Original Article

Snack foods consumption contributes to poor nutrition of rural children in West Java, Indonesia

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Dietary habits of children, including snack foods consumption, in developing countries have seldom been investigated in relation to their nutrition and health. To assess the effects of snack foods consumption of 154 children aged 1-12 years in a rural village of West Java, Indonesia, a 3-hour-interval food recall survey for all meals and snack foods consumed in seven consecutive days for each subject, anthropometry, and interviews for socio-demographic indicators were conducted. Their overall prevalence of stunting and underweight was 69.5% and 35.7%. There were 221 foods consumed by the subjects, among which 68 foods were categorized as snack foods. Though the children of both <7 year and ≥7 year age groups consumed snack foods similarly throughout the day, the latter group only consumed larger amounts of energy from snack foods at school recess-times. The mean percent contribution of snack foods was 59.6% for fat, 40.0% for energy, 20.6% for calcium, and <10% for vitamins A and C. Half number of the subjects who snacked more than the median amount consumed less carbohydrate and vitamin C than the remaining half. Furthermore, the more snack-consuming group the lower z score for height-for-age (HAZ) among schoolchildren. To improve this nutritionally vulnerable situation, consumption of snack foods should be replaced by the non-snack foods which contain much higher nutrient density, i.e., 15 times for calcium and 32 times for vitamin A. Moreover, considering high snack foods consumption of ≥7 y age group at school, appropriate school nutrition programs should be promoted.

Key Words: child nutrition, developing country, Indonesia, schoolchild

INTRODUCTION

Dietary habits of children, that play an important role in determining their health consequences, have not only varied from population to population but also changed due to cultural and socioeconomic factors. In developed countries, the dietary pattern of children and their prevalence of obesity have altered rapidly,[1] although such information is very limited for children in developing countries that have been undergoing rapid socioeconomic changes.

Adair and Popkin compared percentage contributions of snack foods to the total energy intake of children aged 2-19 years in Russia, the USA, Cebu (the Philippines), and China, based on nationally representative data.[2] In their analysis there were nine categories of food items, in which five, i.e. fast food, soft drinks, traditional snack foods, candies and desserts, and modern snack foods, were defined as snack foods. As the results, the percent contribution of these snack foods as a whole was high in three countries: 27.1% in 1989-1991 and 33.0% in 1994-1998 in the USA; 33.6% in 1994 and 33.3% in 2003 in Russia; and 28.3%, 21.1%, and 18.3%, respectively, in 1994, 1998 and 2002 in the Philippines; in contrast, the corresponding values in China were only 1.3% in 1991 and 1.5% in 2000. A limited number of such investigations in other Asian developing countries have been conducted, including Indonesia, especially on rural children whose growth is much more retarded than the national average.[3-4]

Previous food consumption surveys for children and adolescents in Asian developing countries have had some methodological drawbacks. First, these studies were based on the food frequency questionnaire method or the 24-hr food recall method;[5-7] the former does not afford fully quantitative data on energy and nutrient intakes and the latter is likely to underreport consumption due to ambiguous memory of children.[8-13] Second, many studies analyzed data collected for only one or several days, ignoring day-to-day fluctuations.[14-17]

In the present study, food intakes of 154 children aged 1-12 years in a rural village of West Java, Indonesia, were

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thoroughly recorded by a 3-hr-interval food recall survey for seven consecutive days for each child and his/her mother, together with collection of some other data for reliable estimate. Using anthropometric measurements of the subject children and socio-demographic indicators of their households, this paper aimed to elucidate the amounts of foods consumed as meals and snack foods by rural Indonesian children and their energy and nutrient (protein, fat, carbohydrate, calcium, phosphorus, iron, and vitamins A and C) content, and to consider effects of snack foods consumption on the nutritional status of these children.

METHODS

Study village

The study village, Sukajadi, is located in kecamatan (subdistrict) Tamansari, kabupaten (district) Bogor, West Java, Indonesia. Sukajadi has a land area of 304 ha (9 ha residential and 271 ha agricultural) and was inhabited by 6,434 people (3,223 males and 3,211 females) in the survey period in 2001. All villagers were Sundanese speakers and 98% of them were Muslims. Villagers' predominant occupations were farming, small-scale retailing in the village, and employees of small enterprises in nearby towns. The villagers have maintained to a considerable extent the traditional customs and lifestyle, including dietary habits. The villagers consume two meals a day, in the early morning and late afternoon; they recognize that their meal should include rice and vegetables, supplemented by salted fish, tahu/tempe, and/or meat.

Sukajadi is administratively divided into 10 rukun warga (RW, community units), all of which scarcely differ in socioeconomic conditions, including household occupations and accessibility to Bogor city, the administrative and commercial center in this area. Based on the proportions of underweight children among the <5 year age group (below –2 SD from the mean of the standard weight for age, defined by the World Health Organization) in the records of the village health center, RW-1 (including 33% of such children) and RW-6 (19%) were chosen for this study to represent, respectively, the RWs with high and intermediate proportions of underweight children. RW-1 and RW-6 are divided into three and five rukun tetangga (RT, smaller administrative unit), respectively.

Subjects and fieldwork

Fieldwork, on which this paper is based, was carried out twice: the preliminary survey in August–September 2000 and the main survey in January–July 2001. In the former, all children who completed weaning and were aged 1-12 years in the two RWs were identified, and socio-demographic information of the households, to which they belonged, were collected. All 518 children participated in the anthropometric measurements in the main survey in February 2001. Among them, 159 children, who lived in eight small geographic blocks (one from each of the eight RTs studied), were chosen as a sub-sample of the food consumption survey, taking into account the accessibility of the investigator (MS) from the field station. Of the 159 children, however, five were excluded from analysis because two of them were unexpectedly breast-fed and three others stayed overnight out of their home. In analysis, the subjects were divided into <7 years and ≥7 years age groups, the latter being elementary school pupils.

The protocol of this study was explained to, and approved by, the community leaders of Sukajadi and the parents (or caretakers in a few cases) of the subject children, and approved by the Ethics Committee of the Graduate School of Medicine, the University of Tokyo.

Food and nutrient intake

The 3-hr-interval food recall survey, which was most time-consuming and painstaking, was conducted for net 56 days, or 8 seven-successive days, for eight subject groups; the subjects of each group consisted of 10-29 children in one RT. All children in each RT (10-29 children) were surveyed for seven consecutive days. In every survey day, one of the authors (MS) repeatedly strolled around the area, where the houses of these children aggregated, from 0600 to 2000. This survey was designed to meet any child at least once every 3 hours (i.e. 0600-0900, 0900-1200, 1200-1500, and 1500-1800) and to interview the child and his/her mother (or caretaker in a few cases) using local language. At the interview, the following items were required to allow for quantitative estimates for all foods (including beverages) consumed by the child in the duration from the preceding interview: 1) name of food or dish; 2) cooking method (e.g., for an egg, boiled or fried) and relishes accompanied (e.g., served with sweet soy sauce or not); 3) the consumed amount, using an appropriate unit (e.g., number of fruits, number of scoops of rice, and number of cups of soup); and 4) for purchased food, the size, price, and store at which it was purchased.

In addition, three following studies were conducted to reliably estimate the amounts of foods consumed. First, 'portion size' (one scoop) of cooked rice for each of the subject children was weighed at meal time in his/her home because portion size varied markedly from one person to another and thus was judged to be a significant factor in over- or under-estimation of energy and nutrient intakes. In this study, the consumed amount was estimated as the product of the portion size and the number of servings obtained by interview survey. Second, to determine the standard recipes for popularly cooked dishes (n=19), the recipes of each dish, which was consumed in eight selected households (one from each of the eight RTs studied), were weighed for seven consecutive days. Each subject's consumption of each foodstuff in the cooked dishes was estimated to the nearest gram, using the portion size and the amount involved in the standard recipe. Third, all foods purchased at retailers in the village and peddlers stationed around the school were weighed separately by size and price. Furthermore, the authors weighed all foods eaten by 11 selected children for seven consecutive days, simultaneously with the 3-hr-interval recall survey, to compare the results.

The amounts of energy and nutrients contained in each food item followed two Indonesian food composition tables.[18-19] The nutrients listed in these tables are protein, carbohydrate, fat, calcium, phosphorus, iron, and vitamins A and C, all of which were analyzed in this study. Conse-

quently, daily intakes of energy and these eight nutrients for each subject were their average amounts consumed in seven survey days.

Categorization of foods

In this study, snack foods were defined following Adair & Popkin,[2] who classified them into five categories, as mentioned previously. Of them, however, fast food was not available in the study area. Consequently, there were four categories: 1) modern snacks (two kinds of salty chips made from flour; n=2); 2) traditional snack foods (e.g., nuts or seeds; fried chips made from cassava, banana or seed of *Gnetum gnemon*; sweets made from coconuts, sweet beans, flour or rice; and fritters; n=57); 3) candies and desserts (n=7); and 4) soft drinks (e.g., sweetened carbonated beverages and fruit drinks; n=2). These snack foods are sold by retailers or peddlers with prices of 100-1,000 Rp and thus are easily purchased by the children (1 USD=8,695 Rp). Other food items than snack foods were divided into ten groups: 1) cereals and tubers, 2) pulses, nuts, and seeds, 3) meats, 4) eggs, 5) fishes, 6) vegetables, 7) fruits, 8) milk, 9) oil, and 10) seasonings, according to the food composition tables.[18-19]

Anthropometry

Children's height, weight (with minimal clothing), mid-arm circumference, and biceps and triceps skinfold thicknesses were measured by the authors, following the standard methods;[20] the equipments used were, respectively, anthropometer, Tanita digital weighing scale with precision of 0.1 kg, measuring tape, and Eiken callipers. To standardize the anthropometric variables, z scores for height-for-age (HAZ), weight-for-age (WAZ), and body mass index (BMI)-for-age (BMIZ) were calculated by age in months, based on the US Center for Disease Control (CDC) growth charts,[21] using EPI-INFO (Version 6.02; CDC, Atlanta). The cut-offs for stunting and underweight were –2 SD from, respectively, the median height-for-age and weight-for-age.[22]

Statistical analyses

HAZ, WAZ, and BMIZ between the two age groups and between sexes were compared by *t* test. Inter-sex difference in the prevalence of stunting and underweight was examined by chi-square test. Inter-age group difference in total energy intake and energy intake from snack foods was tested using Mann–Whitney's U-test. Intake of energy or each nutrient, HAZ, WAZ, and BMIZ was compared between two groups classified at the median with regard to contribution of snack foods to total energy intake, using *t* test. All statistical analyses were performed using SPSS software (Version 10.0; SPSS Inc, Chicago).

RESULTS

Socio-demographic characteristics

Socio-demographic characteristics of the subject children and their households are shown in Table 1. The major occupations of fathers were farming (25.5%), employee of private company (24.1%), retailing (15.0%), and driver (12.4%), while mothers were mostly housewives (90.8%). The mean birth order of the children was 3.6 and the mean number of household members was 5.9, reflecting high fertility in this village population.[4] The duration of school education of the fathers and mothers was 4.8 and 3.6 y, respectively. The mean per-capita monthly income was <100,000 Rp, with a large inter-household variation

Table 1. Basic characteristics of the subject children and their households

	%	Mean	SD
Area of residence			
RW–1	50.6		
RW–6	49.4		
Household type			
Nuclear	84.4		
Extended	15.6		
Father's occupation			
Farming	25.5		
Private company employee	24.1		
Retail business	15.0		
Driver	12.4		
Others	23.0		
Mother's occupation			
Housewife	90.8		
Working outside	9.2		
Social class †			
Lowest	9.1		
Lower	52.6		
Intermediate	37.0		
Higher	1.3		
Birth order		3.6	2.8
Household members		5.9	2.0
Per capita income (1000 Rp/month) ‡		95.3	114.2
Father's education (years)		4.8	2.8
Mother's education (years)		3.6	2.8

†One from five classes of "lowest–highest" was assigned to each household by the Indonesian government at the census; however, no household in Sukajadi village was assigned "highest".

‡ 1 USD = 8,695 Rp.

Table 2. HAZ, WAZ, and BMIZ and percentages of subject children with less than –2 SD for HAZ (stunting) and WAZ (underweight) by sex and age groups

	Age group (y)	N	HAZ		Stunting (%)	WAZ		Underweight (%)	BMIZ	
			Mean	SD		Mean	SD		Mean	SD
Male	<7	41	–2.58	0.89	75.6	–1.95 †	0.75	56.1 §	–0.42	0.98
	≥7	40	–2.32	1.39	70.0	–1.68	0.91	35.0	–0.62	0.60
	Both	81	–2.45	1.14	72.8	–1.82 ‡	0.86	44.4 ¶	–0.52	0.81
Female	<7	29	–2.14	1.07	72.4	–1.40 †	0.69	24.1 §	0.09 ¶	0.90
	≥7	44	–2.21	0.87	61.4	–1.53	0.72	25.0	–0.51 ¶	0.68
	Both	73	–2.18	0.97	65.8	–1.48 ‡	0.71	26.0 ¶	–0.28	0.82
Both	<7	70	–2.40	0.99	74.3	–1.72	0.73	42.9	–0.21 ††	0.98
	≥7	84	–2.26	1.10	65.5	–1.60	0.80	29.8	–0.56 ††	0.64
	Both	154	–2.32	1.05	69.5	–1.66	0.78	35.7	–0.41	0.82

HAZ: z score for height-for-age; WAZ: z score for weight-for-age; BMIZ: z score for body mass index-for-age.
† Significantly different between sexes (*t* test, $p<0.05$).
‡ Significantly different between sexes (*t* test, $p<0.01$).
§ Significantly different between sexes (chi-square test, $p<0.01$).
¶ Significantly different between sexes (chi-square test, $p<0.05$).
†† Significantly different between age groups (*t* test, $p<0.01$).

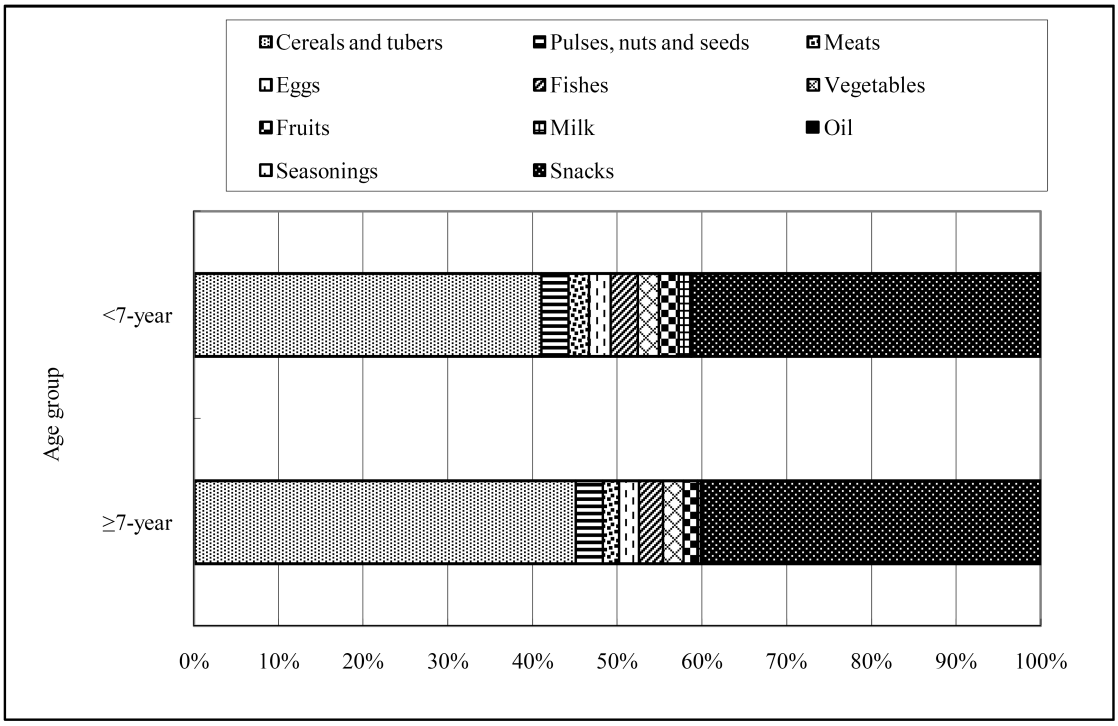

Figure 1. Proportions of energy taken from 11 food groups by two age groups of the subject children.

due to much lower incomes in the farming households.

Anthropometry

Table 2 shows the means and SDs of HAZ, WAZ, BMIZ, and the percentage of children with less than –2 SD for HAZ (stunting) and WAZ (underweight), separately by sex and age groups. The overall prevalence of stunting and underweight was 69.5% and 35.7%, respectively. There were no inter-age group differences in HAZ, WAZ, and the proportion of stunting or underweight. BMIZ was significantly lower in ≥7 years group than <7 years group for girls (*t* test, $p<0.01$) and for both sexes combined (*t* test, $p<0.01$). WAZ and the prevalence of underweight differed significantly between sexes (*t* test, $p<0.01$; chi-square test, $p<0.05$), being worse in boys than in girls. Broken down into the two age groups, significant sex differences were found only in WAZ (*t* test, $p<0.05$) and the proportion of underweight (chi-square test, $p<0.01$) for <7 years group.

Food consumption and energy and nutrient intakes

There were 221 'foods' consumed by the subject children. Of those, 76 were raw ingredients, 91 were processed foods manufactured in factories, and 54 were retailer-made cooked dishes (e.g., fried bananas). In this study, any processed food or cooked dish was sorted into one of the 11 food groups, according to the Indonesian food composition tables. Thus, the 221 foods consisted of 26 'cereals and tubers', 19 'pulses, nuts, and seeds', eight 'meats', three 'eggs', 20 'fishes', 41 'vegetables', 28 'fruits', three 'milk', one 'oil', four 'seasonings', and 68 'snack foods'. The percent contribution of each food group to energy intake was only slightly different between the two age groups (Figure 1). Any foods catego-

Table 3. The mean nutrient density of snack foods (n=68) and non-snack foods (n=153)

Nutrient		Snack foods	Non-snack foods	
Protein	g/MJ	5.42	9.95	**
Fat	g/MJ	8.46	6.44	*
Carbohydrate	g/MJ	40.2	36.9	
Calcium	mg/MJ	15.9	236	**
Phosphorus	mg/MJ	45.6	182	**
Iron	mg/MJ	1.76	4.10	**
Vitamin A	µg retinol equivalent/MJ	12.2	396	**
Vitamin C	mg/MJ	0.94	42.6	**

*,** Significantly different between groups at $p<0.05$ and $p<0.01$ (t test).

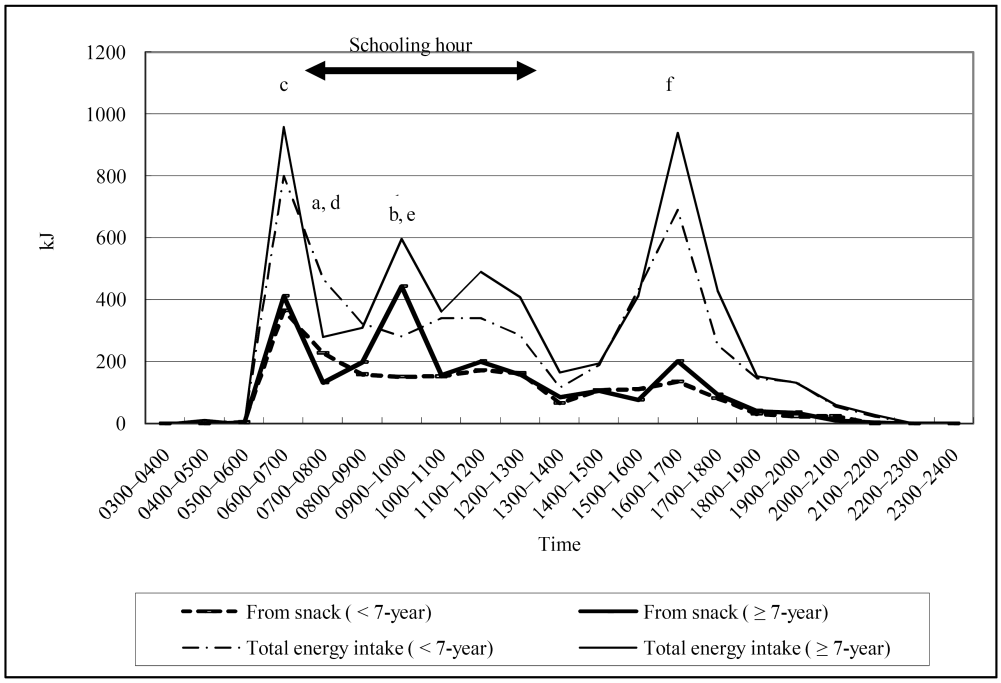

Figure 2. The mean energy intake and that from snack foods for two age groups of the subject children, for every one hour duration. a: Energy intake from snack foods in 0700–0800 was larger in <7 years group than ≥7 years group (Mann-Whitney's U test, $p<0.001$). b: Energy intake from snack foods in 0900–1000 was larger in ≥7 years group than <7 years group (Mann-Whitney's U test, $p<0.01$). c: Energy intake in 0600–0700 was larger in ≥7 years group than <7 years group (Mann-Whitney's U test, $p<0.05$). d: Energy intake in 0700–0800 was larger in <7 years group than ≥7 years group (Mann-Whitney's U test, $p<0.001$). e: Energy intake in 0900–1000 was larger in ≥7 years group than <7 year group (Mann-Whitney's U test, $p<0.001$). f: Energy intake in 1600–1700 was larger in ≥7 years group than <7 years group (Mann-Whitney's U test, $p<0.05$)

rized as 'cereals and tubers', except rice, were eaten very rarely. In other words, rice was the largest energy supplier, accounting for 41.1% of energy, on average, consumed by the subject children. Remarkably, the extents of snack foods and rice as energy suppliers were similar. To clarify nutrient contents of each food, nutrient density, i.e., the amount of nutrients (mg or µg retinol equivalent) per MJ energy, was calculated for each food. Nutrient densities varied considerably among snack foods and also among non-snack foods, and there were two overall differences between snack foods and non-snack foods; the densities for micronutrients (calcium, phosphorus, iron, and vitamins A and C) were much higher in the latter than in the former, whereas those for major nutrients differed less manifestly between them (precisely speaking, snack foods had significantly higher density for fat and lower density for protein) (Table 3).

Consumption of snack foods

There were three major observations in hourly intake of energy (Figure 2). First, the largest energy intake occurred in the early morning (0600–0700) and afternoon (1600–1700); in both periods meals were consumed in many households. Second, the ≥7 years group only consumed larger amounts of energy from snack foods at 0900–1000, i.e., school recess-time. Third, except the abovementioned peak hours for the ≥7 years group, snack foods consumption of both age groups continued throughout the day, gradually decreasing from morning to evening.

The percent contributions of snack foods, divided into four categories, relative to total intake of energy and eight nutrients are shown in Figure 3. There were high percentage contributions of snack foods to energy (40.0%), protein (39.4%), fat (59.6%) in particular, and iron (48.3%), in contrast with low contributions to phosphorus (28.8%), calcium (20.6%), vitamin C (9.9%), and vitamin A (7.7%). It is noteworthy that the subjects' intakes of vitamin A, vitamin C, and calcium, all of which were scarcely provided by snack foods, was only 58.5, 45.0, 40.4 % of recommended dietary allowance (RDA) of Indonesian population[18]. Further examination of the effects of snack food

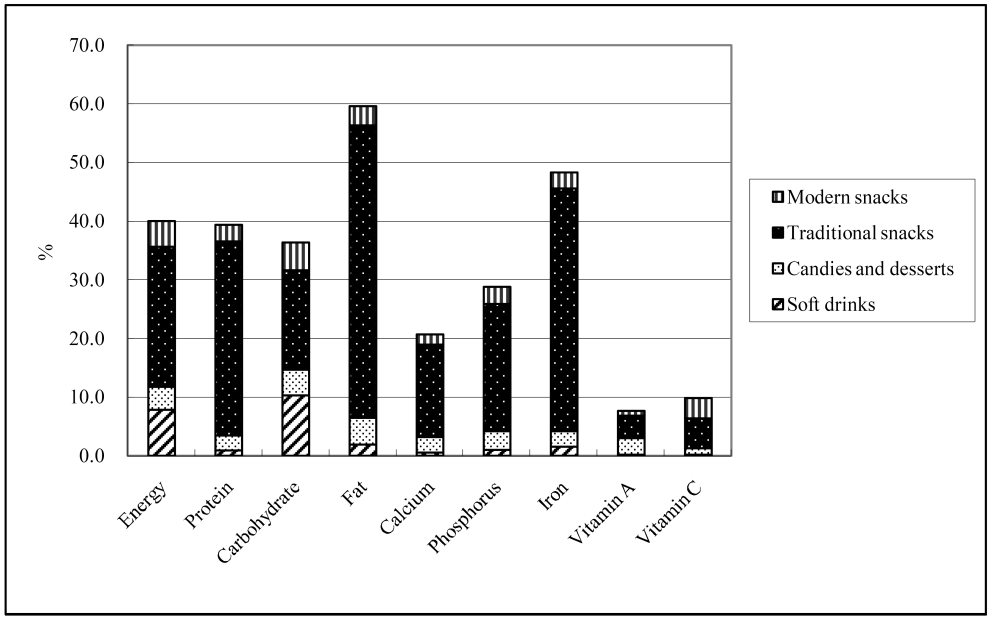

Figure 3. Percent energy and nutrient intakes from snack foods classified into four groups.

consumption on energy and nutrient intakes was made between two groups of the subjects (males and females combined) classified at the median in the contribution of snack foods to total energy intake, i.e., 41.1%; these two halves are called a more snack-consuming group (n=37, 40, 77, respectively, for <7 years group, ≥7 years group, and both age groups combined) and a less snack-consuming group (n=33, 44, 77, respectively, for <7 years group, ≥7 years group, and both age groups combined). As the results, the more snack-consuming group consumed less protein ($p<0.05$) and vitamin C ($p<0.01$) in <7 years group, and less carbohydrate ($p<0.05$) and vitamin C ($p<0.01$) in both age groups combined (Table 4).

Snack foods consumption and nutritional status

Subsequently, nutritional status was compared between the more snack-consuming group and a less snack-consuming group (Table 5). The result shows that HAZ was significantly lower in the more snack-consuming group than the less snack-consuming group for the ≥7 years group ($p<0.01$).

DISCUSSION

Feasibility of food recall survey

Feasibility and reliability of data collected are most critical in food consumption surveys using the recall method, particularly for children. To cope with this problem, we conducted the interview survey frequently, at least once every 3 hours, for seven consecutive days per child. Furthermore, three other surveys were useful for reliable estimates of foods consumed. First, the measurement of each child's portion size (one scoop) of cooked rice revealed large individual differences even within the same age group; for instance, among the 6 years age group, it ranged from 90 g to 210 g. Secondly, 11 kinds of cooked dishes such as fried cassava or papaya leaves, fried chicken with coconut milk, and fried egg with chilli, which were popular in the study village, were not listed in the Indonesian food composition tables. Thus, their energy and nutrient contents were reasonably estimated. Thirdly, the weight of each snack food purchased at retailers was properly estimated, based on the name of retailer and price of the product, because there were various sizes for the same-named food and because different stores dealt with different-sized foods of the same name.

In order to evaluate the validity of this 3-h-interval recall method, energy intakes of 11 selected children (aged 3–11 years) were calculated using two different methods, namely, direct weighing for all foods consumed and 3-hour-interval recall method, and compared to recommended dietary allowance (RDA) [23]. The result shows that the proportion to RDA obtained by direct weighing was 73, being very close to that of the same children's values obtained by the 3-hr-interval recall method, i.e., 72. It is thus determined that the data in this study were highly reliable.

Nutritional status and energy and nutrient intakes

According to a governmental report,[24] common child nutritional disorders in Indonesia are underweight for the <5-year-old group and stunting for the school age group. Based on the governmental records, Februhartanty reported that underweight prevalence in 1-5-year-olds was 27.3% in 2002, and stunting prevalence in 5–9-year–olds was 36.1% in 1999.[25] The children in the present study were thus judged malnourished due to higher proportions of underweight (35.7%) and stunting (69.5%), even though their ages differed slightly from those of the reference groups.

The roles of snack foods

Snack foods played significant roles in dietary intake among the subject children in rural Indonesia, representing 40% contribution to total energy intake. Compared to the findings of Adair & Popkin that contribution of snack foods to energy intake was much higher among children in Russia (33.6% in 1994 and 33.3% in 2003) and the USA (33.0% in 1994–1998) than among those of the

Table 4. Energy and nutrient intakes among the more or less snack-consuming groups (n = 77 for each; males and females combined)

	Age group (y)	Energy (MJ/day)		Protein (g/day)		Fat (g/day)		Carbohydrate (g/day)		Calcium (mg/day)		Phosphorus (mg/day)		Iron (mg/day)		Vitamin A (μgRE/day)		Vitamin C (mg/day)	
		More group	Less group	More group	Less group	More group	Less group	More group	Less group	More group	Less group	More group	Less group	More group	Less group	More group	Less group	More group	Less group
Both	< 7	4.7	5.2	23.8	27.8*	27.3	26.8	192.9	220.5	195.4	244.7	284	348.8	9.4	9.9	218	235.4	9.2	15.5**
	≥ 7	5.8	6.1	28.6	29.1	30.7	27.5	244.2	267.8	196.7	222.5	329.8	339.1	11.1	10	209.2	254.3	10	12.3
	All	5.2	5.8	26.3	28.5	29	27.2	219.5	247.5*	196.1	232	307.8	343.3	10.3	10	213.4	246.2	9.7	13.7**

*, ** Significantly different between groups at $p < 0.05$ and $p < 0.01$ (*t* test).

Table 5. Relations of snack foods consumption and nutritional status

	Age group (y)	HAZ		WAZ		BMIZ	
		More group	Less group	More group	Less group	More group	Less group
Both	< 7	–2.32 ± 1.26	–2.48 ± 1.00	–1.78 ± 0.88	–1.65 ± 0.85	–0.38 ± 1.16	–0.02 ± 0.69
	≥ 7	–2.57 ± 0.83	–1.98 ±1.01**	–1.73 ± 0.64	–1.49 ± 0.76	–0.47 ± 0.61	–0.64 ± 0.67
	All	–2.45 ± 1.05	–2.19 ± 1.03	–1.75 ± 0.76	–1.56 ± 0.79	–0.43 ± 0.90	–0.38 ± 0.74

HAZ: z score for height-for-age; WAZ: z score for weight-for-age; BMIZ: z score for body mass index-for-age.
** Significantly different between groups at $p<0.01$ (*t* test).

Philippines and China,[2] it can be suggested that the subject children in this study relied on snack foods for energy intake more than many other groups in the world. The comparison also showed that most snack foods consumed in Indonesia were of the traditional type, accounting for 23.9% of total energy intake, similarly to Russia (27.8% in 1994 and 26.3% in 2003). In contrast, consumption of soft drinks as well as fast food, which were not available in the study area, was very small and comparable to Russia and also to the Philippines and China.

One of the most significant effects of snack foods consumption was reflected in varied contributions to intake of nutrients, compared to energy. The extents of contribution were relatively high for fat and iron but low for micronutrients, especially vitamin A, vitamin C, and calcium (Figure 3). Regarding inadequacy of these three nutrients, application of recommended dietary allowance (RDA) for Indonesian people is of some meaning despite that RDA is, in nature, equivalent to the mean plus 2 SD (standard deviations), and thus covers the requirements of almost 97.5% of individuals in a population.[26] Among six nutrients whose RDA was available, only three, namely, vitamin A, vitamin C, and calcium, showed significantly low proportions compared to the other three. It is thus reasonable to judge that inadequate intake of micronutrients was caused by consumption of large amounts of snack foods, in which the ratios of micronutrients to energy were lower than in non-snack foods (Table 3).

Snack foods consumption and nutritional status

Regarding the relation between snack foods intake and nutritional status, this study revealed that HAZ score was significantly lower in more snack-consuming group among schoolchildren (≥7 years group). As many studies have reported, deficient intake of micronutrients such as calcium and vitamin A impairs linear growth of children.[27-30] The subjects had low habitual dietary intake of calcium and vitamin A, due to rare consumption of animal foods such as meat and dairy products, like their counterparts in other developing countries in Asia. A more important finding in this study was that the subjects' nutritional situation was worsened by consumption of large amounts of snack foods with low micronutrient contents. Thus, in order to improve their linear growth, consumed amounts of snack foods should be reduced and/or snack foods consumption should be replaced with non-snack foods consumption which contains much higher nutrient density; i.e., 15 times for calcium and 32 times for vitamin A.

Limitation of this study

Collection of data for this study was conducted almost ten years ago, since then Indonesia has achieved high economic growth, with 5 times larger GDP in 2011 (834 billion USD) than in 2001 (160 billion USD). According to the author's survey in this study area in 2011, however, little change was observed in children's dietary habits (unpublished data). Thus, this paper provides useful baseline data of child dietary intake, snack foods consumption in particular, in rural Indonesia.

Conclusion

In conclusion, this study found that dietary intake of rural children in West Java, Indonesia largely relies on snack foods consumption, represented by their 40% contribution to total energy intake. Nutrient density of snack foods was much lower in micronutrients especially vitamin A, vitamin C, and calcium, being parallel to the findings that the proportions of these three micronutrients intake was below 60% of RDA for Indonesian people. This study also highlighted that schoolchildren consumed large amounts of snack foods during school recess-time, and that among the more snack-consuming group had lower HAZ score than the less snack-consuming group. To improve their nutritionally vulnerable situations, appropriate school nutrition programs should be promoted.

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AUTHOR DISCLOSURE

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Original Article

Snack foods consumption contributes to poor nutrition of rural children in West Java, Indonesia

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印尼西爪哇的鄉村兒童零食攝取與較差營養有關

在發展中國家較少研究兒童的飲食習慣，包括零食攝取與他們的營養與健康之相關。本研究評估印尼西爪哇鄉村的 154 位年齡 1-12 歲兒童的零食攝取之影響。連續 7 天以 3 小時間隔之飲食回憶記錄，調查他們所有餐點及零食攝取；也進行體位測量和社經人口學指標的面談。這些兒童矮小及體重過輕的整體盛行率為 69.5%及 35.7%。有 221 種食物被研究對象攝取，其中有 68 種食物被歸類為零食。一天之中，兒童<7 歲或≥7 歲零食攝取的熱量類似，但≥7 歲的學童在學校休息時間攝取較多零食。零食平均貢獻百分比為脂肪 59.6%、熱量 40.0%、鈣質 20.6%及<10%的維生素 A 與 C。零食攝取熱量超過中位數的研究對象比起另一半兒童有較少的醣類和維生素 C 攝取量。而且在學童中，零食攝取越多，身高年齡比 Z 分數越低。為了改善這個營養缺陷狀況，零食的攝取應該以非零食食物取代，後者含較高營養密度，即 15 倍的鈣與 32 倍的維生素 A。此外，對攝取較多零食的≥7 歲學童，應進行適當的學校營養計劃。

關鍵字：兒童營養、發展中國家、印尼、學童