central Bureau of Statistics reported in July 1998 that the number of Indonesians living below the poverty level had soared to 79.4 million, or about 40% of the population [6]. Between 1997 and 1998, the Indonesian per capita GNP declined by 41%, from US$1,089 to US$640 [7].

During the crisis, low-income families probably could not afford their usual diet. However, a change in food habits involves not only an acceptance of new foods, but also decreases and increases in the quantities and varieties of foods with which people are already familiar. Therefore, it is difficult for people to change their food habits, even during a crisis [8]. Still, when ecological and economic conditions change, it is surprising how rapidly people change even their staple foods [9]. The objective of this study was to describe the consequences of the economic crisis with respect to food intake and food patterns among pregnant women before and during the crisis in Purworejo District, Central Java, Indonesia.

Conceptual model

For normal goods, the demand will decrease when prices increase. In contrast, what is labeled a Giffen good in economics is a strongly inferior good for which the quantity demanded increases as the price rises [10]. In Indonesia, this effect is likely when the price of rice increases. In this situation, rice intake increases and people reduce their demand for some other nutritious foods (meat, chicken, etc.). Eventually, rice will be the only staple food consumed. Thus, it seems reasonable to expect changes in the entire pattern of food intake in response to the crisis. However, it would be naive to expect a uniform response to price increases among people, as the income level or wealth of the household must naturally also be an important determinant of adjustments to price changes. To summarize, food intakes are determined by, among other things, food prices, the income or wealth of households, and the culture. Thus, we can expect different responses to the crisis in different households.

For this study in Indonesia, we used the entitlement theory developed by Sen [11] in order to study different groups of households and identify the most vulnerable ones. Sen's theory suggests that starvation is not a consequence of the physical shortage of food, but rather is caused by a rapid increase in the price of foods while wages remain stable. Thus, food production may still be sufficient in order to sustain the availability of food in the legal market. Sen's theory focuses on the ability of people to obtain food when the price of food rapidly increases. Wealthy people obviously have a higher chance of success in handling the crisis. Further, peasants or farmers can obtain food directly from their own fields without going through the legal market, or they can sell their products in the market. In contrast, the landless or laborers are employed in exchange for wages, and they cannot avoid the risk of starvation. We have previously described this theory in detail [12].

Based on Sen's theory, our hypotheses regarding pregnant Indonesian women are as follows. First, rich pregnant women are able to handle a crisis. Second, urban poor and rural poor landless women are vulnerable groups at high risk for inadequate dietary intake because they work for wages. Third, pregnant women in rural areas whose families own or cultivate rice fields have more direct access to basic foods such as rice. They may increase their income and welfare when rice prices increase, since they are rice sellers.

Methods

Study site and selection of subjects

The study was conducted in Purworejo District, Central Java, Indonesia. This district is composed of 16 subdistricts (*kecamatan*) and 494 villages (*desa*). According to the 1998 census, Purworejo had a population of 756,900 (372,000 males and 384,900 females), and approximately 87% of the population lived in rural areas [13].

The dietary study was part of a larger community-based trial on the effect of vitamin A and zinc supplementation on maternal and infant morbidity, as well as the effect of reproduction on maternal nutritional status. In the period 1996–98, 846 newly pregnant women were enrolled through a surveillance system operated by the Community Health and Nutrition Research Laboratories (CHN-RL).

Of the 846 women, 232 were enrolled before the dietary study was implemented; 121 were lost at the peak of the economic crisis because of difficulties in the field; 10 were too shy, mentally ill, or sick to be interviewed; 11 refused; 12 had incomplete information; and 10 were lost for other reasons. Hence, a final sample of 450 pregnant women was included in the analyses of dietary intake. The study is further described elsewhere [12]. The ethics committees of the Medical Faculties of Umeå University, Umeå, Sweden, and the Faculty of Medicine, University of Gadjah Mada, Yogyakarta, Indonesia, approved the study.

Data collection

Dietary intake data on the type and amount of food and beverages consumed by individual pregnant women during the previous 24 hours were collected once each trimester. For this part of the study, only data from the second trimester are utilized. Six 24-hour recalls were randomly distributed over the five different days in the Javanese calendar. Twenty-two female interviewers with a high-school education carried out the interviews in the homes of the women. Editing of data forms was conducted in the field within a few days of data collection. Visual aids such as wooden food models (banana, fish, meat, tomato, bread, etc.) and calibrated eating utensils (plate, teaspoon, bowl, and glass) were used to estimate amounts of food eaten. Detailed descriptions of all foods and beverages as well as vitamin and mineral supplements consumed, together with cooking methods and the ingredients of recipes, were recorded by the interviewers. A computerized data analysis system (Inafood) was developed to convert the food data to nutrient intakes. Values for nutrient intakes were obtained from Indonesian and other food-composition tables [14–17]. Vitamin A values were predominantly taken from the food-composition table in de Pee and Bloom [18].

Data on household demographic characteristics, socioeconomic status, and reproductive history were collected during home visits in 1997 by trained CHN-RL fieldworkers. Data on food prices were collected from the Development and Planning Board of the District Level and the Central Bureau of Statistics [13, 19–20]. Information about access to rice fields was collected by field interviewers during the same year as the dietary intake data were collected.

In accordance with the conceptual model, the study population was divided into four socioeconomic groups. The *rich* group was defined by ownership of a car or motorbike, irrespective of whether the family lived in a rural or an urban area and irrespective of access to rice fields. The *urban poor* group was defined as those living in an urban area without fulfilling the criterion for rich. The *rural poor* group was defined as those living in a rural area without fulfilling the criterion for rich. In the last step, the rural poor group was divided according to access to rice fields. One group included those who had access to rice fields, as defined above. This group was labeled *rural poor with access to rice fields*. Finally, the fourth group was labeled *rural poor landless*.

Based on changes in the price of three essential commodities (rice, cooking oil, and sugar) and the value of the Indonesian rupiah (at an exchange rate of about 4,000 rupiah per US$1 in 1997), we defined three time periods. The first period, up to August 1997, was labeled *before the crisis*, and the second period, from September 1997 to November 1997, was labeled *transition*. During this second period, the prices of essential commodities started to climb in Purworejo as the crisis was approaching. The third period from December 1997 onwards was labeled *during the crisis*.

Statistical analyses

The intakes of energy, protein, fat, carbohydrates, calcium, iron, and vitamin A by women during the second trimester of pregnancy have been described and analyzed in previous reports [12, 21]. The intake of rice also has been reported [12], and these results are referred to in this article because rice is an important component of the Indonesian food pattern, defined here as the pattern of food groups consumed by each pregnant woman during the second trimester of pregnancy. The following eight food groups were defined: *rice, nonrice staple foods* (roots, other cereals, tubers, and corn), *animal foods* (red meat, chicken, liver, fish, and eggs), *nuts and pulses* (peanuts, beans, and seeds), *vegetables* (green vegetables, yellow or red vegetables, and white vegetables), *fruits* (red or yellow fruits and white fruits), *fats and oils* (cooking oil and butter), and *sugar* (white sugar and palm sugar added to foods or beverages in processing or preparation or consumed as sweeteners).

The contribution of a food or food group to the total nutrient intake was calculated as the nutrient intake of a food or food group divided by the total nutrient intake. The average daily weight of a food or food group consumed (in grams) was calculated by dividing the total weight of the food or food group consumed by the number of repetitions of the 24-hour recalls. All six repetitions were performed for 406 women, five repetitions were performed for 22 women, four repetitions were performed for 15 women, and three repetitions were performed for 7 women. All analyses were stratified according to socioeconomic group.

Information from the second trimester of pregnancy was analyzed cross-sectionally in relation to the date of data collection. Two-way analysis of variance (before the crisis vs. transition and before the crisis vs. during the crisis) was used. Paired comparisons for each subgroup before the crisis were performed by Student's t-test and analysis of variance. The weights of animal foods, vegetables, fruits, sugar, chicken, egg, and fermented soybean (tempe) and the amounts of expenditures were skewed to the right and are therefore presented as medians (25th–75th percentiles); these were analyzed by the Kruskal-Wallis test and the Mann-Whitney U test. The Pearson product-moment correlation was used to estimate the correlation between the consumption of rice and other food groups. Differences were considered statistically significant when the p value was less than .05. Data analyses were performed with the Statistical Package for the Social Sciences (SPSS version 9.0).

Results

Characteristics of the subjects

The parity of the 450 pregnant women ranged from 1 to 9; 26% of the women were primipara. The mean age was 28.3 ± 5.3 years, and the mean height was 150.3 ± 5.0 cm. Among the women, 78% had electricity, 50% owned a television, and 87% owned a radio. The majority (72%) used a protected well, 80% used firewood for cooking, and 2% of the women (all in the rich group) owned a refrigerator.

Household expenditures before the crisis

Household expenditure is one possible proxy for classifying socioeconomic position. Before the crisis, the rich group had the highest food, nonfood, and total household expenditures (table 1). The differences between socioeconomic groups are all significant ($p < .05$). The percentage of the total household budget spent on food by each group was 69% for urban poor women, 67% for rural poor women with access to rice fields, 66% for rural poor landless women, and 60% for rich women. This expenditure pattern confirms the classification of socioeconomic groups used in this study.

General food pattern

Overall, the food patterns of the women were based on rice, nuts and pulses, and vegetables, i.e., on plant foods. The staple food was rice, and other potential staple foods were consumed only as snacks. Vegetables, nuts and pulses (especially fermented soybeans or tempe), and animal foods were served with rice and occasionally with fruit if it was available. Plain water and tea, usually with granular sugar or palm sugar added, were the common beverages for all women. Overall, pregnant women consumed meat (47%), milk (46%), liver (28%), chicken (70%), eggs (75%), fish (80%), and tea (92%). Only five women (all in the rich group) said they consumed butter.

Food intake in relation to the crisis for different groups of women

The changes in median daily intake per subgroup between the periods are presented in table 2. Before the crisis, the most important food groups (in addition to rice; see also Hartini et al. [12]) were other staple foods, vegetables, fruits, and nuts and pulses. Each of these food groups was consumed at the level of about 80 to 100 g/day. Animal food intake was only around 15 to 50 g/day. In general, the food intake of the urban women was higher than that of the rural women, but the differences across periods were not significant, except for the intake of fats and oils ($p < .05$). As expected, rich women had the highest median daily intakes of animal foods, fats and oils, and sugar ($p < .05$).

When the intake before the crisis was compared with that during transition, urban women consumed

TABLE 1. Median household food and nonfood expenditures before the crisis according to area and socioeconomic group

Area, socioeconomic group, and type of expenditure	Median expenditure in US$[a] (25th–75th percentile)	$p > 0.01$	% of total expenditures
Food expenditure			
Area[b]			
Urban	23 (17–33)[c]	.53[d]	68
Rural	24 (18–31)		65
Socioeconomic group[e]			
Rich	29 (21–38)	.00[f]	60
Urban poor	24 (18–30)		69
Rural poor with access to rice fields	23 (18–30)		67
Rural poor landless	23 (17–34)		66
Nonfood expenditure			
Area[b]			
Urban	13 (9–17)	.83[d]	32
Rural	13 (9–18)		35
Socioeconomic group[e]			
Rich	20 (14–30)	.00	40
Urban poor	12 (9–15)		31
Rural poor with access to rice fields	11 (9–16)		33
Rural poor landless	12 (9–16)		34
Total expenditure			
Area[b]			
Urban	37 (28–47)	.61[d]	
Rural	37 (29–48)		
Socioeconomic group[e]			
Rich	51 (35–64)	.00	
Urban poor	37 (29–45)		
Rural poor with access to rice fields	36 (28–44)		
Rural poor landless	35 (28–50)		

a. In 1997, the exchange rate was approximately 4,000 rupiah per US$1.
b. There were 21 urban and 214 rural pregnant women.
c. Median (25th–75th percentile).
d. Mann-Whitney U test for differences in median expenditure between pregnant women living in urban and rural areas.
e. There were 31 pregnant women in the rich group, 16 in the urban poor group, 118 in the rural poor with access to rice fields group, and 61 in the rural poor landless group.
f. Kruskal-Wallis test for differences in median expenditure among pregnant women in different socioeconomic groups.

TABLE 2. Daily food intake (g) of pregnant women according to area, socioeconomic group, and time in relation to the economic crisis[a]

Food group, area, and socioeconomic group	Time[b]			*p* value for differences		
	Before crisis	Transition	During crisis	Among all groups, before crisis	Before crisis vs. transition, all groups	Before crisis vs. during crisis, all groups
Rice						
Area[c]						
Urban	254 ± 74	187 ± 99	241 ± 141	.98[d]	.07[d]	.79[d]
Rural	254 ± 173	265 ± 82	285 ± 73		.55	.09
Socioeconomic group[e]						
Rich	241 ± 93	236 ± 89	283 ± 82	.06[f]	.85	.07
Urban poor	263 ± 72	184 ± 125	300 ± 112		.09	.45
Rural poor with access to rice fields	262 ± 87	277 ± 84	290 ± 79		.26	.04
Rural poor landless	227 ± 86	252 ± 48	270 ± 68		.35	.06
Nonrice staple foods						
Area[c]						
Urban	135 ± 73	73 ± 53	139 ± 79	.05	.05	.92
Rural	103 ± 62	100 ± 57	81 ± 47		.69	.00
Socioeconomic group[e]						
Rich	120 ± 64	111 ± 46	101 ± 55	.13	.62	.23
Urban poor	138 ± 85	60 ± 41	103 ± 76		.07	.52
Rural poor with access to rice fields	97 ± 57	95 ± 61	75 ± 43		.86	.00
Rural poor landless	112 ± 77	102 ± 46	91 ± 56		.66	.32
Animal foods						
Area[c]						
Urban	28 (18–40)	9 (3–27)	11[g]	.08[h]	.01[i]	.02[i]
Rural	19 (7–38)	20 (8–37)	16 (7–30)		.89	.31
Socioeconomic group[e]						
Rich	49 (26–72)	38 (16–73)	26 (14–40)	.00	.42	.00
Urban poor	23 (14–30)	9 (2–19)	16[g]		.02	.19
Rural poor with access to rice fields	16 (5–27)	19 (7–33)	13 (5–25)		.49	.63
Rural poor landless	18 (7–40)	7 (1–25)	14 (5–39)		.04	.49
Nuts and pulses						
Area[c]						
Urban	109 ± 44	86 ± 49	94 ± 44	.16	.27	.54
Rural	95 ± 37	103 ± 52	100 ± 41		.73	.14
Socioeconomic group[e]						
Rich	99 ± 43	97 ± 36	97 ± 43	.59	.86	.86
Urban poor	109 ± 51	76 ± 48	115 ± 27		.20	.84
Rural poor with access to rice fields	93 ± 40	96 ± 39	96 ± 42		.60	.63
Rural poor landless	92 ± 43	86 ± 35	117 ± 36		.66	.04
Vegetables						
Area[c]						
Urban	103 (76–140)	93 (70–106)	101[g]	.27	.20	.46
Rural	95 (69–129)	95 (61–137)	99 (74–135)		.88	.31

continued

TABLE 2. Daily food intake (g) of pregnant women according to area, socioeconomic group, and time in relation to the economic crisis[a] *(continued)*

Food group, area, and socioeconomic group	Time[b]			*p* value for differences		
	Before crisis	Transition	During crisis	Among all groups, before crisis	Before crisis vs. transition, all groups	Before crisis vs. during crisis, all groups
Socioeconomic group[e]						
Rich	105 (67–148)	112 (74–179)	110 (74–153)	.82	.29	.40
Urban poor	100 (81–134)	83 (46–113)	106[g]		.16	.71
Rural poor with access to rice fields	98 (74–128)	96 (60–130)	98 (69–118)		.69	.81
Rural poor landless	92 (64–136)	77 (46–129)	108 (79–151)		.42	.45
Fruits						
Area[c]						
Urban	124 (97–157)	166 (84–229)	55[g]	.07	.30	.04
Rural	88 (69–153)	93 (48–155)	86 (51–144)		.92	.78
Socioeconomic group[e]						
Rich	126 (76–206)	138 (70–183)	104 (68–172)	.06	.97	.44
Urban poor	123 (80–157)	166 (65–206)	206[g]		.51	.19
Rural poor with access to rice fields	88 (55–152)	85 (42–149)	80 (46–131)		.60	.23
Rural poor landless	84 (33–149)	113 (49–171)	81 (62–178)		.32	.83
Fats and oils						
Area[c]						
Urban	21 ± 6	17 ± 9	21 ± 9	.03	.11	.58
Rural	20 ± 7	20 ± 37	19 ± 7		.68	.77
Socioeconomic group[e]						
Rich	23 ± 7	23 ± 7	21 ± 7	.02	.96	.26
Urban poor	22 ± 8	16 ± 9	25 ± 3		.11	.56
Rural poor with access to rice fields	19 ± 7	18 ± 7	18 ± 6		.54	.28
Rural poor landless	19 ± 9	20 ± 9	22 ± 6		.64	.12
Sugar						
Area[c]						
Urban	48 (36–78)	31 (22–45)	38[g]	.08	.04	.21
Rural	41 (25–56)	37 (26–56)	44 (30–61)		.66	.61
Socioeconomic group[e]						
Rich	56 (42–77)	53 (38–77)	56 (36–72)	.00	.62	.69
Urban poor	47 (28–70)	27 (18–51)	51[g]		.13	.71
Rural poor with access to rice fields	39 (24–52)	32 (23–51)	41 (24–53)		.41	.75
Rural poor landless	40 (24–53)	34 (29–47)	63 (30–68)		.88	.04

a. Some data in this table were previously published in Hartini et al. [12].
b. Plus-minus values are means ± SD. Other values are medians with 25th and 75th percentiles in parentheses. All values are in grams.
c. The numbers of pregnant women in the study area were 235 before the crisis, 104 during the transition, and 111 during the crisis.
d. Student's *t*-test.
e. The numbers of pregnant women in the four socioeconomic groups were 226 before the crisis, 102 during the transition, and 110 during the crisis.
f. Analysis of variance.
g. The 25th and 75th percentiles are not reported because there were not enough cases in the sample.
h. Mann-Whitney U test/Kruskal-Wallis test.
i. Mann-Whitney U test.

less nonrice staple foods, animal foods, and sugar in the latter period. As described previously [12], rural women consumed significantly more rice in the latter period. Further, urban poor and rural poor landless women consumed significantly less animal foods in the latter period. During the crisis, rural poor women with access to rice fields had a significant reduction in their intake of nonrice staple foods ($p < .05$). Most women shifted to buying nuts and pulses, and rural poor landless women, in particular, increased their intake of nuts and pulses significantly ($p < .05$) (table 2).

Before the crisis, rich women consumed more chicken and eggs than the other subgroups. During the crisis, when the price of animal foods increased, small quantities of animal foods, particularly red meat, fish, milk (data not shown), chicken, and eggs (table 3), were consumed by all subgroups; the amounts and proportions of chicken differed significantly between rich women and rural poor women with access to rice fields ($p < .05$).

Main sources of nutrients from foods

The contribution of various food groups to total nutrient intake is illustrated in figure 1. Before the crisis, rice accounted for 40% to 50% of the total energy intake.

TABLE 3. Selected daily sources of protein for pregnant women according to area, socioeconomic group, and time in relation to the economic crisis

Protein source, area, and socioeconomic group	Time[a]			p value for differences		
	Before crisis	Transition	During crisis	Among all groups, before crisis[b]	Before crisis vs. transition, all groups[c]	Before crisis vs. during crisis, all groups[c]
Chicken						
Area						
Urban	14 (2–23)	4 (1–12)	3[d]	.98	.07	.05
Rural	5 (0–16)	2 (1–10)	1 (1–6)		.02	.00
Socioeconomic group						
Rich	18 (8–36)	11 (2–36)	2 (1–13)	.00	.31	.00
Urban poor	7 (1–19)	2 (1–8)	3[d]		.14	.37
Rural poor with access to rice fields	4 (1–11)	1 (1–7)	1 (1–5)		.02	.02
Rural poor landless	4 (1–18)	3 (1–11)	1 (1–13)		.68	.20
Egg						
Area						
Urban	13 (6–24)	7 (1–54)	1[d]	.30	.56	.09
Rural	10 (1–21)	9 (1–24)	9 (1–24)		.66	.60
Socioeconomic group						
Rich	20 (10–28)	15 (7–41)	22 (4–41)	.01	.87	.77
Urban poor	11 (6–24)	7 (1–22)	4[d]		.45	.29
Rural poor with access to rice fields	9 (1–15)	8 (1–23)	6 (1–17)		.85	.52
Rural poor landless	10 (1–22)	7 (1–18)	7 (1–14)		.32	.12
Fermented soybeans						
Area						
Urban	71 (47–97)	60 (58–106)	27[d]	.20	.85	.21
Rural	54 (37–81)	64 (45–90)	63 (53–93)		.01	.01
Socioeconomic group						
Rich	46 (34–71)	51 (43–94)	64 (32–90)	.09	.12	.12
Urban poor	77 (52–98)	59 (48–114)	53[d]		.68	.58
Rural poor with access to rice fields	58 (37–85)	47 (47–95)	62 (54–90)		.08	.09
Rural poor landless	52 (31–82)	44 (44–82)	71 (46–106)		.52	.11

a. Values are medians with 25th and 75th percentiles in parentheses. All values are in grams.
b. Mann-Whitney U Test/Kruskal-Wallis test.
c. Mann-Whitney U test.
d. The 25th and 75th percentiles are not reported because there were not enough cases in the sample.

Rice also contributed the largest amount of protein, particularly for rural poor women with access to rice fields. The second richest source of protein was nuts and pulses, especially fermented soybeans. Animal foods contributed only 8% to 16% of the total protein intake. Most of the protein contributed by animal foods came from eggs. The predominant source of fat was cooking oil. A high intake of vegetables by poor women (except rural poor) contributed to a high vitamin A intake among these women. Vegetables contributed 40% to 53% of the total vitamin A intake, and green leafy vegetables also were a major source (data not shown).

The trends for transition and during the crisis were similar to those before the crisis regarding the contributions of different foods to total nutrient intake. This was particularly true of rice, nuts and pulses, and vegetables. During the crisis, rice accounted for 45% to 55% of energy, 35% to 45% of protein (fig. 1), and 60% to 70% of carbohydrates (data not shown). The contribution of nuts and pulses to protein and calcium intake increased. Surprisingly, the contribution of vegetables to vitamin A intake increased to 58% to 74% during the crisis. In contrast, the contribution of animal foods to protein, fat, vitamin A, and iron decreased, particularly for rich women. Milk accounted for only 2% to 6% of total calcium intake and eggs for only 1% to 5% of total iron intake. Nuts and pulses provided the largest amount of calcium and iron.

Food pattern in relation to the crisis for different groups of women

Before the crisis, the intakes of nuts and pulses, vegetables, and fats and oils had a significant positive relationship with rice intake among rural poor

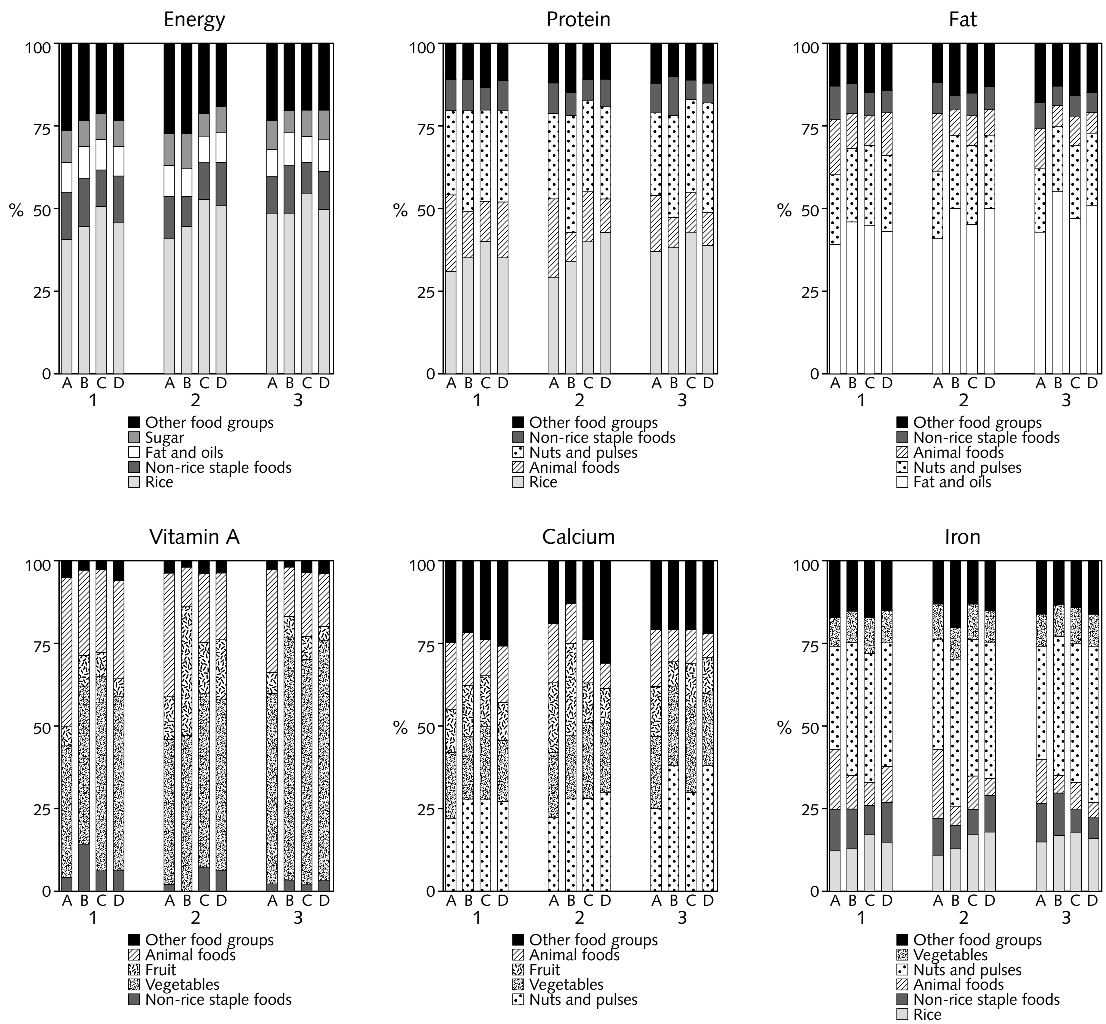

FIG. 1. Contributions of foods and food groups to nutrient intake of pregnant women according to socioeconomic characteristics and timing in relation to the economic crisis. 1, Before crisis; 2, transition; 3, during crisis; A, rich; B, urban poor; C, rural poor with access to rice fields; D, rural poor landless

women with access to rice fields as well as rural poor landless women (table 4). During the transition, when the economic crisis started, the rich women increased their intake of rice, and this was significantly related to an increased intake of nuts and pulses, followed by vegetables, fats and oils, and sugar. For rural poor women with access to rice fields, the increased rice intake was significantly associated with increased intakes of nuts and pulses and of vegetables. Also, during the crisis, rich women increased their intakes of nuts and pulses, vegetables, fats and oils, and sugar when their intake of rice increased. Urban poor women were most affected by the crisis. When their intake of rice increased, they tended to decrease their intakes of most foods except for nuts and pulses.

Discussion

Food intake

In our study, all pregnant women consumed rice as a staple food [12]. During the crisis, the intake of rice increased, and this was especially so among rural poor women with access to rice fields. As mentioned earlier, rice must be considered as a Giffen good. Thus, despite the price increase, during the crisis rice provided more than 45% of the daily energy intake, 40% of the daily protein intake, and 65% of the daily carbohydrate intake. Whether this represents a rational choice by the household is not clear. This depends on the prices and the nutrient content of different foods. However, a switch from rice to nonrice staple foods is not easily undertaken, as human selection of food intake is influenced by multiple sensory, cultural, and economic factors [22]. Qualitative studies are needed to improve the understanding of how such a change could be promoted if it was necessary during a time of emergency.

In Indonesia meat is an expensive source of protein, and it became even more expensive during transition and during the crisis. Consequently, the intake of meat was low among all subgroups, and it became significantly lower during the crisis among rich women. We have previously shown that fat intake decreased during the crisis [21]. Although animal foods are recognized as nutritious and healthful, the pregnant Indonesian women were unable to purchase those foods because of their high cost. This was also found to be the case among pregnant Gambian women [23]. Further, pregnant Iranian women ate meat rarely, usually only on special occasions, and their intake of meat and dairy products was low [24]. Finally, the contribution of meat, poultry, and fish to energy intake was less than 5% among pregnant women in South Malawi [25]. In our study, rice was a strongly inferior

TABLE 4. Correlation coefficients (r) between intake of rice and intake of other food groups for pregnant women according to socioeconomic group and time in relation to the economic crisis[a]

Time and socioeconomic group	Nonrice staple foods	Animal foods	Nuts and pulses	Vegetables	Fruits	Fats and oils	Sugar
Before crisis							
Rich	.12	–.04	.15	.24	.25	.58**	.08
Urban poor	–.86	.28	.12	.41	–.05	.37	.06
Rural poor with access to rice fields	.26**	–.01	.26**	.31**	.08	.38**	.03
Rural poor landless	–.06	–.01	.26*	.32**	–.02	.32*	.12
Transition							
Rich	.17	.48	.49*	.49*	–.06	.75**	.46*
Urban poor	.61	.21	.31	.58	.21	.83	–.86
Rural poor with access to rice fields	–.02	–.15	.34**	.30*	.09	.23	.07
Rural poor landless	.28	–.39	.51	.08	.62	.14	.17
During crisis							
Rich	–.12	.23	.40*	.48*	.19	.62**	.58**
Urban poor	–.83	–.99	.30	–.77	–.99	–.96	–.17
Rural poor with access to rice fields	–.20	–.14	.14	.28	.00	.16	–.08
Rural poor landless	.15	.45	.17	.61*	.30	.45	.28

a. A negative correlation indicates that the more rice a woman consumed, the less other foods she consumed; a positive correlation indicates that the more rice a woman consumed, the more other foods she consumed.

* $p < .05$, ** $p < .01$.

good, meaning that when the price of rice increased, the consumption of rice increased and the consumption of animal food decreased. Hence, it seems reasonable to expect changes in the entire pattern of food intake.

The intake of nuts and pulses increased during the crisis, and this food group, particularly fermented soybeans or tempe, became the predominant source of calcium and iron. Tempe is an original Indonesian food, consumed particularly in Java [26, 27]. Further, the intake of vegetables increased during the crisis. Vegetables, particularly spinach and cassava leaves, were the most important source of vitamin A, which may explain why vitamin A intake increased in all rural women [21]. Fruit was more expensive than vegetables, and consequently the intake of fruits decreased. A national study in Indonesia likewise found that Indonesian women consumed the same amount of vegetables, and their consumption of fruits decreased during the crisis as compared to consumption before the crisis [28]. In Iran, women of the low socioeconomic group consumed smaller amounts of fruits, vegetables, and rice than those in the middle socioeconomic group, because the prices of those foods were higher than those of staple foods [29]. In China, the intakes of energy, protein, fats, iron, and vitamin A came mostly from plant foods [30]. Finally, Panwar and Punia [31] reported that the intake of fruits by pregnant Indian farming women was higher than that by pregnant nonfarming women.

Food pattern

In general, the pregnant Indonesian women in our study had similar food patterns during the three time periods. However, the food patterns differed among the different subgroups of women. Rich women had a better food pattern than the other groups and were able to maintain a good diet during the crisis. Rural poor women with access to rice fields increased their intake of rice during the crisis at the same time as they decreased their intakes of other staple food. Rural poor landless women increased their intake of nuts and pulses during the crisis. Urban poor women decreased their intakes of most food groups during the crisis. Overall, during the crisis, the food patterns of the women appeared to become less varied, because they decreased their intake of nonrice staple foods, animal foods, and fruits. Similarly, a study in Poland reported that the majority of families made dietary sacrifices that included eating less food as well as buying lower-quality and less expensive foods during economic reform as a result of increased prices of those items [32]. The Indonesian women consumed predominantly plant-based food. Although women need extra food during pregnancy, the food intake of these women was insufficient for their needs. The eating patterns of Javanese women differ from those of men and other family members: women are the last family members to eat, even when they are pregnant.*

Food policy and public health implications

During the crisis the price of rice increased, primarily because of an expected decrease in domestic rice production due to changes in the rainfall pattern. As a response, the government imported large amounts of rice, and the imported rice was supplied at subsidized prices. Hence two parallel markets existed, one for imported rice and one for locally produced rice. The increased rice intake of the pregnant women may reflect this government intervention [12]. For example, Wasito et al. [33] reported that the food aid program in East Jakarta and Kalimantan reached 46.6% of households.

A policy of low rice prices, or subsidized rice, has existed in Indonesia during the last three decades of agricultural development [34], and this also applies to cooking oil and sugar [33]. The government sells subsidized food on the market, and all groups who want these foods can buy them. Thus, the rich group also benefits from the low food price policy. For more than three decades, the Indonesian Government has encouraged people to eat a wide variety of staple foods [35]. In spite of this, the pregnant women in our study decreased their intake of staple foods such as cassava, sweet potatoes, and potatoes and increased their intake of rice.

Although the prices of sugar and cooking oil increased sharply during the crisis in Indonesia [19, 20, 36], the intakes of these goods were almost constant, meaning that the price increase did not affect intake. In contrast to the transition period, urban poor women and rural poor landless women tended to increase their intake of most food groups during the crisis. Fats and oils in meals provide energy and make foods more palatable. The study by Wasito et al. [33] in Jakarta and Kalimantan reported that during the crisis the consumption of rice, vegetable oil, and sugar could be maintained, and in our study the consumption of these goods also remained relatively stable during the crisis. The Indonesian food guidelines recommend that at most 10% of total energy should come from fats and oils [35]. Our results indicate that fats and oils contributed 9% of the energy intake. Thus, consumption is still lower overall than the recommended limit.

Our findings of increased intakes of other food

* Hartini TNS, Padmawati RS, Lindholm L, Surjono A, Winkvist A. Did the food habits influence the food intake among pregnant women during the economic crisis in Central Java, Indonesia? A study based on quantitative and qualitative data. Submitted for publication.

groups during the crisis may reflect support from relatives and neighbors, as seen in our qualitative study [33]. Help from relatives and neighbors is one of the most important survival mechanisms. The most devastating impact of the severe crisis was on the food security of Asian countries [37]. Consequently, food security in Indonesia still requires support from the government. Nutrition is not a simple problem, as it is affected not only by agricultural production but also to a great extent by economics and politics. We hope the Indonesian Government will overcome the odds and concentrate also on economics.

Conclusions

The characteristic food-intake pattern of the Indonesian pregnant women was based on plant food. Our study demonstrates that food intake among the urban poor and the rural poor landless subgroups was influenced by the emerging economic crisis. Even so, the food intake of these vulnerable groups was higher during the crisis than during the transition period, probably because of support from relatives and neighbors. Although the price of rice increased, the intake of rice also increased among all subgroups. All but the rich women decreased their intake of nutritious foods such as animal foods. Rice was a strongly inferior good. The intakes of nuts and pulses and of vegetables increased, whereas the intakes of cooking oil and sugar remained constant.

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Recent experience with fortification of foods and beverages with iron for the control of iron-deficiency anemia in Brazilian children

Mark Anthony Beinner and Joel Alves Lamounier

Abstract

Iron-deficiency-anemia affects 30% of the world population. Women of reproductive age and children are the most affected. Iron supplementation in the form of tablets and syrups has not been successful in developing countries, and iron deficiency is still the most important deficiency related to malnutrition. Iron-deficiency anemia affects physical and cognitive development at an early age in children, often resulting in irreversible outcomes. Studies from the last two decades have shown that the prevalence of iron-deficiency anemia can be reduced given adequate investments and political will directed at iron fortification of foods and liquids. A successful low-cost iron-fortification program incorporates implementation and strategic use of communication for program inception where education is in the forefront. A review of the available reports from experience in Brazil with iron fortification of foods and liquids is presented.

Key words: Benefit-cost, foods, iron, prevention, supplementation

Introduction

A number of studies worldwide have investigated iron-deficiency anemia in women and children. On a global scale, 3.5 billion people are affected, 42% of whom are from developing countries [1]. This represents a greater number than the 2.1 billion people with iron-deficiency anemia reported in 1993 [2]. Unfortunately, the alarming number of preschool children affected by iron-deficiency anemia has not decreased as projected since United Nation leaders gathered in 1990 at the World Summit for Children in New York. Among their goals was a 50% reduction in malnutrition by 2000 in developing countries, but only a 27% reduction was achieved. Therefore, new goals for 2010 foresee a 33% reduction in malnutrition, with special attention to children under two years of age [3].

Studies on the prevalence of iron-deficiency anemia from Latin America are scarce; however, according to data reported by Horwitz [4], during the 1980s, 13.7 million children, or 26% of the population, were suffering from iron-deficiency anemia. Among the Latin American and Caribbean countries with an elevated prevalence of iron-deficiency anemia, Peru was cited as having the highest prevalence (57%) among children between zero and four years of age, followed by Brazil with 35% [5]. The actual prevalence in Brazil may be even higher.

The long-term consequences of iron-deficiency anemia have been extensively studied and presented in the literature. Infants born to mothers with iron-deficiency anemia are more likely to have low iron stores and require more iron than can be supplied by breastmilk at three to six months of age [6, 7]. There is convincing evidence that iron-deficiency anemia is linked to lower cognitive test scores and that these effects can be long-lasting [8]. As animal studies suggest, iron-deficiency anemia during maximal brain growth has effects on the brain and behavior that are not reversed by treatment with iron supplements [9]. However, as Pollitt [10] points out, there is no documentation that shows that the cerebral alterations produced by experimentally induced iron-deficiency anemia in rodents are the underpinning for cognitive delays of children.

There are several causes of iron-deficiency anemia. The principal cause in children and women of reproductive age in developing countries is inadequate intake of usable iron, which is normally found in a

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well-balanced diet in the form of heme and nonheme iron. Fortification involves adding nutrients to foods to maintain or improve the quality of a diet. The fortification of foods has been shown to be a good and adequate preventive measure for the control of iron-deficiency anemia on a long-term basis. In fact, fortification of foods has been practiced for years in many industrialized countries such as Canada and the United Kingdom. In the United States, legislation was enacted in 1941 that required the food industry to fortify foods with required daily allowances (RDAs) of nutrients [11]. In developing countries, several program trials from the literature have demonstrated effectiveness in the control of iron-deficiency anemia, principally from studies conducted in Guatemala, India, South Africa, Thailand, and Venezuela. Several well-controlled fortification trials have been effective in reducing the prevalence of anemia in school-age children [12–14]. Fortification is an attractive option for controlling iron-deficiency anemia in countries where a significant number of groups are vulnerable to an ever-increasing consumption of centrally processed foods. In this analysis we examine the effectiveness and cost of fortification studies conducted in Brazil over the last two decades that may also be considered for use in other developing countries.

Preventing iron-deficiency anemia: overcoming technical and practical barriers in Latin American countries

In developing countries, common vehicle fortificants include salt, sugar, infant foods, and skimmed milk [15]. In several Latin American countries, wheat flour is widely consumed by all population groups, and most wheat flour is centrally milled, substantially decreasing its micronutrient content. The fortification of wheat flour is an attractive option to remedy this situation and benefit all population groups. A majority of Latin American and Caribbean countries (81%) have already planned or implemented flour-fortification programs. Laws mandating the fortification of flour with iron have been introduced in Chile, Peru, Trinidad, Tobago, Venezuela [16], and some Central American countries, and recently federal legislation on iron fortification of wheat and corn flour was passed in Brazil [17].

One of the most common nutritional problems in Brazil, as in many other Latin American countries, is iron-deficiency anemia. Incidences may vary according to region, but estimates are that one-third to two-thirds of the population between zero and five years of age are affected [18, 19]. Clinically controlled trials have shown that methods of reducing or even controlling iron-deficiency anemia in children have been effective. Supplementation involves providing extra iron in medicinal form, either orally or by injection when iron levels are seriously depleted. Programs aimed at using iron supplements for children often have poor compliance because of negative side effects caused by high concentrations of elemental iron in tablets or syrups [20]. Another problem generally encountered is adherence; mothers often forget to give their children their daily or weekly iron supplements. The result is poor adherence, and the child continues to suffer from iron-deficiency anemia, thus continuing the vicious anemic cycle. Health professionals may not be concerned with lower levels of iron in a child diagnosed as underweight, and iron-deficiency anemia may be overlooked. In addition, supplements are about 10 times more expensive than fortification, but they are more appropriate when the target group is less than 10% of the population [21].

Fortification with iron to counter iron-deficiency anemia and promote normal child growth will reach a greater proportion of the population with fewer side effects than iron supplementation. If foods and liquids are considered for fortification with elemental iron, the conditions will be favorable for a targeted population to receive the minimum RDAs necessary to promote normal growth [22]. However, as Mora [23] points out, strategies directed at fortifying foods are not likely to be beneficial, especially for infants and young children. The author argues that children less than five years of age consume small portions of enriched foods and therefore may not obtain enough iron from an iron-supplemented diet. Mora [23] recommends a sustainable approach to a daily iron-supplementation program that is inexpensive, simple, easy to administer, and has no side effects.

Recent work and current thought

Recently, the Working Group Committee [24] of the International Nutrition Foundation and the Centers for Disease Control have been actively working to develop programmatic strategies to prevent and treat iron-deficiency anemia in vulnerable populations. Intermittent iron supplementation has been shown to increase hemoglobin levels dramatically in children and in adolescent populations. A review of the research on iron supplementation by Beard [25] has confirmed that intermittent iron supplementation works as well as daily supplementation, regardless of the severity of anemia. The review goes on to say that "the reports of side effects were related to the frequency of iron supplementation, with many fewer side effects in the intermittently supplemented groups than in the group given supplement daily". In spite of the difficulties of iron-supplementation programs, especially those directed at child populations, an overall review and commitment are needed not only by health services, but also by private sector groups and nongovernmental organizations. More specifically, attention needs to be focused on educational aspects (increasing compliance), training of personnel, and a specific definition of the at-risk groups (children, adolescents, and pregnant women), and financial and infrastructure commitments should be channeled to multiple public and private sectors for research and development of suitable iron supplements.

Current thinking emphasizes treating the anemic individual more than the prevention of iron-deficiency anemia. In public health terms, the alarming incidence of iron-deficiency anemia among children in Brazil therefore requires more aggressive interventionist measures. With this in mind, an interesting approach may be to consider all children from socioeconomically poor regions as iron-deficient until they are diagnosed as not deficient. Under these circumstances, effective iron-fortification programs will result in full coverage at the community, regional, and even national levels.* The cost of fortification is low, and extension to children will be more practical, should be flexible according to local conditions, and will be routine and economical in the long term [27]. In pregnant and reproductive-aged women, iron-deficiency anemia may be so prevalent that presumptive daily consumption of iron-fortified foods or iron supplements may be more cost-effective than a program of screening plus treatment. Fortunately, iron-absorption studies have shown that the extraordinarily well-regulated system for controlling the absorption of iron works to prevent iron overloading in cases of iron sufficiency and increases the uptake of iron at times of iron deficiency in normal individuals [28]. Therefore, concern about iron overloading should not constrain programs to prevent iron-deficiency anemia by fortification [1].

* The policy climate in Brazil is largely reflected by the inability of the government to conduct and promote aggressive social marketing with the backing of national and local health agencies. Despite the impetus to do something about iron deficiency and iron-deficiency anemia in children through research and development, ignorance and cultural factors still continue to hinder progress in this area. But there has been some progress. In December 2002, the Brazilian government passed legislation requiring the milling industry to begin fortifying wheat and corn flour with iron and folic acid by the beginning of 2004. This is the first time federal legislation of this nature has been enacted at the national level. However, much more remains to be done regarding the fortification of foods. In the meantime, the scaling up of small studies should be multiplied with the help of community organizations and nongovernmental organizations. There are no cost-analysis studies regarding the long-term consequences of iron deficiency and iron-deficiency anemia in Brazil. An estimate of approximately US$4 per capita for the economic losses to society in terms of growth, development, and productivity can be extrapolated from the data of Ross and Horton [26]. These losses are far greater than the developmental costs of preventing iron deficiency and iron-deficiency anemia in the first place.

Fortification studies in Brazil

Iron-deficiency anemia reflects the severe end of the spectrum of depletion. Advanced iron deficiency is associated with anemia which the World Health Organization (WHO) defines by a hemoglobin cutoff value of <11.0 g/dl or a serum ferritin cutoff value of <12 µg/L [29].

Unfortunately, only a small number of trials of the efficacy and effectiveness of iron fortification of foods and liquids conducted in Brazil have been published during the past two decades. Table 1 presents a summary of nine important studies of fortification of foods and liquids that have demonstrated positive results in combating iron deficiency or iron-deficiency anemia in the Brazilian child population. These studies show a substantially reduced prevalence of iron-deficiency anemia after fortification in all poor populations, whose initial prevalence of iron-deficiency anemia varied between 25% and 75%. One study demonstrated that incorporating 20 mg of elemental iron per liter of drinking water over eight months in a day-care facility reduced the incidence of iron-deficiency anemia from 48% to as little as 3% in 31 children at a cost of R$0.09 (US$0.05) per child [31]. The mean hemoglobin level was 10.7 ± 0.7 g/dl at baseline and 13.0 ± 1.1 g/dl at eight months; the mean serum ferritin level was 13.7 ± 8.9 µg/L at baseline and 25.6 ± 10.5 µg/L at eight months) [31].

Another study of the addition of iron to water (not shown in table 1) was conducted by Dutra-de-Oliveira and colleagues [39] and published in 1996. Over four months, 10 mg of elemental iron (ferrous sulfate) and 100 mg of vitamin C were added to each liter of drinking water consumed by 44 persons. An additional 44 persons served as a control group who did not receive iron in their drinking water. The mean hemoglobin levels at baseline in adults (12.9 g/dl) and in children (10.9 g/dl) increased significantly ($p < .01$) to 13.7 and 11.7 g/dl, respectively. The increase in serum ferritin was significant at four months in adults (94.4 ± 38.3 to 162.2 ± 113.8 µg/L), but not in children (27.6 ± 21.6 to 33.8 ± 22.1 µg/L). The hemoglobin levels decreased in control families but not in experimental families. When iron-soluble inorganic salts were given together with water, the absorption was higher than when they were given with foods [40]. The cost of iron and ascorbic acid for the four-month trial was R$0.37 (US$0.19) per family member. A mild metallic iron taste did not inhibit consumption.

In a more recent study by Beinner and colleagues [36] (table 1), 400 preschool children from eight municipal day-care facilities benefited from daily consumption of iron plus ascorbic acid prepared in 20-L plastic water jugs. The study evaluated hemoglobin levels and anthropometric measurements in 241 children from eight facilities. The mean hemoglobin at base-

TABLE 1. Summary of studies of iron fortification in Brazil

Study	No. of children	Duration of study (mo)	Prevalence of anemia (%) Before intervention	After intervention	Fortification vehicle	Organoleptic characteristics	Side effects/ acceptability[a]	Per capita cost (R$)[b]	p
Nogueira et al. [30]	16	3	75	0	Bovine hemoglobin-fortified cookies	Chocolate color	N/E	1.00	<.001
Dutra-de-Oliveira et al. [31]	31	8	48	3	Drinking water (20 mg iron/L)	Some color; mild metallic iron taste	N/E	0.09	<.001
Torres et al. [32]	239	6	70.7	20.6	Powdered milk (27 mg ferrous sulfate/100 g)	No color; mild metallic iron taste	N/E	0.31	<.001
Fisberg et al. [33]	102	6	25	7	Powder supplement (1.4 mg ferrous sulfate/100 ml)	No color or taste	N/E	0.10	<.01
Torres et al. [34]	238	12	62.3	26.4	Milk (3 mg Ferrochel/L)	No color or taste	N/E	0.53	<.001
Torres et al. [35]	238	6	72.3	18.5	Powdered milk (27 mg ferrous sulfate/100 g)	No color or taste	N/E	0.44	<.001
Beinner et al. [36]	241	8	43.2	21	Drinking water (30 mg ferrous sulfate/L)	No color; mild metallic iron taste	N/E	0.19	<.01
de Paula et al. [37]	93	6	33.3	18.3	Sugar (50 mg Ferrochel/kg)	No color or taste	N/E	0.65	<.001
Fisberg et al. [38]	89	6	28	9	Sweet rolls (10 mg Ferrochel/25 g roll)	No color or taste	N/E	0.34	<.001

a. Side effects: N, none; acceptability: E, excellent.
b. Currency, Real (R). US$1=R$2. Calculations are estimates based on the acquisition cost of iron and ascorbic acid only.

line and after eight months of intervention increased significantly from 11.8 ± 1.4 to 12.4 ± 0.93 g/dl. The prevalence of iron deficiency and iron-deficiency anemia determined by hemoglobin levels decreased from 43.2% to 21% at eight months postintervention. Fundamentally important to the success of these studies was education of the targeted populations, which resulted in behavior change and a greater awareness of the importance of combating iron deficiency and iron-deficiency anemia by the use of iron-fortified drinking water.

In 1992 studies were conducted on the effect of bovine hemoglobin-fortified cookies on the hemoglobin levels of 16 iron-deficient preschool children in northeast Brazil [30]. Each child was offered five cookies per day containing 1.25 mg of iron over three months as part of the normal school meal program. An evaluation of the total nutrients offered to the children showed an iron intake of only 4.0 mg/day. The baseline mean hemoglobin was 9.4 ± 2.6 g/dl, and at three months the mean hemoglobin increased to 13.2 ± 0.2 g/dl. With the addition of bovine hemoglobin-fortified cookies to the children's diet, the total iron intake increased to an average of 8.3 mg (83% of iron RDA) at a total cost of $US0.50 per child, with no measurable side effects or taste alterations reported. Although the authors do not specify, the use of heme iron has remained controversial. Important considerations and guarantees should be given as to its safety and sterility when a product derived from livestock is used. There are no reports of side effects from contamination (bacterial or viral) attributable to its use [30, 41].

Studies on milk fortified with iron have produced favorable results with the use of ferrous sulfate and iron bis-glycinate chelate (commercially known as Ferrochel). Torres and colleagues [32] incorporated 27 mg of ferrous sulfate and 100 mg of ascorbic acid in each 100 g of powdered milk offered to 239 children in day care over six months. The prevalence of iron-deficiency anemia was 70.7% at baseline and decreased to 20.6% by the conclusion of the study. The mean hemoglobin level was 10.3 ± 1.4 g/dl at baseline and 11.6 ± 1.1 g/dl at six months, a statistically significant increase of 1.3 g/dl. The extra cost was R$0.31 (US$0.16) per child over the six months (table 1). Torres and colleagues [34] also studied fortification of milk with iron bis-glycinate chelate (Ferrochel). In an attempt to reduce the high prevalence (62.3%) of iron deficiency and iron-deficiency anemia in children, the mothers of 238 children 6 to 42 months of age participated in a program that provided liquid milk fortified with 3 mg of Ferrochel per liter. The mean hemoglobin levels at baseline for children younger than 12 months, 12 to 23 months, 24 to 35 months, and 36 months of age and older were 10.2 ± 1.3, 10.1 ± 1.6, 11 ± 1.3 and 11.8 ± 1.3 g/dl, respectively. The fortified milk program was studied for 12 months with hemoglobin evaluations at baseline, 6 months, and 12 months. The mean hemoglobin levels at 12 months were 11.1 ± 1.3, 11.6 ± 1.1, 12 ± 1.2, and 12.1 ± 1.0 g/dl, respectively; the increases were significant for the first three age groups, but not for the last group (36 months and older). Both studies reported no adverse side effects or alterations in color or taste (table 1). A cost-benefit analysis of the incorporation of ferrous sulfate or iron bis-glycinate chelate in milk, targeting a greater number of children, would be worthwhile. Interestingly enough, the first Torres study [32] demonstrated a greater reduction in iron-deficiency anemia than the later Torres study [34]; 71% versus 57.6% in half the time (6 months versus 12 months) and at a lower cost per child (R$0.31 versus R$0.53). Ferrous sulfate and, to a lesser extent, iron bis-glycinate chelate promote fat oxidation in stored cereals and powdered milk and cause discoloration. However, if the foods are stored for shorter periods, oxidative changes can be prevented [42]. Iron bis-glycine has a bioavailability comparable to that of ferrous sulfate plus ascorbic acid in milk, but a major disadvantage is that it is a patented compound, making it more expensive [43]. Therefore, if costs are an underlying factor in an iron-deficiency prevention program, ferrous sulfate may be seen as a better option for reducing iron deficiency and iron-deficiency anemia than bis-glycinate chelate.

Other examples of iron-fortification experiences in Brazil include the addition of iron to wheat flour. Fortification of wheat flour with iron has been practiced for decades. However, iron-fortified wheat flour is not always available, or it is consumed by poor children 6 to 60 months of age in quantities too small to be effective [23]. There are ongoing studies to show that fortified flour can reduce iron-deficiency anemia in children when consumed regularly. Fisberg and colleagues [38] fortified sweet-roll dough with 10 mg of Ferrochel in two low-income day-care facilities in São Paulo, Brazil. Eighty-nine children each received two 25-g sweet rolls Monday through Friday as part of their meal program for six months. At baseline, 28% of the children had hemoglobin levels under 11.0 g/dl (the mean serum ferritin was 11.3 ± 15.5 μg/dl). At the conclusion of the study, the prevalence of anemia had decreased to 9% (mean serum ferritin, 20.2 ± 12.7 μg/dl). The authors reported a 178% increase in serum ferritin and concluded that an iron intake of 4 mg per day provides 40% of the RDA at a cost of R$0.34 (US$0.17) per child (table 1).

Studies on fortification of wheat flour with iron in the state of Ceará [44] began at the end of the 1990s and motivated the private grain industry to take steps to control the high prevalence of iron-deficiency anemia in one of the poorest states in northeastern Brazil. The prevalence of iron deficiency and iron-deficiency anemia in the northeast during the last decade was 50%, according to studies by Santos et al. [45], and as high as 70% in other, more isolated regions [46]. Since 2000 local commercial bakeries in Ceará have been receiving 30 mg of iron per kilogram as ferrous fumarate in bakery flour, principally for use in making bread products. In December 2002, government legislation was passed requiring fortification of all wheat and corn flour with 4.2 mg of iron and 150 μg of folic acid per 100 g by 2004 [17].

Economics of iron fortification

Iron deficiency causes economic loss to society in terms of growth, development, and productivity in a developing nation such as Brazil. According to a 15-country example analysis by Ross and Horton [26], the mean value of productivity losses due to iron-deficiency anemia was estimated at US$4 per capita, or 0.9 percent of the gross domestic product (GDP). These losses are in line with a World Bank publication [47] as to the economic losses imposed on developing countries, which represent 5 percent of the GDP. The study further states that the cost of adequate daily iron fortification would be less than US$0.04 per person annually. For example, assuming a developing-country per capita income of US$350 (US$17.5 billion for the whole country), the annual losses from micronutrient deficiencies (US$1 billion) would amount to more than 5 percent of the GDP. Implementation of a feasible food and beverage fortification program costing US$25 million would use less than 0.15% of the developing country's GDP [47]. Given a sustainable fortification program, including education directed at preventing iron-deficiency anemia, the cost of programs would be less than 3% of the GDP annually.

To give another example, the cost of treating a child for anemia in a Brazilian public hospital, with an average stay of nine days, is R$211 (US$84.40 at the 2001 exchange rate) [48]. The average annual cost per child for iron-fortification programs varies from R$0.09 to R$1.00 (table 1). These added costs would be passed on to the consumers if steps were taken to educate them about the fundamental importance of receiving "vitaminized" and/or iron-fortified foods and beverages. In the case of the poor, all government allotments, as is the case in Brazil, would contain iron-fortified foods (wheat and corn flour and powdered milk staples).

Challenges and recommendations

Experience has shown that merely passing legislation requiring fortification is insufficient. What is necessary is community activism, which can formulate strong opinions for shaping political and industrial commitment for implementing nutritional programs aimed at controlling micronutrient deficiencies, especially iron-deficiency anemia. Commitment is urgently needed for program duplication and up-scaling of the above-summarized experiences of fortification of food and liquids with iron if developmental and cognitive losses to children are to be avoided in future generations. If the targeted populations are thoroughly educated about the benefits for normal growth of preventing iron-deficiency anemia, there may be more openness to adapting to change, as studies of, for example, iron in drinking water have shown in Brazil. Food fortification has already been shown to work in developed countries [12–14].

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Nutrition challenges in the next decade*

S. Rajagopalan

My heart aches to think of the conditions of the poor and the low in India. So long as millions live in hunger and ignorance, I hold everyone a traitor, who has been educated at their expense and pays not the least heed to them. No amount of politics can be of any avail until the masses of India are well fed, well educated and well cared for.
— Swami Vivekanandha [1]

The State shall regard the raising of the level of nutrition and the standard of living of its people and the improvement of public health as among its primary duties.
— Article 47 of the Constitution of India [2]

Food and nutrition security leading to a healthy population has been the endeavor of the Indian Government. Towards this end, several policies have been formulated and various programs have been implemented across the country. Policies and programs to translate the duty of the State require an integrated approach, as they involve synthesis of many disciplines and synchronized inputs of manpower and resources from different sectors of economic and social activity. The logistics of such an integrated approach and the incorporation of the various apparently competing objectives within the feasible framework of planning require careful examination. If every sector of planning treats "man" as the key to development and the quality of human existence as the ultimate measure of development, then cohesion among different objectives can be easily achieved. In India, these objectives were sought to be achieved through the implementation of the integrated Five-Year Plans. At the time of independence, India faced two major nutritional problems: one was the threat of famine and acute starvation due to low agricultural production and lack of an appropriate food-distribution system, and the other was chronic energy deficiency due to low dietary intake related to poverty and low purchasing power. A high prevalence of infection because of poor access to safe drinking water, poor sanitation, and poor health care aggravated energy deficiency. The Green Revolution helped the country to move from chronic shortages of food to an era of surplus. Similarly, the White Revolution resulted in the production of large quantities of milk and milk products.

The first three Five-Year Plans [3] assumed that economic growth would itself solve the problem of poverty and undernutrition. But development benefits did not percolate to the poor as expected. So in the fourth Five-Year Plan [4], specific intervention programs for improving the nutrient status of vulnerable mothers and children were developed. Schemes for poverty eradication were also developed. The fifth Five-Year Plan implemented cohesive Minimum Needs Programmes [5] covering education, water supply, health, sanitation. and nutrition for the vulnerable sections of the population. An Integrated Child Development Services Scheme (ICDS) [6] was developed as a national program addressing issues related to child development and nutrition, based on a number of field-level studies. This centrally sponsored program is currently in operation in all the states.

The National Family Health Survey (NFHS) 1998–99 [7] and the Diet and Nutritional Status of Rural Population 2001 of the National Nutrition Monitoring Bureau (NNMB) [8] of the Indian Council of Medical Research, Government of India, depict the current nutrition picture of the country. Table 1 gives an overview of the population at risk throughout the life cycle due to a nutrient intake less than 50% of the recommended daily allowance (RDA). This table shows that an intake of iron less than 50% of the RDA is seen in all age groups, with the proportions varying from 70% to 80%. Apart from a low intake of iron, there is

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TABLE 1. Percentage of adults and children whose nutrient intake was below 50% of the RDA in rural areas of India in 2001

Age (yr) and sex	Adults				Age (yr) and sex	Children			
	Protein	Calories	Iron	Vitamin A		Protein	Calories	Iron	Vitamin A
≥ 18 F(L)	13.9	1.3	71.1	86.7	1–3	17.4	38.0	72.1	87.5
≥ 18 F(P)	15.4	1.6	68.1	82.4	4–6	6.5	24.1	70.7	87.3
≥ 18 F(NPL)	4.7	1.4	67.9	85.7	7–9	11.2	19.0	76.2	90.0
≥ 18 M	5.4	3.0	50.1	83.5	10–12 M	19.2	16.8	80.7	87.8
16–17 F	22.7	5.9	71.2	87.8	10–12 F	23.8	8.5	77.5	87.8
16–17 M	24.7	6.6	73.3	87.8	13–15 M	24.4	10.3	79.6	86.3
					13–15 F	24.9	5.8	68.0	87.7

M, Male; F, female; L, lactating; P, pregnant; NPL, neither pregnant nor lactating. Source: National Nutrition Monitoring Bureau 2002 [8].

also poor absorption of iron due to a largely vegetarian diet. Similarly, a vitamin A intake less than 50% of the RDA is seen in all age groups, with the proportions varying from 80% to 90%. Such poor intakes are reflected in the nutritional status of the population in all age groups (table 2).

Among ever-married women in the age group from 15 to 49 years, 51.8% were found to be anemic. Among ever-married adolescent women in the age group from 15 to 19 years, 56% suffered from anemia (table 2). In addition, chronic energy deficiency, indicated by a body mass index (BMI) [9] of less than 18.5 kg/m^2, was seen in 35.8% of the ever-married women. The prevalence of low BMI varied between 31.1% and 41.8% in different age groups. In the early reproductive period from 15 to 29 years, the prevalence of chronic energy deficiency was nearly 40%. This unacceptably low nutrition profile is the result of the reproductive behavior of the earlier cohort of undernourished mothers, resulting in 33% of children with low birthweight, based on a number of studies in India in 1998 and 1999. A high proportion of anemia and a BMI value below 18.5 among ever-married women from 15 to 19 and 35 to 49 years is likely to be an important factor contributing not only to low birthweight but also to underweight, stunting, and anemia in children below three years of age (tables 3 and 4). Many studies show that during the first six months, when children are breastfed, there is no growth-faltering, even for low-birthweight infants [10]. But when supplemental foods are given along with breastmilk from six months onwards, underweight and stunting emerge. Starting from the weaning period after breastfeeding, i. e., from less than six months to three years of age—the critical period for mental development and physical growth—growth-faltering resulted in underweight and stunting in 47% and 45.5% of children, respectively. The problem is related to the lack of access to good weaning food and poor sanitation, water supply, and hygiene. This shows that nutrition intervention should start much earlier and cover the period from six months to three years of age. An integrated intervention for the mother and child together, not in isolation from each other, is crucial to break the vicious circle of malnutrition in the life cycle. We also need a special program to ensure proper adolescent growth so that the height of the mother at the time of marriage is above 145 cm and her body weight is above 35 kg.

The Integrated Child Development Services (ICDS) and the Tamil Nadu Integrated Nutrition Project

TABLE 2. Overview of undernutrition status in India in 1999

Age (yr)	% of mothers				Age	% of children		
	Height < 145 cm	Anemia	BMI < 18.5	LBW		Underweight	Stunted	Anemia
35–49	13.7	50.5	31.1	Overall prevalence, 33%	<6 mo	4.9	15.4	71.7
30–34	12.3	50.5	35.0		6–11 mo	37.5	30.9	71.7
25–29	12.4	51.4	39.1		12–23 mo	58.5	57.9	77.0
20–24	13.0	53.8	41.8		24–36 mo	58.4	56.5	72.0
15–19	14.7	56.0	38.8		4–6 yr	60.1	49.3	60.0
					7–9 yr	73.2	NA	60.0
					10–13 yr	83.0	NA	60.0
					14–17 yr	75.8	NA	60.0

BMI, Body mass index; LBW, low birthweight; NA, not available.
Sources: National Family Health Survey 1998–99 [7], National Nutrition Monitoring Bureau 2002 [8].

TABLE 3. Relation between anemia status of mothers and their children in India in 1999

Mother's anemia status	% of children with any anemia
No anemia	67.8
Mild anemia	76.8
Moderate anemia	85.6
Severe anemia	86.8
Any anemia	74.3

Source: National Family Health Survey 1998–99 [7].

TABLE 4. Relation between nutritional status of mothers and their children in India in 1999

Mother's nutritional status	% of children		
	Underweight	Stunted	Wasted
Height			
< 145 cm	59.8	60.7	17.1
≥ 145 cm	45.1	43.3	15.2
Body mass index			
< 18.5	57.2	50.3	19.6
≥ 18.5	40.2	42.3	12.7

Source: National Family Health Survey 1998–99 [7].

(TINP) [11] have been designed to address the nutritional needs for orderly growth from the fetus to three years of age. This is an important challenge. Growth-faltering continues beyond three years unabated, as seen from the NNMB's rural survey. The proportion of underweight children increased from 60.1% for the age group from 4 to 6 years to 83% for the age group from 10 to 13 years. In the age group from 14 to 17 years, 75.8% of the children had low weight for their age. This shows that the expected growth velocity in the critical adolescent age group from 14 to 17 years did not materialize. The current nutrition situation may make one wonder whether the current vector of programs developed and implemented in all nine Five-Year Plans helped to realize the constitutional mandate of Article 47 of the Constitution of India with regard to raising the level of nutrition, raising the standard of living, and improving public health.

The following are some of the milestones achieved towards food and nutrition security [12]:

» The Green Revolution ensured food security at the macro level but not completely at the household level.
» Poverty was reduced.
» Per capita income was increased by more than 100%, and there was a modest improvement in the standing of living.
» The expectation of life at birth increased to 61 years.
» Severe forms of malnutrition, such as marasmus and kwashiorkor, have virtually disappeared. Some nutritional deficiencies, such as scurvy, beriberi, and pellagra, have been eliminated.

Although the expectation of life at birth has gone up to 61 years, the nutritional status of the surviving population has not improved considerably, in spite of huge investments in the Five-Year Plans. We have miles to go to realize the constitutional mandate.

Dr. Shanti Ghosh's study [13] following low-birthweight infants for 18 years revealed that their growth performance was poor compared with other infants and children of the same socioeconomic groups with normal birthweight. Apparently, children suffering from intrauterine growth retardation (IUGR) are programmed to grow and develop in a substandard growth trajectory, thus swelling the numbers of stunted and underweight children with low learning capacity and adults with low BMI and low productivity. Nearly 50% of children are stunted, and a nearly equal number have low weight for their age. These children also have low growth velocity during the adolescent period and end up as adults with chronic energy deficiency and BMI values less than 18.5. Women in the reproductive age group with low BMI values and anemia will in all probability deliver low-birthweight infants. This vicious circle perpetuates malnutrition from generation to generation. Synergic interaction between inadequate dietary intake and disease aggravates the vicious circle that is responsible for high mortality and morbidity in children.

Diarrheal diseases, intestinal parasitoids, and respiratory infections are common in developing countries and may also have an impact on IUGR. The immediate causes of IUGR often operate simultaneously with more deeply rooted underlying and basic causes. These causes relate to the care of women, access to and quality of health services, environmental hygiene and sanitation, household food security, educational status, and poverty. It has been estimated that for term infants weighing 2,000 to 2,500 g at birth, the risk of neonatal death is four times higher than for infants weighing 2,500 to 3,000 g, and 10 times higher than for infants weighing 3,000 to 3,500 g [14]. In developing countries with a high prevalence of low birthweight, infants with IUGR account for the majority of neonatal deaths. Most immune functions have been shown to be impaired in infants with IUGR. The greater the fetal growth retardation, the greater the impairment of immune competence. This impairment may be sustained through childhood. One study [15] links disproportionate fetal growth to altered immunoglobulin E concentrations in adult life, and another links it to autoimmune thyroid disease.

Epidemiological evidence suggests a link between maternal and early childhood undernutrition and increased risk of various chronic diseases in the adult population. The risk of diseases such as hypertension, coronary heart disease, stroke, and non-insulin-dependent diabetes, together called syndrome X [16], is associated with small size, wasting, and stunting at birth. The life-cycle picture shows how the causes and consequences of various nutrition problems change and interact over time (fig. 1). The short-term and long-term effects of early malnutrition are graphically portrayed in a chart by the UN Commission on Nutrition (fig. 2) [17].

Malnutrition all along the life cycle should be recognized as a national problem. Direct nutritional interventions, short-term measures such as supplementary feeding, prophylaxis through limited nutrient supplements, growth monitoring, etc., although they have an important role in controlling specific nutritional problems, do not play a major part in the overall improvement of the population's nutritional status. Current programs try to treat existing nutritional problems in preschool children and mothers during pregnancy and lactation. The new focus should be on the prevention of malnutrition at various stages of the life cycle. Schoolchildren and adolescent boys and girls are largely not covered by the existing programs. There are specific nutritional requirements for the aged, and this also needs to be addressed by the state. Although direct nutritional interventions are necessary, they are not sufficient. The nutritional status of the population also depends to a large extent on the level of development in several sectors of the government.

Denying a child the opportunity for the full expression of its innate potential for mental and physical development is the cruelest form of inequality and violence. In this context, the Life Cycle Rights for

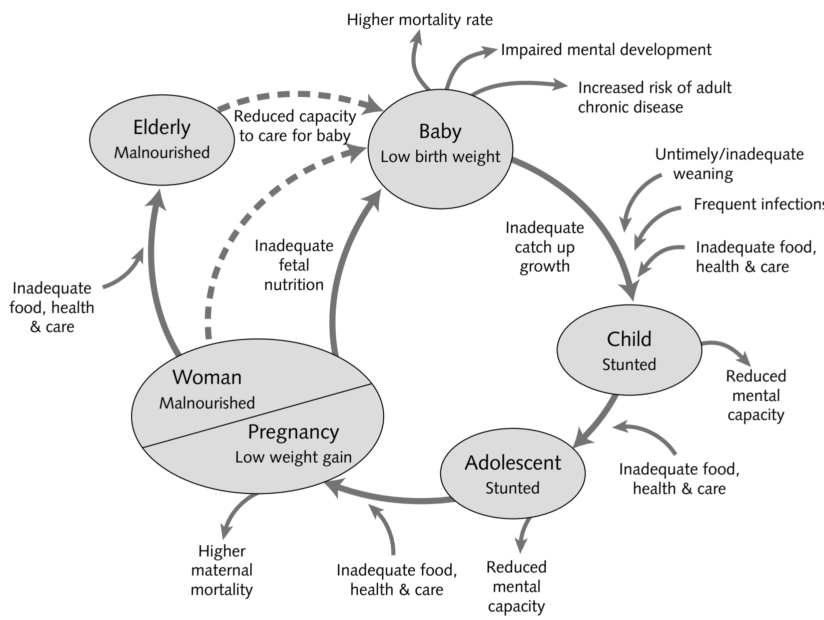

FIG 1. Interaction and change over time of the causes and consequences of various nutrition problems [17]

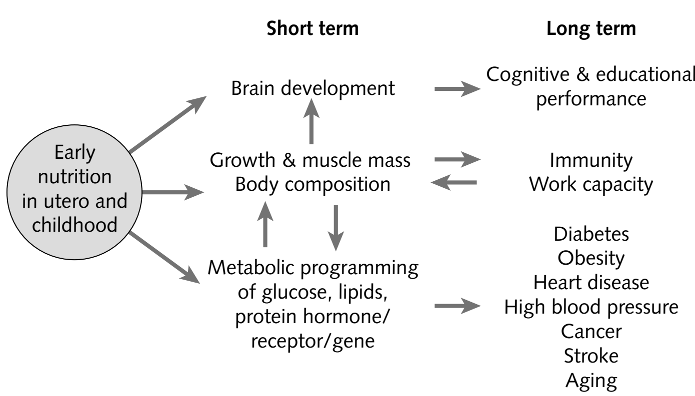

FIG 2. The short-term and long-term effects of maternal malnutrition [17]

growing children are the following [18]:

- The first right of a newborn child is a birthweight of 2.5 kg or more. This right requires orderly intrauterine growth through maternal nutrition.
- The second right refers to the nutritional needs of children in the growing phase of the first year of their life.
- Protection of children from infectious diseases is the third right.
- Supplementary nutrition in the next growing stage when phased weaning from breastmilk takes place is the child's fourth right.
- Children should not be victims of gender bias of their elders. This is their fifth right.
- There is no organized attempt to look at the health and nutrition profile of school-age children and adolescents—a critical phase of growth before they enter the labor market. This requires special attention. This is their sixth right.
- Adolescent girls, the future mothers, require special attention, especially in the growth phase after puberty. This basic seventh right will ensure healthy motherhood.
- The adult population faces degenerative noninfectious diseases because of the epidemiological transition. This population requires integrated health facilities to reduce the disease burden on them. This is their eighth right.
- The ninth right is to enable the elderly population to live in comfort and health. Caring for the aged, particularly those belonging to the economically and socially underprivileged sections of the population, is a priority task.

The Indian experience is unique in the sense that several sectors of the government already have well-defined policies and programs that directly or indirectly contribute to nutrition promotion. There are strong and viable national policies—agriculture policy, food policy, education policy, health policy, and various development programs, most of which, directly or indirectly, influence the health and nutrition of the people. The government has initiated several measures in the spheres of women and child development, health and family welfare, education, rural development, etc., in recent years. The major task in the war against malnutrition, therefore, is to ensure that nutritional objectives not only are articulated in various development/sectoral plans and policies, but also are matched by plans of action, and that there is close coordination between these sectors to achieve the goals set in various sectors in the tenth Five-Year Plan and improve development outcomes in a sustainable manner. There is an imperative need for mainstreaming nutrition to improve development outcomes.

A long-held tenet is that healthy soil will produce healthy and nutritious food that in turn will ensure healthy human beings and animals. Soil contains a vector of nutrients, crops grown on these soils acquire a vector of nutrients, and men and animals subsisting on these crops also acquire a vector of nutrients. There are many nonnutritional factors in the foods normally consumed that play a beneficial role in improving human health. Dr. C. Gopalan [19] wants nutrition scientists to consider phytonutrients as important as other conventional nutrients in the foods. There is some unknown synergy and convergence among various nutrients in providing sustainable health, which is perhaps nature's gift to mankind. Promoting any one nutrient and attributing to it all health consequences is to ignore the accumulated knowledge of many interrelationships among different micro- and macronutrients and their role in human nutrition. A holistic view of an integrated role of different nutrients is yet to emerge. Dr. Gopalan graphically describes how all nutrients in the food act collectively, synergistically, each nutrient playing a part in an orchestra: "It will be poor strategy to converge, what is essentially an orchestra in to solo." In a real-life situation, the diets of the poor, and even of some rich people, may be deficient in a number of nutrients. Planning with the understanding of the soil-plant-food nexus may be necessary for the next decades.

Vertical programs of many departments are implemented as an end in themselves without the necessary synergy convergence. The intersectoral coordination mechanism may be useful only if nutrition objectives are also an internal part of the sectoral development goals and objectives. The Government of India, Department of Women and Child Development, in their National Plan of Action on Nutrition [20] have indicated specific nutrition objectives to be included in planning for different sectors, such as agriculture, forests, etc. Healthy human capital is a prerequisite for improving developmental outcomes. In this context, the Symposium on Mainstreaming Nutrition to Improve Development Outcomes, organized by the UN Subcommittee on Nutrition, was very timely. The Thirteenth Session of the United Nations System's Standing Committee on Nutrition met in Chennai between 3 and 7 March 2003, hosted by the M. S. Swaminathan Research Foundation. A special consultation on Malnutrition Free Tamil Nadu, organized on 3 March 2003, had the benefit of the thinking of experts attending the UN Subcommittee Meeting.

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Prevention of chronic diseases: WHO global strategy on diet, physical activity and health

Amalia Waxman

In 2001, noncommunicable conditions, including cardiovascular diseases, diabetes, obesity, cancers, and respiratory diseases, accounted for 59% of the 56.5 million deaths and 45.9% of the global burden of disease. Of 17 million deaths, the majority were related to heart disease and stroke. This reflects a shift in the pattern of disease worldwide, so that many countries in the developing world are now struggling with the double burden of both infectious and noncommunicable diseases. This shift in turn reflects a significant change in dietary habits, physical activity levels, and tobacco use as a result of industrialization, urbanization, economic development, and the increasing globalization of the food market.

The World Health Report 2002 [1] describes in detail how a few major risk factors account for a significant proportion of all deaths and disease in most countries. For chronic diseases, the most important include high blood pressure, tobacco use, high cholesterol levels, low fruit and vegetable intake, overweight, and physical inactivity.

Many of the chronic disease risks, and the diseases themselves, overlap. Heart attacks and strokes kill about 12 million people every year (7.2 million due to ischemic heart disease and 5.5 million to cerebrovascular disease). In addition, 3.9 million people die annually from hypertensive and other heart conditions.

Two-thirds of the estimated 177 million people worldwide affected by diabetes (mostly type 2) live in the developing world. More than 1 billion adults worldwide are overweight, and at least 300 million of these are clinically obese.

The nutrition transition and the increase in sedentary behavior are occurring at a much faster pace in developing countries than in developed countries. Several trends suggest that the noncommunicable disease problem will grow steadily worse unless urgent action is taken. Some of these trends include increased consumption of animal fats and unhealthful hydrogenated fats; widespread displacement of nutrient-rich foods (such as fruits, vegetables and legumes) by energy-dense, nutrient-poor foods; and increased global consumption of salty, sugary, and fatty foods, all within a context of reduced levels of physical activity.

In all countries, chronic diseases have a major impact on the demand for health services. High costs of treatment, lost productivity, and premature death negatively affect economies and quality of life. Thus, the cost-effective prevention of noncommunicable diseases should be an important development agenda issue.

In both developed countries and many lower middle-income countries, patterns of unhealthy behaviors and associated deaths often begin in the more affluent sectors of society. However, global experience suggests that in time all major harmful risks to health will cluster in the poorest communities—even in many rural areas—and become a major contributor to inequities by social class.

The scientific evidence is strong that a change in dietary habits and physical activity can powerfully influence several of these risk factors in populations. Sustained behavioral interventions have been shown to be effective in reducing population risk factors. Although an optimal diet is critical, daily physical activity of moderate intensity is well-established as an important determinant for good health, helping to lower blood pressure, reduce body fat, and improve glucose metabolism. Daily physical activity can also help reduce the incidence of osteoporosis and falls among older people.

About 75% of cardiovascular diseases can be attributed to the majority risks: high cholesterol, high blood pressure, low fruit and vegetable intake, inactive lifestyle, and tobacco use. Up to 80% of cases of coronary heart disease, 90% of type 2 diabetes, and one-third of cancers of all types can be avoided by changing to a healthier diet, increasing physical activity, and stopping

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smoking. The benefits of behavioral interventions in reducing the rates of cardiovascular diseases, cancers, and diabetes in populations have been well-proven in countries such as Finland, Japan, and Singapore. Cost-effective behavioral and pharmacological treatments for high blood pressure, diabetes, and raised cholesterol have life-saving effects and should be routinely implemented at the primary health care level. Dietary, physical activity, and smoking cessation programs should be integral to both the prevention and management of chronic diseases. Such interventions will require a life-course approach to eating and physical activity that begins before pregnancy, includes breastfeeding, and extends into old age.

Recognizing this, the Fifty-Third World Health Assembly in May 2000 adopted a resolution endorsing the World Health Organization (WHO) Director-General's global strategy for prevention and control of noncommunicable diseases (WHA53.17). The strategy emphasized integrated prevention by targeting three main risk factors: tobacco use, unhealthful diet, and physical inactivity.

The Fifty-Fifth World Health Assembly in May 2002 discussed a report by the WHO secretariat and recognized the importance of the framework for action on diet and physical activity within the integrated approach to prevention and control of noncommunicable diseases. The resolution approved by the Assembly requested that the Director-General develop a global strategy on diet, physical activity, and health (WHA55.23) [2].

In her address to the delegates of the Fifty-Fifth World Health Assembly, WHO Director-General Dr. Gro Harlem Brundtland said:

> High blood pressure and high blood cholesterol, strongly linked to cardiovascular and cerebrovascular diseases, are also closely related to excessive consumption of fatty, sugary and salty foods. They become even more dangerous when combined with the deadly forces of tobacco and excessive alcohol consumption. Obesity, a result of unhealthy consumption, is itself a serious health risk. All of these factors—blood pressure, cholesterol, tobacco, alcohol and obesity, and the diseases linked to them—are well known to wealthy societies. They dominate in all middle- and upper-income countries. The real drama is that they are becoming more prevalent in developing communities, where they create a double burden on top of the infectious diseases that always have afflicted poorer countries. [3]

In response to these resolutions and in keeping with the seriousness of the public health problem, WHO is engaged in a process that will involve a broad and inclusive consultation, which will lead to the Global Strategy on Diet, Physical Activity and Health. The overall goal of the strategy is to improve public health through healthy eating and physical activity.

The guiding principles of this process are the following:

» Stronger evidence for policy: synthesize existing knowledge, science, and interventions on the relationship between diet, physical activity, and chronic disease;
» Advocacy for policy change: inform decision makers and stakeholders of the problem, determinants, interventions, and policy needs;
» Stakeholder involvement: agree on the roles of stakeholders in implementing the global strategy;
» A strategic framework for action: propose appropriately tailored policies and interventions for countries.

The process

Stronger evidence for policy

Phase I: Finalizing the expert consultation report

A joint WHO/FAO Expert Consultation on Diet, Nutrition and the Prevention of Chronic Diseases was held in Geneva on 28 January through 1 February 2002. Sixty experts were involved in assembling and reviewing the latest scientific evidence on diet, physical activity, and prevention of chronic diseases. The report specifically discusses obesity, cardiovascular diseases, cancer, diabetes, dental diseases, and osteoporosis and provides recommendations on population nutrient goals. This report represents the current scientific evidence and updates work carried out by a similar group in 1989. The recommendations in the report will be considered by WHO as it develops the Global Strategy on Diet, Physical Activity and Health [4].

The executive summary of the report is published in this issue of the *Food and Nutrition Bulletin* (see pages 285–286). The key recommendations of this report include: eating more fruit and vegetables, as well as nuts and whole grains; daily physical activity; moving from saturated animal fats to unsaturated vegetable oil-based fats; cutting the amount of fatty, salty, and sugary foods in the diet; and maintaining a normal body weight (within the body mass index range of 18.5 to 24.9).

Advocacy for policy change

The success of developing the Global Strategy on Diet, Physical Activity and Health through consultation with stakeholders will rely on a well-informed public. Countries and their peoples must be alerted to the health problems caused by unhealthful diets and physical inactivity, to the devastating social and economic outcomes of chronic conditions resulting from these risk factors, and to the proven prevention interventions.

The involvement of different stakeholders will allow an opportunity to ensure that this information is adequately provided to decision makers, the public, and, above all, the participants in the process. Communication of this information, therefore, is an essential component in the process leading to a strategy document.

Stakeholder involvement

Phase II: Process for stakeholder consultation on the WHO Global Strategy on Diet, Physical Activity and Health

The Fifty-Fifth World Health Assembly resolution on diet, physical activity, and health requested that the strategy be developed in consultation with member states, bodies of the United Nations, and professional organizations. It also requested that the Director-General strengthen collaboration with other partners, including intergovernmental organizations and the private sector.

In response, the WHO Noncommunicable Diseases and Mental Health Cluster (NMH) has embarked on an 18-month consultation process with these stakeholders. The consultation process provides the content basis for the strategy. A high-level, internationally recognized group of experts (called the Reference Group) with diverse and multisectoral backgrounds is assisting WHO in devising a strategy from this process. This consultation process was conducted through meetings with a selected number of countries (81) organized by six WHO regional offices, UN agencies, civil society organizations, and the private sector.

Member states. The purpose of the regional consultations with member states is for countries in each region to provide information on the extent of the problem associated with diet, physical activity, and chronic disease, and appropriate prevention strategies for their particular countries. The consultations focused on the discussion of national, regional, and global interventions that will be effective within individual countries and that will take account of national, social, cultural, and economic realities. Regional differences, common concerns, or global consensus were noted and served as the basis of the development of the global strategy. This consultation process is building on past and current activities and programs on the issue carried out by WHO regional offices and by member states.

UN agency consultation. This track is important to ensure that all concerned UN agencies are involved. A technical meeting was convened in Geneva on June 4, 2003. It is hoped that this meeting will lead to the involvement of the concerned technical officers in the agencies whose work is vital to a successful implementation of the strategy.

Invited agencies included the Economic Commission for Europe, the Food and Agriculture Organization (FAO), the International Atomic Energy Agency (IAEA), the International Food Policy Research Institute (IFPRI), the International Labour Office, the United Nations Environment Programme (UNEP), the United Nations Educational, Scientific, and Cultural Organization (UNESCO), the United Nations Children's Fund (UNICEF), the World Bank, the World Food Programme (WFP), and the World Trade Organization (WTO).

Consultation with civil society organizations. Not-for-profit consumer organizations and professional and lay health organizations with special interest in the areas of health, nutrition, and physical activity are closely involved in this process. A roundtable meeting with Dr. Brundtland and civil society organizations took place on May 16, 2003, and a broader consultative meeting with civil society organizations was held on May 17, 2003, for NGOs to agree on recommendations to the global strategy on diet, physical activity, and health.

Consultation with the private sector. Private-sector consultations will primarily involve the food, sport, and advertising industries, as they are important stakeholders in the area of diet and physical activity. The process of consultation will have two tiers. One will focus on trust-building and identifying common ground for collaboration. The second will be a formal consultation to comment on the discussion paper. A roundtable meeting with senior executives from food and related industries took place in May 2003. A consultation meeting with industry and trade associations was held on June 17, 2003, where recommendations to the global strategy were agreed upon [5].

A strategic framework for action

Phase III: Drafting the global strategy

After all consultation meetings have been concluded, the WHO secretariat will prepare a strategy document for the deliberation of its member states. WHO will be advised in this process by the reference group. A first discussion on the global strategy will take place at the 113th Executive Board Meeting in January 2004. It is expected that the strategy will be endorsed by the Fifty-Seventh World Health Assembly in May 2004.

This strategy will become the backbone for WHO and its member states to continue to work together with stakeholders in promoting global changes toward healthier diets and increased physical activity, with the goal of preventing chronic diseases and promoting population health.

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Joint WHO/FAO expert report on diet, nutrition and the prevention of chronic diseases: Executive summary

The WHO/FAO Expert Consultation on Diet, Nutrition and the Prevention of Chronic Diseases met in Geneva from 28 January to 1 February 2002 to examine the science base of the relationship between diet and physical activity patterns, and the major nutrition-related chronic diseases. Recommendations were made to help prevent death and disability from major nutrition-related chronic diseases. These population nutrient intake and physical activity goals should contribute in the development of regional strategies and national guidelines to reduce the burden of disease related to obesity, diabetes, cardiovascular disease, several forms of cancer, osteoporosis and dental disease. They are based on the examination and analysis of the best available evidence and the collective judgement of a group of experts representing the global scope of WHO's and FAO's mandate. Key findings include:

» *Obesity*. The imbalance between declining energy expenditure due to physical inactivity and high energy in the diet (excess calories whether from sugar, starches or fat) is the main determinant of the obesity epidemic. Increasing physical activity, plus reducing intakes of foods high in fat and foods and drinks high in sugars, can prevent unhealthy weight gain. Taking these simple goals to concrete action requires major social and environmental changes in order to effectively promote and support healthier choices at the individual level.

» *Diabetes*. Excess weight gain, overweight and obesity and physical inactivity account for the escalating rates of type 2 diabetes, worldwide. Diabetes leads to increased risk of heart disease, kidney disease, stroke and infections. Increased physical activity and maintaining a healthy weight play critical roles in the prevention and treatment of diabetes.

» *Cardiovascular diseases*, the major killers worldwide, are to a great extent due to unbalanced diets and physical inactivity. Risk of their main forms, heart disease and stroke, is reduced by eating less saturated and trans fats, and sufficient amounts of (n-3 and n-6) polyunsaturated fats, fruits and vegetables and less salt, as well as by physical activity and controlling weight. Reduction of salt intake helps reduce blood pressure, a major cause of cardiovascular diseases.

» *Cancer*. Tobacco is the number one cause of cancer, but dietary factors contribute significantly to some types of cancer. Maintaining a healthy weight will reduce the risk for cancers of the oesophagus, colorectum, breast, endometrium and kidney. Limiting alcohol intake will reduce risk for cancers of the mouth, throat, oesophagus, liver and breast. Ensuring an adequate intake of fruit and vegetables should further reduce risk for oral cavity, oesophagus, stomach and colorectal cancer.

» *Osteoporosis and bone fractures*. Fragility fractures are a problem of older people. Adequate intakes of calcium (500 mg per day or more) and of vitamin D in populations with high osteoporosis rates helps to reduce fracture risk, so does sun exposure and physical activity to strengthen bones and muscles.

» *Dental disease*. Caries is preventable by limiting the frequency and amount of consumption of sugars and by appropriate exposure to fluoride. Erosion of teeth by dietary acids in beverages or other acidic foods may contribute to tooth destruction.

The crucial role of physical activity as part of nutrition and health was acknowledged. Physical activity is a key determinant of energy expenditure, and thus fundamental to energy balance and weight control. The beneficial effects of physical activity on the metabolic syndrome are mediated by mechanisms beyond controlling excess body weight. Physical inactivity is already a major global health risk and is prevalent in both industrialized and developing countries, particularly among the urban poor in crowded mega cities. Measures and policies required to promote healthier food consumption patterns and facilitate a physically active life share common grounds and are mutually interactive in determining healthier behaviors.

Healthy diets and physical activity are key to good nutrition and necessary for a long and healthy life. Eating nutrient dense foods and balancing energy intake with the necessary physical activity to maintain a healthy weight is essential at all stages of life. Unbalanced consumption of foods high in energy (sugar, starch and/or fat) and low in essential nutrients contributes to energy excess, overweight and obesity. The amount of the energy consumed in relation to physical activity and the quality of food are key determinants of nutrition related chronic disease.

Not all fats are the same, it pays to know the difference. The scientific complexities of these issues should not obscure the simple messages required to orient and guide consumers. People should eat less high-calorie foods, especially foods high in saturated or trans fats and sugar, be physically active, prefer unsaturated fat and use less salt; enjoy fruits, vegetables and legumes; and select foods of plant and marine origin. This consumption pattern is not only healthier but more favourable to the environment and sustainable development.

To achieve best results in preventing nutrition-related chronic diseases, strategies and policies should fully recognize the essential role of both diet and physical activity in determining good nutrition and optimal health. Policies and programs must address the need for change at the individual level as well as the modifications in society and the environment to make healthier choices accessible and preferable.

In communities, districts and nations in which widespread, integrated interventions have taken place, dramatic decreases in NCD-related death and disability have occurred. Successes have come about where people have acknowledged that the unnecessary premature deaths that occur in their community are largely preventable and have empowered themselves and their civic representatives to create health-supporting environments. This has been achieved most successfully by establishing a working relationship between communities and governments; through enabling legislation and local initiatives affecting schools and the workplace; involving food producers and processing industry. Beyond the rhetoric, this epidemic can be halted—the demand for action must come from those affected. The solution is in our hands.

This report is only the first step in a process that includes consultations with governments, as well as other public and private sector stakeholders in all geographic regions, to culminate in the formulation of a Global Strategy on Diet, Physical Activity and Health, to be considered by the World Health Assembly in 2004.

The importance of women's status for child nutrition in developing countries

International Food Policy Research Institute (IFPRI) Research Report Abstract 131

Lisa C. Smith, Usha Ramakrishnan, Aida Ndiaye, Lawrence Haddad, and Reynaldo Martorell

Malnutrition affects one out of every three preschool-age children living in developing countries. This disturbing, yet preventable, state of affairs causes untold suffering and, given its wide scale, presents a major obstacle to the development process. Volumes have been written about the causes of child malnutrition and the means of reducing it. But the role of women's social status in determining their children's nutritional health has gone largely unnoticed until recently. This study explores the relationship between women's status and children's nutrition in three developing regions: South Asia, Sub-Saharan Africa (SSA), and Latin America and the Caribbean (LAC).

The study defines women's status as women's power relative to men. Women with low status tend to have weaker control over household resources, tighter time constraints, less access to information and health services, poorer mental health, and lower self-esteem. These factors are thought to be closely tied to women's own nutritional status and the quality of care they receive, and, in turn, to children's birth weights and the quality of care they receive.

The study sets out to answer three main questions: First, is women's status an important determinant of child nutritional status in the three study regions? Second, if so, what are the pathways through which it operates? And finally, why is South Asia's child malnutrition rate so much higher than SSA's? To answer these questions, this report brings together Demographic and Health Survey data on 117,242 children under three years of age from 36 developing countries. It uses two measures of women's status: women's decision-making power relative to that of their male partners and the degree of equality between women and men in their communities.

The empirical results leave no doubt that higher women's status has a significant, positive effect on children's nutritional status in all three regions. Further, they confirm that women's status impacts child nutrition because women with higher status have better nutritional status themselves, are better cared for, and provide higher quality care to their children. However, the strength of influence of women's status and the pathways through which it influences child nutrition differ considerably across regions.

In South Asia, increases in women's status have a strong influence on both the long- and short-term nutritional status of children, leading to reductions in both stunting and wasting. The human costs of women's lower status in the region are high. The study estimates that if women and men had equal status, the under-three child underweight rate would drop by approximately 13 percentage points, meaning 13.4 million fewer malnourished children in this age group alone. As women's status improves in the region, so does the quality of the pathways through which it influences child nutrition. The pathways identified by the study are women's nutritional status (as measured by body mass index [BMI]), prenatal and birthing care for women, complementary feeding practices for children, treatment of illness and immunization of children, and the quality of substitute child caretakers. In Sub-Saharan Africa too, women's status and the long- and short-term nutritional status of children are linked. If women and men enjoyed equal status, child malnutrition in the region would decrease by nearly 3 percentage points—a reduction of 1.7 million malnourished children under three. The pathways to this judicious outcome are largely the same as those in South Asia, except that higher women's status improves child nutrition only for women with very little relative decision-making power and has no influence on treatment of child illness. LAC exhibits a different pattern from that of South Asia and SSA. Women's status has a positive effect only on children's short-term nutritional status and only in those households in which women's relative decision-making power is very low. Women's status has a distinctly negative influence on their BMI in this region, where weight gain is an emerging public health problem. The effect probably reflects the greater tendency among higher status women to "weight watch" and likely does not threaten children's nutritional status. The pathways connecting women's status and children's nutrition include prenatal and birthing care for women, feeding frequency, immunization, and quality of substitute caretakers.

Among the developing-country regions, South Asia's particularly high child malnutrition rate has remained a puzzle. South Asia trails even SSA, despite surpassing that region's record on many of the determinants of child nutritional status—national income, democracy, food supplies, health services, and education. The study indicates that three broad socioeconomic factors help explain this "Asian Enigma": women's status, sanitation, and urbanization. Women's status makes by far the greatest contribution to the regional gap in children's nutritional status. It plays this role not only because it is lower in South Asia than in SSA, but mainly because its positive impact is stronger in South Asia—making its costs in terms of child malnutrition far higher in that region.

The implication of the study's empirical results is clear: in the interest of sustainably improving the nutritional status of children, women's status should be improved in all regions. Doing so is especially urgent for South Asia, followed by SSA. Accomplishing this task requires policies that eradicate gender discrimination and policies that reduce power inequalities between women and men by proactively promoting catch-up for women. Examples include enabling women to gain access to new resources, implementing cash transfer programs that promote girls' education and health care, introducing technologies that save household labor, subsidizing child care for working parents, and initiating programs to improve the nutritional status of adolescent girls and young women. In communities that resist shifts in the power balance between genders, policies can mitigate the negative effects of the imbalance, rather than addressing it directly. Targeting health services to communities where women's status is low is one example of this indirect approach. The study also warns that improving women's status can lead to reduced breastfeeding, which is harmful to child nutrition. Efforts to improve women's status, therefore, must be accompanied by efforts to protect, support, and promote breastfeeding.

This research shows unequivocally that making a decision at the policy level to improve women's status produces significant benefits. Not only does a woman's own nutritional status improve, but so too does the nutritional status of her young children. Raising women's status today is a powerful force for improving the health, longevity, mental and physical capacity, and productivity of the next generation of young adults.

Moving forward with complementary feeding: Indicators and research priorities

International Food Policy Research Institute (IFPRI) Discussion Paper 146 (April 2003)

Marie T. Ruel, Kenneth H. Brown, and Laura E. Caulfield

Key words: Breastfeeding practices, complementary feeding practices, dietary diversity indicators, hygiene, psychosocial care

Development of successful interventions to improve child-feeding practices requires appropriate instruments to assess current practices and monitor the impact of programs designed to improve them. Simple, valid, and reliable tools are lacking to measure child feeding in the context of program development, for the purposes of (1) assessment, (2) design and targeting of intervention programs, and (3) monitoring and evaluating their progress. The problem of measurement arises primarily because child-feeding practices encompass a series of age-specific, interrelated behaviors that are difficult to summarize into one or a few variables.

The main objectives of this report are to review and discuss possible indicators of adequate or optimal complementary feeding practices as they relate to children ages 6–23 months and to describe steps in validating and assessing the utility of these potential indicators for various purposes.

Characteristics and performance criteria of indicators

Indicators are data collected through measurement, observation, or interview that describe an underlying phenomenon. In the case of complementary feeding practices, indicators are required to characterize caregiver behaviors related to feeding and the child's usual dietary intake.

In developing a set of possible indicators, the authors consider key performance issues, such as validity, reliability, and responsiveness. They also discuss main threats to indicator performance, namely systematic biases and reactivity (which affect both validity and reliability), and random error and intra-individual and day-to-day variability (which affect reliability). The authors also discuss several aspects related to the application of the indicators and discuss the strengths and weaknesses of different data collection approaches.

Current recommendations and possible indicators of adequacy of complementary feeding practices

In 1998, the World Health Organization (WHO)/UNICEF developed a technical document to establish energy and nutrient requirements from complementary foods (CF) for the breastfed child, which was updated in 2003 by Dewey and Brown. A set of "Guiding Principles" was then developed by the Pan American Health Organization (PAHO)/WHO to guide programs aimed at improving complementary feeding practices.

The present document proposes a series of indicators based on these "Guiding Principles," and focuses on the following practices: breastfeeding duration and frequency, energy and nutrient density of CF, safe preparation and storage of CF, and care during feeding. The indicators proposed apply to 6- to-23-month-old breastfed children and are to be used for population, as opposed to individual-level inferences. In each case, the authors discuss the most precise indicators and measurement approaches and then propose proxy indicators that might be easier to collect and thus potentially more useful for programs and large-scale surveys.

Examples of proposed indicators for the different dimensions of complementary feeding practices are as follows:

» **Breastfeeding**: *Percent of 6- to 23-month-old children breastfed yesterday.* (Note: other age groupings such as 3-month or 6-month intervals can be used if sample sizes allow; this indicator is based on maternal recall during the previous 24 hours.)

» **Energy intake**: *Average energy density of main CF fed to children 6–8 and 9–11 months of age, respectively.* (Note: This indicator is based on data collected at the group- or community-level, using group recipe trials.)

- » **Feeding frequency**: *Percent of children 6–8 months and 9–23 months fed CF at least twice, and three times a day, respectively*. (Note: This indicator is based on maternal recall, usually for the previous 24 hours. Intake of snacks should also be measured and an indicator of snacking frequency can be used.)
- » **Nutrient adequacy**: (1) Percent of children 6–23 months old who consumed in previous 24 hours: (a) animal products; (b) dairy products; (c) vitamin A-rich foods; (d) fortified products. (2) Mean number of foods (or food groups) consumed in previous 24 hours (an indicator of dietary diversity). (Note: These indicators are based on the assumption [still to be verified] that dietary diversity and/or intake of specific groups of nutrient-dense foods predict nutrient density of the diet.)
- » **Safe preparation and storage of CF**: A series of indicators related to hand-washing, safe storage and rewarming of cooked foods, use of clean utensils to prepare and serve food to the child, avoidance of baby bottles and use of safe water is proposed. (Note: Collection of hygiene information based on recall is highly subject to systematic biases resulting from overreporting of good practices, because most populations have at least some knowledge of appropriate hygiene practices.)
- » **Care during feeding**: Two types of indicators are proposed to measure care during feeding. Indicators to assess: (1) feeding styles (responsive, controlling, laissez-faire behaviors); and (2) psychosocial care during feeding, as defined in the "Guiding Principles" (e.g., feed infants directly and assist older children, be responsive to hunger and satiety cues, feed slowly and patiently, encourage the child to eat, utilize various strategies when child refuses to eat, feed in a protective environment, etc.)

Research and indicator validation priorities

The paper concludes by highlighting research priorities to validate the suggested indicators.

- » **Care during feeding**: For breastfeeding frequency: Research is needed to assess whether feeding frequency accurately differentiates between children with low versus high breast milk intake. Research should also test the accuracy of recall compared to observational approaches.
- » **For energy intake from CF**: The group recipe trial method proposed to assess average energy density of main CF needs to be validated. Variability within and between recipes, households, and population groups needs to be assessed. The underlying assumption that infants 6–11 months of age receive most of their energy from few CF also needs to be verified in a variety of contexts.
- » **Feeding frequency**: Recall methods to assess feeding frequency should be validated against observations. Recall methods to accurately differentiate between snacks and meals should also be developed.
- » **Nutrient adequacy**: The usefulness of dietary diversity measures to predict nutrient adequacy of CF needs to be validated. A number of methodological aspects still need to be addressed to design accurate and reliable dietary diversity indicators for CF.
- » **Safe preparation and storage of CF**: The main research need in this area is to assess the validity of recall approaches and to try to design rapid observational methods such as spot check instruments that would minimize recall biases.
- » **Care during feeding**: There is an urgent need to develop and validate indicators of feeding behaviors within the context of psychosocial care during feeding. Indicators based on caregiver recall need to be developed and tested against structured observations.

Conclusion and discussion

This report highlights the need to carry out a wide range of validation studies to accelerate progress in developing simple and useful indicators of complementary feeding. A number of existing data sets could be used to address most of the indicator validation needs identified here. Research to develop and validate simple tools to assess the crucial psychosocial care aspects of complementary feeding is also urgently needed.

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Commentary

Response to "Malnutrition and dietary protein: Evidence from China and from international comparisons"

This commentary was received too late for publication in the June 2003 issue of the Bulletin, *but we publish it here because the observations of Dr. Wray add a good deal to the discussion.*

The opportunity to comment on the paper by Jamison and his colleagues [1] is most welcome. My perspective, and biases, on the issues they discuss are based largely on work in pediatrics and community health in Turkey, Colombia, and Thailand during a period of 17 years. In addition, I was privileged to visit China in 1973 as a member of the Early Childhood Development Delegation, one of the earliest US delegations to visit China, when I was able to pay particular attention to growth in children under five years of age [2–4]. Nutrition, growth, and mortality in young children have been major concerns throughout my career.

Dr. Jamison has studied health issues having to do with China for many years, and this is an interesting contribution. There is no need here to repeat the study design, but the three populations from which data were used for the study, must be mentioned. They include:

» Data from a sample of urban adults, aged 18 to 25 years, from 13 provinces of China, in 1979: information on average heights and weights for men and women and on average income and availability of energy and protein;

» Data from a sample of adult men and women from 64 rural counties: information on heights and weights plus data on income, energy availability, and protein share from 26 provinces, around 1983;

» Data from 41 populations of men and 33 populations of women in 40 and 32 countries, respectively: information on average heights, as well as income, energy, protein share, and ethnic group, around 1960.

Their analyses showed that in the populations studied, protein availability was the variable that correlated most strongly with adult height, and this effect was found to be stronger in males than in females. As the authors put it, "The results consistently suggest that protein rather than energy deficiency is the principal dietary cause of growth failure." The effect was not always apparent in women. There was no correlation with the income data.

One of the caveats offered by the authors concerns the fact that the data pertaining to protein availability "are averages rather than individual values." This does pose an interesting problem in interpreting this paper. The data estimating protein availability, as well as the rest of the data, except for the anthropometry, are, to say the least, far removed from the individuals measured to obtain the population means for height. In the case of the young adults, the protein availability estimates are based on the availability of protein at the provincial level; for the 64 counties, the data referred to "average consumption in the specific communities studied," and for the cross-country studies, the data are based on country-level estimates of per capita protein availability in World Bank reports. Given what we know about the host of variables that affect the quantity of nutrients that finally reach the individual, including, and probably most important, economic factors and intrafamilial variations in dietary intake, the fact that there is any correlation whatsoever between height and such estimates is astounding. That differences in protein availability as estimated at the national level, not to mention province or county levels, are associated with differences in population mean heights suggests that the connection is extraordinarily powerful.

It is interesting to note, however, that in all three data sets, the authors found that protein availability correlated with height more significantly for men than for women. Women were shorter than men, and their height varied little with protein availability. This was true even in the cross-national analyses.

It is almost a truism in many cultures, and more so in poor populations, that men are first at the table, get their choice of whatever food is available, and are likely to consume the protein, if there is any. Women and children get the leftovers. The results in this paper seem to confirm that on a global scale! Whether there is a lot or a little, it does not seem to make much difference to the height of women. To put it another way, women are equally deprived and stunted to a similar degree regardless of protein availability.

In each of the data sets considered, the anthropometric data are from one source and the protein and energy availability data are from other sources, at different points in time. The authors state that "the estimates of nutrient availability refer to the approximate time when adult heights and weights were measured; we assume that these contemporary measures provide indicators of relative availabilities during the preceding two or three decades." They go on to note that dietary practices have probably changed little, especially in the rural counties, where they depend on locally produced and stable foods.

These seem to be reasonable assumptions, but there have been huge variations in food availability over time in postliberation China. There seems to be little doubt that the situation improved significantly early on, and then in the late 1950s during the "Great Leap Forward" there was famine in parts of China that killed millions. In the more stable periods, guaranteed employment and food rationing were practiced widely, and the food supply was fairly stable. Several important things that affected growth were happening: women were better nourished in adolescence; they married relatively late; they had simple, but adequate, prenatal and obstetric care; breastfeeding was widely practiced, and provisions were made for working mothers to breastfeed. The beneficial effects were apparent in 1973, when examination of growth records showed that the heights and weights of young children had improved greatly compared with pre-World War II levels [4]. In the early 1980s, when farmers were encouraged to grow food independently of the commune system, overall food production increased substantially. However, unemployment has steadily increased in recent years, resulting in increasing rates of poverty, with little doubt that those people have had steadily decreasing access to an adequate diet.

The matter of timing of the estimates of food availability compared with the time of anthropometric measurements raises an interesting question: If you have a population of adults who you assume are stunted in growth because of malnutrition, mainly inadequate protein intake, when did that stunting take place? When I see a population in which the average adult is short, my assumption has always been that they are probably short because their diets were seriously inadequate in their particular culture when they were under five years old. This is true whether they are elderly Eastern Europeans living in New York City or contemporary villagers in many parts of the world. As a pediatrician, I have always assumed that most of the stunting occurs between 6 and 36 months of age. I make that assumption because it is well known that in many cultures, dietary, especially protein, intake during that period, mainly the weaning period, is known to be insufficient. Beyond that, mean growth curves for height and weight of infants in such diverse cultures as Turkey, Colombia, Nicaragua, India, Thailand, and many others show that during the first several months of life, growth is fairly near the North American 50th percentile levels. Then, typically in poor countries today, the mean values begin to lag at some time between the 4th and the 6th months, and by 12 months they are around the third-percentile levels. After that the population means begin to rise slowly, following the slope of the third percentile. They often continue at that level through childhood and may recover slightly in adolescence and adulthood [5].

Shrimpton and colleagues [6] at UNICEF recently carried out a review of the timing of growth faltering using nationally representative data sets from 39 countries (2001). Their study showed that in fact faltering in weight starts at around three months, whereas faltering in length or height starts at birth. The authors emphasize the importance of intrauterine growth but note the unexpected fact that in all three regions—Africa, Asia, and Latin America—the "mean birth lengths were very close and similar to the NCHS (National Center for Health Statistics) reference median (1977)." The global means for weight-for-age leveled off at 12 to 15 months of age then began very slowly to recover. Height, on the other hand, continued to fall further behind until around 42 months and then recovered hardly at all. This study concludes, "Our findings have important policy implications. The data show that interventions during the earliest periods of life—prenatally and during infancy and early childhood—are likely to have the greatest impact in preventing childhood malnutrition."

There seems to be no doubt that the diets of infants and young children in poor countries are most inadequate during the weaning period. That is also the period when repeated bouts of infection take their toll, as shown so clearly in Mata's work [7]. If you follow the growth patterns, however, it appears that if children survive until the age of three years, they will begin to grow following 3rd percentile levels, and the annual increment in height will not be far behind that of the 50th percentile. This does not prove, however, that it is only inadequate dietary intake during the early years of life that produces stunting in adults.

Jamison et al. state in their conclusion: "As we have stressed, there are many other possible correlates of protein availability that are potential determinants of growth. Examples of other influences include water supplies, education levels, health services, general sanitation levels, and so forth." This statement brings out beautifully the difference between a clinical and a socioeconomic-statistical approach. A clinician would say that it is protein that is essential for growth, protein that is the essential building block for cellular growth, protein, primarily, that is lacking when growth falters. Thus, to whatever extent those "potential correlates" are also "potential determinants" of growth, it is only because of their potential impact on protein intake, whether because of excessive infections or the foods provided, in the case of education. The authors acknowledge the relation between malnutrition and mortality in young children: "Fully 50% of the total number of deaths in children under five years of age were associated with malnutrition." At the risk of quibbling, it seems worth noting that a strong case has been made that malnutrition is causal, rather than merely associated with mortality in young children. To be sure, the terms "cause" and "association" are often used seemingly interchangeably but are also frequently a source of confusion. In the case of this paper, it seems fair to ask, first, does it matter whether we use one term or the other? I submit that it does matter, because policy makers are usually more interested in factors that are causal rather than merely associated.

Second, we need to ask whether the assertion that it is causal rather than simply associated is true. In using the term "associated," the authors quote a paper by Rice et al. [8], which in turn cites Pelletier et al. [9]. In discussing the issues, Pelletier and colleagues say, "*The odds of dying increase at a compounded rate of 7.3 percent for each percentage point deterioration [decrease below 80 percent of expected weight] in weight-for-age.*" They note in their discussion that "Contrary to earlier impressions, mild to moderate malnutrition is indeed associated with an elevated risk of mortality, an association that has great policy significance considering the overwhelming number and proportion of children who fall into this category. The result is that 45% to 83% of all malnutrition-related deaths (i.e., the population attributable risk) occur to children in the mild and moderate category (weight-for-age 60% to 80%). *These deaths would not be reduced if policies and programs were directed solely toward treatment of the severely malnourished*" (Pelletier et al. [9], emphasis added).

The implication of their remarks is that malnutrition of various degrees of severity, certainly including milder forms, is causing the mortality. In fact, Pelletier and his colleagues at Cornell have published a number of papers dealing with the relationship [10–12], and they do indeed use both terms, but all the papers generally support the notion that it is fair to call the effect causal. They do acknowledge that many factors are at play, but they stress the role of malnutrition. What happens, in simplest terms, is that children die of diseases they would otherwise survive were it not for malnutrition, or, as the authors themselves say, "[children] are more likely to die if infected." Jean-Pierre Habicht put it this way: "*Trying to count deaths due to malnutrition is impossible because malnutrition kills in synergy with other diseases.* Estimating universally valid, disease-specific mortality rates is also impossible. The higher the overall levels of disease, *the more deaths will be caused by the same severity of malnutrition…. The number of children who die because of the synergy of malnutrition with infection is much greater at milder degrees of malnutrition* than at more severe degrees of malnutrition because the prevalence of mild to moderate malnutrition is so much higher even though their death rate is much lower" (Habicht [13], p. 217, emphasis added).

The point, then, is that because malnutrition is so widespread and so lethal—causing 50% to 60% of all deaths in children under five years of age, or 5 to 6 million deaths per year—it deserves all the attention we can give it. Jamison and colleagues also discuss the impact of infection on nutrition. They cite recent papers that point to a substantial contribution of disease to malnutrition [14, 15]; although much older, McKeown's comprehensive analysis of European data [16, 17] concludes persuasively that the single most important factor in the reduction of mortality from infectious diseases in the nineteenth and early twentieth centuries was better nutrition. It is interesting that Black, in the paper they cite, ends his abstract with the statement, "Although reduction in infectious diseases is desirable for many reasons, the relative feasibility and cost of this approach to improve nutritional status *must be compared with more direct nutrition interventions.*" The authors cite reports that from 10% to 80% of observed levels of malnutrition are due to the impact of infections. The literature is replete with reports that show, as the authors say, that "Children who are ill eat less and are less able to absorb what they do manage to eat." The impact on growth of repeated bouts of infection is probably nowhere more clearly shown that in the longitudinal studies of Mata [7]. Again, at the risk of seeming to quibble, it seems worthwhile noting that a few studies that focused specifically on this issue showed that if the infected children were receiving adequate supplements at the time, the impact of infections was minimized.

Gopalan reported a serendipitous case in which an epidemic of measles occurred in a population of children in villages near Hyderabad, India, some of whom were receiving supplementation and some of whom were not. Daily supplementation consisted of 23 g wheat flour, 35 g sugar, and 10 g edible oil, providing 310 kcal and 3g of protein. When gains in height and weight were compared six to eight weeks after the epidemic, they found: "In the unsupplemented group, gains in heights and weights of children who had measles were considerably lower than those in children who did not develop the disease. In fact, in those who developed measles, there was an actual loss in body weight (–0.3 kg) as against an increase in children who did not develop measles (mean, 0.1 kg). In marked contrast, in children who received the supplement, gains in height and weight were similar, whether or not they had measles, and these increases were similar to those of the 50th percentile of American children" (table 1) (Gopalan [18], pp. 337–8).

TABLE 1. Mean increments over three months in height and weight of Indian children affected or not affected with measles and receiving or not receiving supplementation

	Height gain (cm)				Weight gain (kg)			
	Supplemented		Unsupplemented		Supplemented		Unsupplemented	
Age (yr)	Measles	No measles	Measles	No measles	Measles	No measles	Measles	No measles
1–2	2.4	2.7	2.0	2.2	0.42	0.67	0.13	0.19
2–3	2.5	2.5	1.1	1.9	0.64	0.44	–0.19	0.05
3–4	2.4	2.4	1.3	1.6	0.48	0.37	–0.63	0.36
4–5	2.5	2.5	1.5	1.8	0.30	0.52	–0.12	–0.03

Source: Gopalan [18], p. 338.

In a well-known longitudinal study of malnutrition and mental development, carried out in Bogota, Colombia, between 1973 and 1980 [19], an important substudy included a careful prospective evaluation of the impact of diarrheal disease on stunting in supplemented and unsupplemented children [20]. This paper is relevant here, because the authors discuss the impact of diarrhea and nutrition on growth at various ages during the early months of life. By carefully recording the number of days of diarrhea for each child from birth to 36 months, they were able to divide the supplemented and unsupplemented populations into quartiles for total days of diarrhea. This approach showed that in the unsupplemented population, the more diarrhea, the greater the difference in attained length at 36 months. Their abstract states the results most succinctly: "Among unsupplemented children diarrhea was negatively associated with length. Among supplemented children diarrhea had no effect on length and differed from that of unsupplemented children. Thus, supplementation completely offset the negative effect of diarrheal disease on length." (Lutter et al. [20], p. 1).

Finally, among the few other studies that have measured the impact of nutrition on growth and morbidity, there is the remarkable longitudinal study carried out in the village of Tezonteopan in the State of Puebla, Mexico, by Chavez and colleagues [21]. The unique feature of their study, to my knowledge, is that it was designed to study, over a period of six years, two cohorts of children living in the same village, one of which received supplementation and one of which did not. The researchers managed this by enrolling all of the children born in one year in the study village and following them carefully and frequently from birth to 60 months, providing primary health care but no nutritional supplementation. The second cohort included all of the children born in the following year, all of whom received supplementation, as did their mothers during pregnancy and lactation. They followed this population of children equally carefully until they were 60 months old. Thus, for at least four years they were able to follow two groups of children whose parents were essentially identical and who were living under exactly the same environmental conditions. What they learned was that the cohort receiving supplements not only grew better, both in weight and height, but also suffered fewer days of illness.

There is a wealth of data showing that the excessive mortality and stunting seen in millions of children from poor countries is, day in and day out, the result of the repeated interaction of malnutrition and infection. The evidence cited above suggests that in those children, better nutrition can make a significant difference, not only with regard to surviving infectious disease episodes, but also with regard to preventing the stunting so often associated with bouts of infection. Infection in these children, in these circumstances, is inevitable, but if they are receiving an adequate diet, by supplementation if necessary, stunting is diminished.

The study by Jamison and colleagues confirms this in interesting ways. Most interesting to me is that they show that the associations are so powerful that even when the data are derived from population estimates, the differences are clear at the individual level. Whether the stunting they observed was due to protein deficiency in childhood, or later, the policy implications are clear: we ought to be doing everything we can to find effective ways to direct as much as possible of the 10 million tons of food aid given away every year to pregnant and lactating women and to providing adequate weaning diets for young children.

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Books received

The Penguin atlas of food: Who eats what, where and why. Erik Millstone and Tim Lang. Penguin Group, Inc., New York, 2003. (ISBN–0-1420-0224-0) 128 pages. US$20.00.

This book covers 42 food-related topics using profusely illustrated two-page chapters, most with tables and maps. These seemingly simple spreads convey a great deal of valuable information and are supplemented by tables showing world food production and consumption. Chapters cover contemporary food-related challenges and the production, trade, processing, retailing, and consumption of food. The book shows clearly that even though poor nutrition affects a third of the world's population, this is not due to any overall scarcity of food but to problems of distribution and poverty. This information-packed atlas will be useful for high school assignments, reading for informed laypersons, and university courses concerned with the economics and politics of food.

Dimensions of food. Fifth edition. Vickie A. Vaclavik, Marcia H. Pimentel, and Marjorie M. Devine. CRC Press, Boca Raton, Fla., USA, 2002. (ISBN 0-8493-1425-9). 320 pages. US$49.99.

This well-recognized textbook, now appearing in its fifth edition, covers the economic, nutritional, palatability, and chemical and sanitary dimensions of food and the scope of modern food processing. A section on food principles covers the measurement of ingredients, laboratory techniques, and the processing of each of the eight major food groups, plus batters and doughs. One chapter deals with the heating of foods by microwave, and the last deals with meal planning. The book does not consist of text, but rather each topic is presented as a series of student exercises, along with 15 very useful appendices. As the preface points out, students of nutrition, dietetics, and food science who are preparing for food-related careers will enjoy and benefit from this integrated approach to the introductory study of food.

From plain fare to fusion food: British diet from the 1890s to the 1990s. Derek J. Oddy. Boydell Press, Woodbridge, Suffolk, UK, and Rochester, N.Y., USA, 2003. (ISBN 0-85115-934-6) 269 pages, hardcover. US$85.00.

From the 1890s to the Second World War, the English diet was gravely deficient and responsible for the poor physique and physical deficiency of the lower socioeconomic groups (Drummond JC, Wilbraham A. The Englishman's food. Revised edition. London: Pimlico, 1991). Much has been written about the improvement of the diet during the dark days of the Second World War, largely because of the better nutritional value of the bread, which was due to higher-extraction flour, as described in detail here. This book outlines how the traditional diet was modified by industrialization and urbanization in twentieth-century England. Food consumption, nutrition, and health since the Second World War are well covered, and a final chapter overviews the changes in the twentieth century. Developing countries today are going through a more rapid and sophisticated dietary evolution, but there are some useful analogies.

—Nevin S. Scrimshaw

News and notes

Eating your way to higher test scores

Linda Gorman

"School districts that increased calories on test days experienced increases in 5th grade pass rates of 11, 6, and 6 percent respectively on the mathematics, English, and history/social studies tests."

Now that public schools can lose federal funding as a result of poor student performance on standardized tests, they have begun paying more attention to test scores. Although the hope was that schools would focus solely on raising test scores by improving student achievement, school officials have responded in other ways as well. Among the known adaptations are removing potentially poor performers from the test pool by reclassifying them as "disabled" and providing students with answers to test questions.

In "Food for thought: the effects of school accountability plans on school nutrition" (NBER Working Paper No. 9319), authors David Figlio and Joshua Winicki examine whether schools exploit a more subtle method to increase test scores: changing their lunch menus. Several studies have suggested that consuming glucose before taking tests may increase scores. Under the Department of Agriculture School Meals Initiative for Healthy Children, schools must meet nutritional guidelines over a one-week period. This gives menu planners the flexibility to alter meals from day to day. Given the software available for school menu planning and nutrient analysis, food service directors also have the tools to fine tune the menu.

Using information from a random sample of 23 Virginia school districts, Figlio and Winicki compare the nutritional and caloric content for school meals over the testing cycle for the Virginia Standards of Learning school accounting system. They find that the schools most likely to increase the caloric content of their lunches are those in districts with threatened schools. In those districts, school lunches averaged 863 calories during testing periods, 761 calories before, and 745 calories after. Though calories increased, nutrients did not. Nor was the calorie increase a result of serving students their favorite meals—pizza, cheeseburgers, and tacos, as measured by sales data—on test days.

School districts that increased calories on test days experienced increases in 5th grade pass rates of 11, 6, and 6 percent respectively on the mathematics, English, and history/social studies tests. Although the authors caution that their results are to be treated with caution because of small sample size, they suggest "that test score gains associated with accountability systems may in part be artifacts of manipulation rather than improved efficiency, particularly for schools on the margin."

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Irradiation Congress

Kirsten Khire

The new millennium has witnessed a number of positive developments on food irradiation including:

» Acceptance of irradiation for one or more food products or classes of food in some 50 countries.

» Commercial application of food irradiation in over 30 countries and the volume of irradiated food increased to some 300,000 metric tonnes in 2001.

» Commercial irradiation of spices and dried vegetable seasonings in over 20 countries with the global production approaching 100,000 metric tonnes/annum.

» Irradiated ground beef and tropical fruits are being sold in an increasing number of supermarket stores (over 5,000 in January 2003) all over the USA; a major fast food chain started selling irradiated hamburgers in 2002 and was joined by several other chain restaurants which now offer irradiated foods in their menus.

» Operation of the first X-ray irradiator for food in Hilo, Hawaii in 2000 for treating increasingly large volumes of fruits for marketing in the US mainland.

- USDA/Animal Plant Health Inspection Service issued its Final Rule on Irradiation Phytosanitary Treatment of Imported Fresh Fruits and Vegetables on October 23, 2002, to pave the way for international trade in irradiated fresh produce to meet phytosanitary requirements.
- Over 70 irradiation facilities have been authorized for treating food and many more are under construction or planned.
- Irradiation is beginning to play an important role to ensure microbiological safety of food and facilitate trade in food and agricultural commodities.

Taking note of these and other issues and developments, the First World Congress on Food Irradiation: Meeting the Challenge of International Trade will attempt to examine and assess the future of food irradiation through a comprehensive programme examining:

- Global situation and outlook on the use of irradiation as a sanitary and phytosanitary treatment
- Major markets and market trends
- Technological developments: irradiation facilities, new products, value addition, quality assurance
- Investment opportunities
- Visit to a commercial food irradiator
- Buyer-seller meet (business session) and technical session.

For more information on the First World Congress on Food Irradiation: Meeting the Challenges of Food Safety and Trade, May 5-7, 2003, McCormick Place, Chicago, Illinois, USA, visit the following website: www.foodsafe.msu.edu.

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