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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 ecchymosis (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/

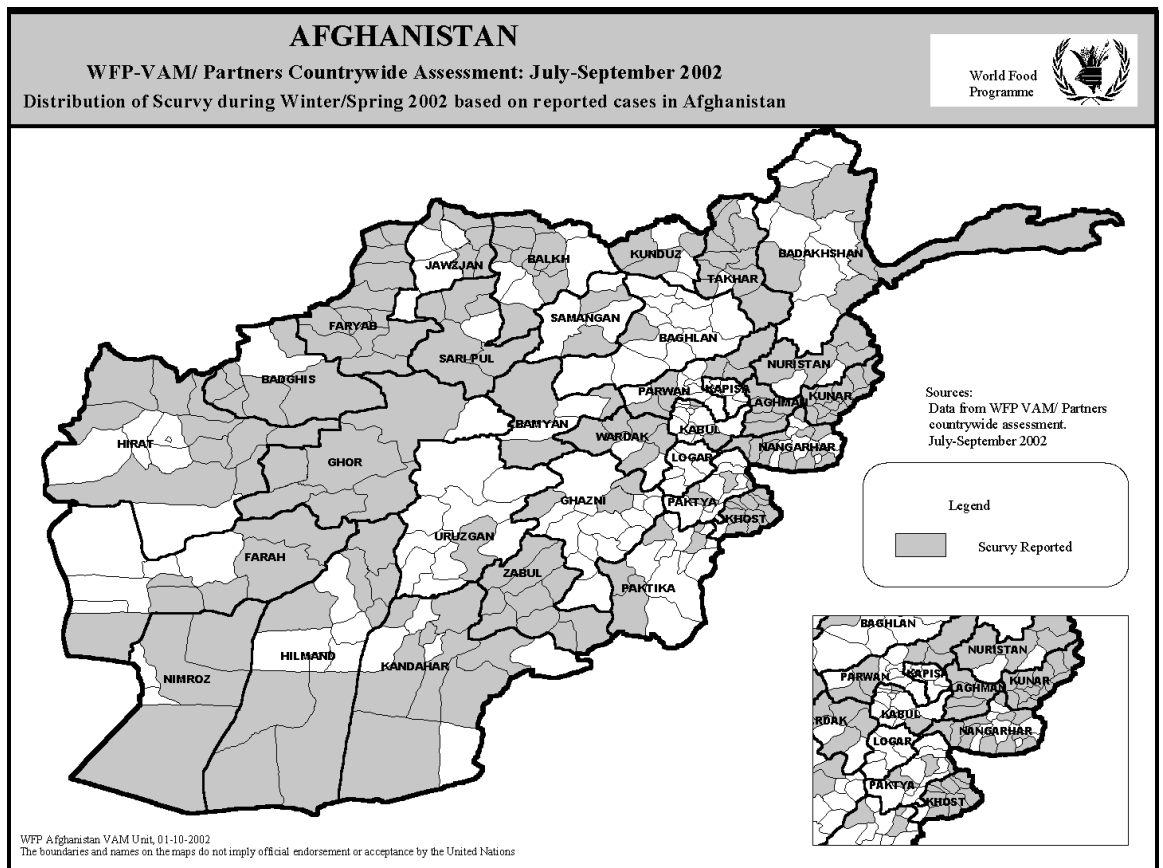


FIG. 1. Distribution of scurvy during winter/spring 2002 based on reported cases in Afghanistan [20]

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 ecchymosis 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 treat-

ment 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 *hush-ein*, green plants; and *sheres*, 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 emergen-

cies. 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 con-

sequence 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 *transi-*

tion. 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

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.

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 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			<i>p</i> 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			<i>p</i> 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			<i>p</i> 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%

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

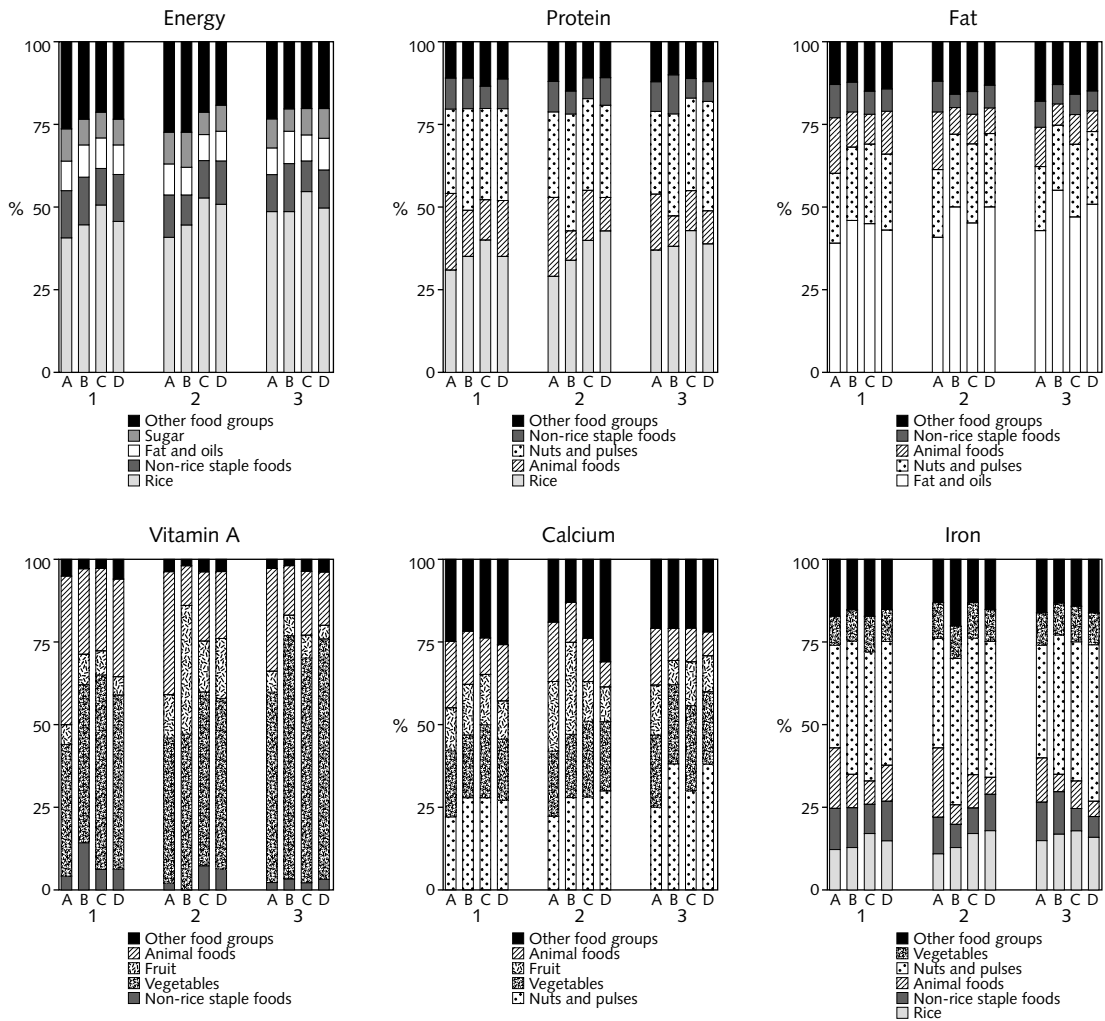


FIG. 1. Contributions of foods and food groups to nutrient intake of pregnant women according to socioeconomic characteristics and timing in relation to the economic crisis. 1, Before crisis; 2, transition; 3, during crisis; A, rich; B, urban poor; C, rural poor with access to rice fields; D, rural poor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

bors. 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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