Breakfast Nutrient Analysis Among School Age Children in Jakarta Area, Indonesia

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ABSTRACT— *Breakfast is considered as one of the most important meal within a day, specifically this is important among school age children due to the nutrients content. The goal of this study was to investigate nutrients provided by breakfast meal and to describe the type and amount of breakfast consumed among school age children in Jakarta, Indonesia. 2nd Indonesian National Basic Health Research Survey (RISKESDAS) data in a cross-sectional setting was analyzed. The main sample consisted of children age 6- to 12- year old randomly selected in Jakarta area (n = 945). A 24-hr dietary recall was used for evaluating the breakfast nutrient contribution to the total daily nutrient intake. Breakfast meal contributed higher proportion of nutrients intake in younger age, higher SES, and also in boys. In every demographic subgroup, breakfast meal contributed high amount of carbohydrate, ranging from 39.2% to 44.6%, high amount of fat, ranging from 35% to 49.6%, and very low fiber content ranging from 3.6% to 4.8%. Vitamin C was notably the least consumed micronutrient by this population in all different sub groups (0% to 1.3%), as well as calcium (3.0% to 8.4%). Breakfast among school age children in Jakarta mostly consisted of rice (25.9%) with fried foods as side dishes. Breakfast consumption significantly contributes to whole diet nutrient adequacy. Breakfast consumption in Jakarta should be more stimulated in lower SES, older age, and girls group. Moreover, due to inadequacy of micronutrient intake, consumption of more whole fruits and fruit products during breakfast should be encouraged along with fat free or low fat milk products. This might be encouraged through a more holistic program from related stakeholders, including family, food companies, school, as well as government.*

Keywords— breakfast, nutrient intake, Jakarta, school age children

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1. INTRODUCTION

Regular breakfast consumption has been acknowledged as an opportunity to meet the nutrition recommendation since it is associated with higher intakes of several vitamins and minerals [1-4]. Breakfast consumption is also often recommended to reduce detrimental consequences of current children dietary behavior, such as excessive intake of high energy dense foods, fast food consumption, inadequate intakes of fresh fruits and vegetables, reduced physical activity and another sedentary behaviors [5,6]. A set of studies were also reported that breakfast consumption is frequently associated with higher intakes of some nutrients, particularly vitamin A, vitamin C, riboflavin (vitamin B_2), calcium, zinc, and iron [1,2,7]. This may boost the likelihood of meeting daily requirement recommendation as a percentage of DRIs. Fiber intake was also enhanced by regularly consuming breakfast which is currently lacking in children dietary diets [1,2,8]. As an essential micronutrient for bone development for children growth, calcium intake was also improved by regular breakfast consumption [1]. Furthermore, the relationship of breakfast consumption with dietary adequacy in Jakarta children has been understudied thus warrants further study. Therefore, the aim of present study was to investigate nutrients provided by breakfast meal, and also to describe the type and amount of breakfast consumed among school age children in Jakarta, Indonesia.

2. MATERIAL AND METHODS

Data from 2nd Indonesian National Basic Health Research Survey (RISKESDAS *Riset Kesehatan Dasar*) was used for this study. RISKESDAS 2010 itself was using a cross-sectional study design and was conducted from May to August 2010. Main sample population in this study consisted of school age children age 6- to 12- year old randomly selected in Jakarta area with total 1062 children were measured as the main respondents for this study.

Data Collection and Analysis

Data used in this study was obtained from RISKESDAS 2010 including subject identity (age, gender, weight, and height), socio-economic (SES) status, 24-hr dietary consumption data, BMI (*Body Mass Index*), and macronutrient consumption (energy, protein, carbohydrate, fat, and fiber). Interview method and family assessment questionnaire was used to collect subject identity data. SES categorization was assessed based on Indonesian Central Statistics Bureau

(*Badan Pusat Statistik*) using quintile with the 1st and 2nd quintile as low SES, 3rd quintile as medium SES, and 4th and 5th quintile as high SES. Parents and subjects filled in together the 24-hr dietary recall questionnaire, guided by expert interviewer. Age was classified based on the range used within Indonesian DRI.

Micronutrient analysis was assessed using *NutriSurvey for Windows* 2005 software (University of Indonesia, SEAMEO-TROPMED). However, if data for particular food does not exist in the software, then DKBM database (*Indonesian Food Consumption Database)* published by Indonesian Ministry of Food and Agriculture was used. For Indonesian Dietary Intake Reference, AKG 2004 (*Angka Kecukupan Gizi*) was used as the standard for each age category. Institute of Medicine (2005) was used as a standard for carbohydrate, fiber, and fat, DRI (Dietary Reference Intake). Body Mass Index (BMI) was calculated as weight/height^2 (kg/m^2) whilst BMI *z-score* was calculated for further analysis based on WHO 2007 formula.

Statistical Analysis

Cleaning and editing were accomplished as preliminary analysis using *Microsoft Excel* 2007 for Windows. All the statistical analyses were conducted using SPSS version 17.0 for Windows. Descriptive statistics were used to describe subject characteristics, daily nutrients intake, and BMI *z-score* within the study population. Descriptive statistics were also used to describe the nutrients provided by breakfast in different demographic subgroups (SES, age, and gender). Multiple regression analysis using Stepwise method was conducted to examine the relationship between age, gender, SES to the total energy intake, macronutrient (protein, carbohydrate, fat, and fiber), selected micronutrient (vitamin A, B_1, B_2, B_6, calcium, iron, and zinc). Actual food type and amount of consumption during breakfast was also analyzed using descriptive statistic analysis. *P-value of* < 0.05 was considered to be statistically significant.

3. RESULTS AND DISCUSSION

Final response rate was 88.9% meaning only 945 children were included after applying the cleaning criterias, which are the availability of height and weight data, total energy ratio to basal metabolic rate (BMR), if it was <0.3 or >3 (FANTA-2 Study, 2009) and the BMI value, if BMI> 36 and <12 (WHO Growth Chart, 2007) then will be excluded. Subject characteristics in this study is shown in Table 1.

Table 1 Means (SD) and percentages of subject characteristics

	n sample (percentages or mean ± SD)
Gender	
Boys	494 (52.3%)
Girls	451 (47.7%)
Socioeconomic status (SES)	
Low	610 (64.6%)
Medium	198 (20.9%)
High	137 (14.5%)
Age (years)	9.00±1.972
6 years old	134 (14.2%)
7-9 years old	409 (43.3%)
10-12 years old	402 (42.5%)
Weight (kg)	29.99 ± 10.00
Height (cm)	129.5 ± 14.81
BMI for age (WHO 2007)	17.63 ± 4.055
Underweight	72 (7.6%)
Normal	565 (59.8%)
Overweight/Obese	308 (32.6%)

Nutrients provided by breakfast in different demographic subgroups

The median nutrient intakes consumed during breakfast and percentage of contribution to total daily intake based on Indonesian DRI were presented in Table 2. Breakfast meal provided approximately between 16 to 24% of total daily energy intake. Furthermore, highest amount of fat consumed during breakfast meal was in 6-year age group (49.6%) while the lowest was in the 10-12 year age group (35%). Breakfast meal contained considerably high amount of carbohydrate, ranged from 39.2% to 44.6% but low amount of fibers, ranged from 3.6% to 4.8%. Although breakfast meal consumed by Jakarta children contained several micronutrients, the amounts were still considerably low, particularly for vitamin C (0%-1.3%) and calcium (3.0%-8.4%). Older age group was also tended to significantly consume the least amount of micronutrients.

Table 2 Macronutrient and Selected Micronutrient Consumed during Breakfast and Percentage Contribution to Total Daily Intake†

Age group / Nutrient	6 years $n = 131$	%	7-9 years $n = 391$	%	10-12 years $n = 376$	%	p-value[*]
Energy (kcal)	374.6 (29.9)	24.2%	354.7 (18.8)	19.7%	343.1 (17.4)	16.7%	ns
Carbohydrate (g)	58 (4.2)	44.6%	53.4 (2.7)	41.1%	50.9 (2.6)	39.2%	ns
Protein (g)	13.7[a] (1.3)	35.1%	11.2[ab] (0.8)	24.8%	9.95[b] (0.7)	19.9%	p<0.05
Fat (g)	12.4 (1.4)	49.6%	10.2 (0.9)	40.8%	8.75 (0.9)	35%	ns
Fiber (g)	0.9 (0.1)	3.6%	0.9 (0.07)	3.6%	1.2 (0.07)	4.8%	ns
Vitamin A (RE)	90.5 (29.2)	20.1%	62 (28.8)	12.4%	20 (14.1)	3.3%	ns
Vitamin B_1 (mg)	0.1[a] (0.02)	16.6%	0.1[ab] (0.01)	11.1%	0.1[b] (0.01)	10%	p<0.01
Vitamin B_2 (mg)	0.2[a] (0.04)	33.3%	0.2[a] (0.02)	22.2%	0.1[b] (0.02)	10%	p<0.001
Vitamin B_6 (mg)	0.2 (0.18)	33.3%	0.2 (0.01)	20%	0.2 (0.01)	15.4%	ns
Vitamin C (mg)	0.6[a] (3.3)	1.3%	0.3[ab] (1.5)	0.7%	0.0[b] (1.4)	0%	p<0.05
Calcium (mg)	42[a] (45.7)	8.4%	36.3[a] (24.5)	6.1%	30.25[b] (20.3)	3.0%	p<0.001
Iron (mg)	1[a] (0.5)	11.1%	1[ab] (0.3)	10%	1.0[b] (0.2)	7.7%	p<0.05
Zinc (mg)	1.4[a] (0.2)	14.4%	1.3[ab] (0.1)	11.6%	1.2[b] (0.1)	8.6%	p<0.05

†All values are presented as median (SE)
[*]$p < 0.05$ is considered as statistically significant

Intakes of macronutrients and selected micronutrient consumed during breakfast and their contribution to total daily intake in different gender were summarized in Table 3. Breakfast meal contributed higher energy intake (19.7% *versus* 19.6%), carbohydrate (41.1% *versus* 40.7%), and protein intake (23.9% *versus* 22.8%) for boys in comparison with girls although these were not statistically significant. Girls consumed higher median fat intake during breakfast in comparison with boys (42.4% *versus* 37%). Furthermore, fiber intake for both genders was still considered as low intake (4-4.8%). Vitamin C intake during breakfast for both genders was 0%. Other micronutrients consumed during breakfast were also considered as low amount.

Table 3 Macronutrient and Selected Micronutrient Consumed during Breakfast and RDA Percentage Contribution to Total Daily Intake in Different Gender†

Gender / Nutrient	Boys n = 476	% Recommendation‡	Girls n = 422	% Recommendation‡	p-value[*]
Energy (kcal)	354.6 (17.1)	19.7%	352.85 (17)	19.6%	ns
Carbohydrate (g)	53.4 (2.4)	41.1%	52.9 (0.9)	40.7%	ns
Protein (g)	10.8 (0.7)	23.9%	10.25 (0.9)	22.8%	ns
Fat (g)	9.3 (0.9)	37%	10.6 (0.7)	42.4%	ns
Fiber (g)	1.2 (0.6)	4.8%	1.0 (0.07)	4%	ns
Vitamin A (RE)	51.6 (25)	10.3%	32.9 (14.3)	6.6%	ns
Vitamin B_1 (mg)	0.1 (0.09)	11.1%	0.1 (0.01)	11.1%	ns
Vitamin B_2 (mg)	0.1 (0.02)	11.1%	0.1 (0.02)	11.1%	ns
Vitamin B_6 (mg)	0.2 (0.01)	20%	0.2 (0.009)	20%	ns
Vitamin C (mg)	0.0 (1.5)	0%	0.0 (1.4)	0%	ns
Calcium (mg)	32.35 (21.9)	5.4%	34.1 (22.4)	5.7%	ns
Iron (mg)	1.0 (0.2)	10%	1.0 (0.2)	10%	ns
Zinc (mg)	1.2 (0.1)	10.7%	1.3 (0.1)	11.2%	ns

†All values are presented as median (SE)
‡Recommended intake is based on Indonesian DRI (AKG 2004) and Dietary Reference Intakes 2005 by Institute of Medicine of The National Academies for carbohydrate and fiber
[*]$p < 0.05$ is considered as statistically significant

The higher the socioeconomic status, nutrient intakes during breakfast were considerably higher as shown in Table 4. For instance, high SES sub-group consumed significantly higher amount of protein, and all selected micronutrients. Energy, carbohydrate, fat, and fiber intake were also higher in high SES sub-group although those were not statistically significant. Fiber intake (4-4.8%) and vitamin C (0%-0.44%) intake among all SES were still considerably low and inadequate. In exception for high SES group, low and medium SES group consumed quite low amount of several micronutrients such as vitamin A, B_1, B_2, B_6, C, calcium, iron, and zinc.

Table 4 Macronutrient and Selected Micronutrient Consumed during Breakfast and Percentage Contribution to Total Daily Intake in Different SES group†

SES groups / Nutrient	Low $n = 131$	%	Medium $n = 186$	%	High $n = 581$	%	*p-value*[*]
Energy (kcal)	340.5 (26.9)	18.92%	352.5 (24.8)	19.6%	354.7 (15.8)	19.7%	ns
Carbohydrate (g)	47 (3.7)	36.15%	57.1 (3.6)	43.9%	53.4 (2.3)	41.07%	ns
Protein (g)	8.8[a] (0.9)	19.55%	9.95[ab] (0.9)	22.11%	11.7[b] (0.7)	26%	$p<0.001$
Fat (g)	8.2 (2.1)	32.8%	9.0 (1.5)	36%	10.3 (0.7)	41.2%	ns
Fiber (g)	1.2 (0.1)	4.8%	1.2 (0.1)	4.8%	1.0 (0.06)	4%	ns
Vitamin A (RE)	5.3[a] (18.9)	1.06%	19.1[a] (17.9)	3.82%	75.1[b] (21.7)	15.02%	$p<0.01$
Vitamin B_1 (mg)	0[a] (0.01)	0%	0.0[a] (0.01)	0%	0.1[b] (0.008)	11.11%	$p<0.001$
Vitamin B_2 (mg)	0.1[a] (0.3)	11.11%	0.1[a] (0.03)	11.11%	0.2[b] (0.02)	22.22%	$p<0.001$
Vitamin B_6 (mg)	0.1[a] (0.01)	10%	0.1[ab] (0.01)	10%	0.2[b] (0.09)	20%	$p<0.05$
Vitamin C (mg)	0[a] (1.2)	0%	0.0[a] (1.7)	0%	0.2[b] (1.5)	0.44%	$p<0.001$
Calcium (mg)	17.6[a] (27.7)	2.93%	29.65[a] (29.8)	4.94%	40.2[b] (21.1)	6.7%	$p<0.001$
Iron (mg)	0.9[a] (0.3)	9%	1.0[a] (0.3)	10%	1.0[b] (0.2)	10%	$p<0.001$
Zinc (mg)	1.1[a] (0.1)	9.82%	1.15[ab] (0.1)	10.26%	1.3[b] (0.09)	11.6%	$p<0.001$

†All values are presented as median (SE)
‡Recommended intake is based on Indonesian DRI (AKG 2004) and Dietary Reference Intakes 2005 by Institute of Medicine of The National Academies for carbohydrate and fiber
[*]$p < 0.05$ is considered as statistically significant

Actual food type and amount of consumption during breakfast

As expected, the most frequently eaten food products during breakfast were rice with different cooking methods, such as white cooked rice (13.9%), rice with coconut milk (8.58%), fried rice (3.5%), followed by another type of carbohydrates which were instant noodle (4.71%), and bread (3.77%). For side dishes, the most common foods being consumed were fried eggs (6.71%), fried tempeh (3.47%), fried chicken (2.49%), and fried tofu (1.42%). Instant milk powder (8.05%) and sweetened tea (6.58%) were the most consumed liquids as shown in Table 5.

Table 5 Amount and frequency of consumption from the most eaten foods and beverages during breakfast among children age 6-12 years old in Jakarta

Type of Food or Drinks	Consumption Amount[†]	Frequency (%)[‡]
Food		
White cooked rice (g)	142.1 (3.7)	13.9%
Rice with coconut milk (g)	175.9 (6.9)	8.6%
Instant noodle (g)	111.5 (6.9)	4.7%
Fried rice (g)	158.8 (8.9)	3.5%
Fried chicken (g)	64.9 (4.2)	2.5%
Fried tempeh (g)	40.3 (3.1)	3.5%
Fried tofu (g)	55.2 (7.6)	1.2%
Bread (g)	64.1 (3.9)	3.8%
Fried eggs (g)	56.8 (2.2)	6.7%
Beverages		
Fresh milk (g)	211.4 (15.4)	0.98%
Instant milk powder (g)	233.3 (10.5)	8.1%
Condensed milk (g)	182.5 (8.5)	3.9%
Sweetened Tea (mL)	209.1 (9.7)	6.6%

†All values are presented as means (SE)
‡Number of food/beverages appears in total breakfast (2249 occasions)

Breakfast provided approximately 16-24% of the total daily energy intake in this population. It contributed a higher proportion of nutrients intake in younger age, higher SES, and also in boys. Williams (2007) also reported that younger children consumed higher proportion of energy intake in comparison with the older age, especially for girls. This might be due to the better economic ability and easier access to food in higher SES and higher energy requirement in boys compare to girls [9]. Stronger parental monitoring for younger children and willingness of parents (specifically mothers) in preparing breakfast may act as plausible mechanisms explaining the reasons why they had better nutrient intake. Salvy and colleagues (2011) reported that children aged 5- to 7-year old consumed fewer unhealthy snacks in the presence of their mothers, compared with the older age [10]. Additionally, mothers were associated with reduced intake of non-nutritious foods rather than an increase of healthier food selection.

Overall, in every demographic subgroup, breakfast meal contributed to very high amount of carbohydrate, ranging from 39.2% to 44.6%, high amount of fat, ranging from 35% to 49.6%, and very low fiber content ranging from 3.6% to 4.8%. Vitamin C and calcium were notably the least amount of micronutrients consumed (0% to 1.3%) and (3.0-8.4%), respectively. Indonesian breakfast mostly consists of rice and side dishes (25.9%), follows by other carbohydrate sources such as instant noodles (4.7%) and bread (3.8%). Not only in Indonesia, in most of South East Asian countries, rice are the most common foods consumed during breakfast [11]. In this study, it was also found that fried side dishes were the most common foods eaten as breakfast, which may explain the high intake of fat and carbohydrate during breakfast. Moreover, up to 70% of children in Indonesia used to buy street foods for breakfast [11] with the most frequent foods consumed are porridge, meat ball broth, and fried foods (fried banana).

Low intake of vitamin C and calcium consumed during breakfast in this study suggested low amount of fruits or milk based product consumption. This finding was also consistent with a study conducted nationally in 2012, which reported that less than 2% of children consumed whole fruits or fruit based products while milk was consumed by less than 10% of the total children population [12]. Therefore, consumption of more whole fruits and fruit products during breakfast should be encouraged along with fat free or low fat milk products to increase the micronutrient intake among the population. This might be performed through a more holistic program from related stakeholders, including family, food companies, school, as well as government.

To the author's knowledge, this was the first recent study in the past few years describing nutrient intake adequacy of school aged children living in Jakarta across different demographic subgroups, as well as breakfast contribution to daily nutrient intake. This study also identified subgroups that need to be given the extra attention when promoting healthier breakfast consumption. Some limitations must be considered as well in this study. RISKESDAS is a cross-sectional study and the data was obtained from 1-day 24-h dietary recall. Therefore, it would not be possible to draw a causal inference, particularly when used to assess the relationship between weight status and breakfast consumption. Dietary intake report was relied on the memory of the participants together with parents or guardian, thus increasing the likelihood of non-sampling errors, such as under-reporting and memory bias [13]. Moreover, a 24-h dietary recalls may not accurately reflects the usual dietary patterns of participants, for instance, portion size estimation.

4. CONCLUSIONS

Breakfast consumption significantly contributes to whole diet nutrient adequacy. Breakfast consumption among school age children in Jakarta should be more stimulated in lower SES, older age, and girls group. Moreover, due to inadequacy of micronutrient intake, consumption of more whole fruits and fruit products during breakfast should be encouraged along with fat free or low fat milk products. This might be encouraged through a more holistic program from related stakeholders, including family, food companies, school, as well as government.

5. ACKNOWLEDGEMENT

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