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Nutrient Intake and Stunting Prevalence among Tea Plantation Workers' Children in Indonesia

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Women working in Indonesian tea plantations are usually part-timers with few skill and low income. In order to work, they have to leave their children at home or in day care. We examined the nutrient adequacy level and prevalence of stunting among children of these workers. The intake of most nutrients was below the recommended dietary allowance: energy 83.1%, protein 91.8%, fat 66.2% vitamin A 71.4%, vitamin C 50.4%, calcium 69.3%, and zinc 32.2%. Nutrient adequacy, especially energy and protein, was negatively correlated ($P<0.05$) with children's age. Nearly 22% of children had a low weight-for-age (WAZ; $Z<-2$), 9% had a low weight-for-height (WZ), and 53% had a low height-for-age (HAZ): that is, they were stunted. HAZ was correlated with the intake of protein, calcium, iron, and zinc ($P<0.01$). The population in this region lacked food and nutrition security.

Key words: children, diet, nutrient adequacy, stunting

Introduction

West Java is the largest tea-producing region in Indonesia, accounting for 77% (110,000/142,800 ha) of the national tea plantation. In 2004, employment in tea plantations supported 17.1 million workers. Tea plantations were the biggest agribusiness employers, on average employing 3–3.5 workers per hectare. Of these, 70% are tea pickers, commonly women, paid at 20% to 30% of the value of the tea buds they pick (Nurmala, 2009; Nur, 2002).

Nutrition and health problems among the families of plantation workers include poor nutrition of children 0–6 years old and worm-related diseases. Female plantation workers are usually part-timers with few skill and low income, and are thus vulnerable to household food insecurity. In order to work, they have to leave their children at home or in care, even though their major role is taking care of their children. Other obstacles these women face in bringing up their children are limited safe water, sanitation, and health care.

Indonesians face four major nutritional problems: protein-energy malnutrition, iron anemia, vitamin A deficiency, and iodine deficiency. The large number of malnourished children reflects a big human resource problem in Indonesia. During 1989–2003, the Indonesian Government reduced malnutrition by less than 1% annually (Ministry of Health, 2005). Poverty is the major cause of nutritional problems in Indonesia, although other related factors may also contribute. For example, appropriate feeding practices result in better growth of infants and young children (Saha *et al.,* 2008). If growth and development during a child's first 5 years are not adequate, the child will not grow into a healthy adult.

Anthropometric indicators are used to measure consumption sufficiency and growth. Three an-

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thropometric indicators frequently used are weight-for-age (WAZ), height-for-age (HAZ), and weight-for-height (WHZ). Although the indicators are interrelated, each has its own specific meaning in relation to growth disorders (WHO, 1995). Weight-for-age (WAZ) reflects body mass relative to chronological age. Low weight for age and "underweight" refer to the underlying pathological processes. On the other hand, weight for height (WHZ) reflects body weight relative to height is use carries the advantage of requiring no knowledge of age. However this is important to note that does not serve as substitutes for HAZ or WAZ, since each index reflects a different combination of biological process, although they share common determinants, they cannot be uses interchangeably. Low WHZ or "wasting" is widely used to describe a recent and severe process that has led to significant weight loss, usually as a consequence of acute starvation and/or severe disease (WHO, 1995).

Stunting (a low HAZ score) is a physical indicator of chronic malnutrition and is often linked to poor mental development. Stunting indicates a failure to achieve normal growth as a result of health disorders or nutritional deficiencies (WHO, 1995). It is a cumulative process of poor growth mainly before the age of 3 and is not easily reversed (ACC/SCN, 2000).

A low indicator score indicates a nutritional problem, but not necessarily insufficient consumption of one single nutrient. It can indicate inadequate nutrients as a result of a lack of food consumption, increased utilization of nutrients as a result of infectious diseases, or disorders in the absorption and assimilation of nutrients. The combination of these factors is frequently found to be the cause of low nutritional status and growth disorders among children in developing countries. Thus, the indicators must be interpreted in relation to socioeconomic aspects (WHO, 1995). Anthropometric surveys of children under 5 can be used to assess food and nutrition security, reflecting the availability, accessibility, stability of supply, and use of food (Gross *et al.,* 2000). Here we examined the nutrient adequacy level and prevalence of stunting among children of female tea plantation workers.

Materials and Methods

Design and Study Location

For this cross-sectional study, we selected tea plantations in Pangalengan (Malabar, Purbasari, Talun-Santosa, and Sedep) and Ciwidey (Rancabali), Bandung Regency, West Java, Indonesia. The study was conducted during 12 months in 2007–2008.

Sampling

We interviewed women tea pickers with children <6 years old. A simple random sampling technique was used to select a total of 500 women in proportion to the number of employees at each site: 93 (18.6%) at Malabar, 90 (18.0%) at Purbasari, 69 (13.6%) at Talun-Santosa, 93 (18.6%) at Sedep and 146 (29.2%) at Rancabali.

Data Collection

In structured interviews, we collected food consumption and nutrition intake data through the use of a 24 h memory recall form. Weight and height were collected by digital weight scale and microtoise, respectively.

We tested the questionnaire to tea plantation women workers at Gunung Mas tea plantation area, different place from study location but same criteria of samples, before collecting the data to determine the appropriate format, questions, word choice, possible range of answers, and maximum length of interview. Graduates of Bogor Agricultural University were trained as enumerators to minimize bias in collecting data. Following data entry according to guidelines we drew up, data reliability was assessed from descriptive statistics for each major variable.

Data Analysis

Data analysis and processing were performed with SPSS 13.0 software (SPSS Inc., Chicago, IL, USA). Descriptive data are presented as mean$\pm$SD. Weight and length were converted into Z-scores by comparison with the child growth reference data incorporated in the WHO's "igrowup.ado" macro for STATA statistical software. Stunting was defined as an HAZ Z-score of <-2, underweight as a WAZ Z-score <-2, and wasting as a WHZ Z-score <-2.

Food recall data were analyzed with a computerized program "food processor". For nutrient intake analysis, we used Recommended Dietary Allowances (RDA) based on National Food and Nutrition Workshop (WKNPG, 2004). For analysis, data of children were grouped into infant age groups of < 6 mo, 6–12 mo, 13–24 mo, 25–36 mo, 37–48 mo, 49–60 mo, and 61–72 mo. Associations of normally and non-normally distributed data were evaluated by using Pearson's correlation and Spearman's rank correlation, respectively.

Results

Children's Characteristics

The biggest proportions of children were in the 25–36 months (21.8%) and 37–48 months (22.2%) age groups (Table 1). Infants (0–12 months) accounted for only 10.8%. The ratio of boys to girls was 1.11: 1, close to the expected ratio of 1.03: 1.

Table 1. Numbers and percentages of children by sex and age

Variables & categories	(*n*)	(%)
Sex		
Boys	263	52.6
Girls	237	47.4
Total	500	100.0
Age (months)		
0–12	54	10.8
13–24	84	16.8
25–36	109	21.8
37–48	111	22.2
49–60	98	19.6
61–72	44	8.8
Total	500	100

Nutrient Adequacy Level

On average, the nutrient intake among children was low: 85% of sufficiency (Table 2). Nearly 40% of children had a deficiency in energy consumption, consuming only 70% of the recommended requirement. The protein and fat intakes were below the recommended requirements (Table 2). Vitamin and mineral consumption was also low; in particular, vitamin C consumption was only 50.4% of the requirement (Table 2). A very high 83.0% of children consumed insufficient calcium, and 97.6% were deficient in zinc intake.

Nutrient intake, especially energy and protein, was negatively correlated ($P < 0.05$) with age. Although increasing growth implies an increase in nutrient requirements, energy and protein consumption decreased with the age. However, vitamin A and C intake remained steady (Fig. 1). HAZ was correlated with the levels of protein, calcium, iron, and zinc ($P < 0.01$). This statistical analysis suggests that children who have higher intake of protein, calcium, iron, and zinc tend to higher HAZ.

Nutritional Status and Growth of Children

The *Z*-scores for nutritional status were all negative, indicating low nutritional status (Table 3). The HAZ *Z*-score was the lowest, indicating prevalent stunting; 53.0% of children were stunted, 21.8% were underweight, and 9.2% showed wasting. The *Z*-scores for all three indicators at the age

Table 2. Average consumption, recommended dietary allowance (RDA), and nutrient adequacy level

Nutrient	Consumption	RDA	Nutrient adequacy level (%)
Energy (Cal)	800.0	1005.1	83.1
Protein (g)	21.5	25.01	91.8
Fat (g)	24.8	39.1	66.2
Vitamin A (mg)	296	415.6	71.4
Vitamin C (mg)	21.2	42.3	50.4
Calcium (mg)	232	482.0	69.3
Iron (mg)	4.0	7.2	108.2
Zinc (mg)	2.7	8.6	32.2

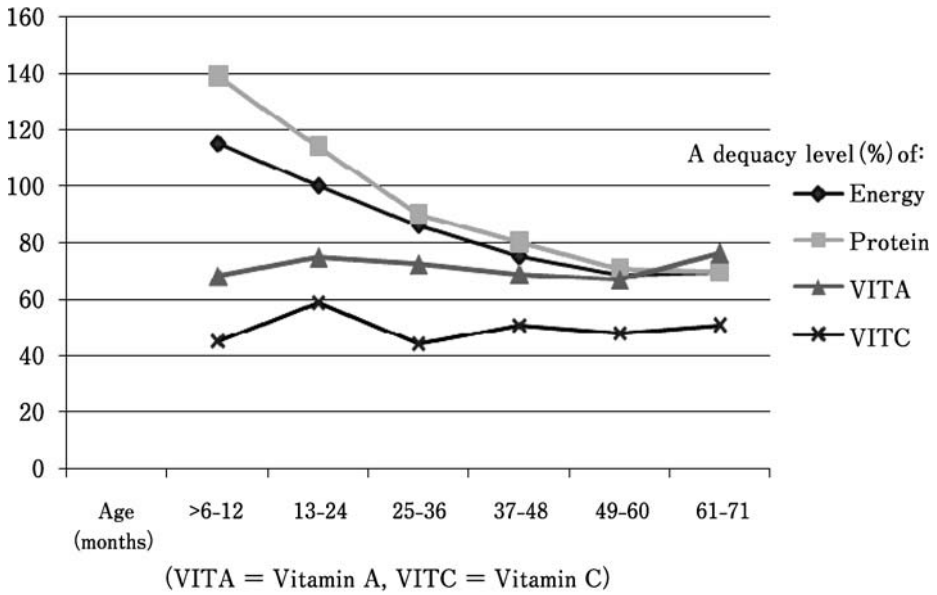

Fig. 1. Adequacy level of energy, protein, vitamin A and vitamin C by age.

Table 3. Numbers and percentages of children by nutritional status

Nutritional status	*n*	%
WAZ categories		
$Z<-2$	95	21.8
Normal	391	78.2
$Z>+2$	14	2.8
Total	500	100.0
Mean±SD	−1.24±1.02	
HAZ categories		
$Z<-2$	265	53.0
Normal	220	44.0
$Z>+2$	15	3.0
Total	500	100.0
Mean±SD	−1.93±1.69	
WHZ categories		
$Z<-2$	46	9.2
Normal	426	85.2
$Z>+2$	28	5.6
Total	500	100.0
Mean±SD	−0.16±1.41	

WHZ=weight-for-height; HAZ=height-for-age; WAZ=weight-for-age.

of 3–6 months were similar, but the WAZ and HAZ *Z*-scores then declined, while the WHZ *Z*-score remained steady (Fig. 2).

Discussion

Fifty-three percent of children were stunted. WHO (1995) considers a rate of 40% as very high. HAZ was correlated with the levels of protein, calcium, iron, and zinc. Micronutrient deficiencies remain common in preschool children in developing countries (Lind *et al.,* 2004; Thu *et al.,* 1999). Interventions that focus on single micronutrients often lack effectiveness. The results of those previous studies indicate that the enhancing effect of zinc supplementation on the average growth of the whole population of children aged <5 years in developing countries is probably small. As reported by Chunming (2000), stunting was correlated with a low intake of protein and fat. Growth differences can indicate the nutrients missing from the diet.

The prevalence of stunting tended to increase with age: age had a significant negative correlation with WAZ ($P<0.01$) and HAZ ($P<0.01$) (Fig. 2). But WHZ was steady because the ratio of stunted and underweight children increases with age (ACC/SCN, 2001). The very high prevalence of stunting in this population was due to a deficiency of nutrients, especially protein, calcium, iron, and zinc. The study population lacked food and nutrition security.

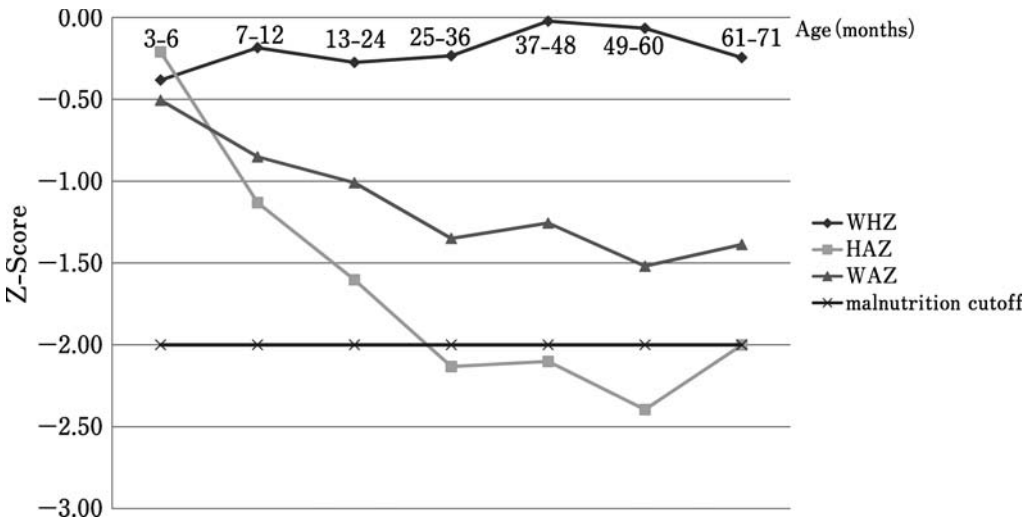

Fig. 2. Average *Z*-score to age (WHZ=weight-for-height, HAZ=height-for-age, and WAZ=weight-for-age).

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