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NARRATIVE REVIEW

The importance of school snacks for primary school-aged children nutritional support as the foundation of *Sekolah Generasi Maju* in Indonesia

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Abstract

As a developing country, Indonesia is still burdened with high prevalence of child malnutrition including those in primary school. One of the main factors affecting nutritional status of children is snack consumption in school. School snacks are expected to be able to contribute to nutritional requirements. This narrative review is written to collect information and knowledge regarding nutritional status, nutritional requirements, factors determining nutritional status of primary school children and, lastly, recommended school snacks. This review also acts as a basic information for school snacks program establishment.

Keywords Indonesia, nutritional status, school-aged children, snacks

Background

Primary school age acts as the continuation from toddler to the next phase of children's growth, development, and learning. In this phase, nutrition is one of the most important aspects. Nevertheless, high numbers of malnutrition in school-aged children remains a national problem.

Despite of its economic growth, Indonesia suffers from high prevalence of undernutrition, obesity and micronutrient deficiency in children (commonly known as the triple burden).[1] According to Basic National Health Research/*Riset Kesehatan Dasar* (Riskesdas) 2013,[2] as much as 11.2% of primary school-aged children were underweight, 26.4% were anemic and 18.8% were obese. Prevalence of stunted school-aged children was still high (30.7%), regardless of its decline from 35.8% in year 2010 Riskesdas data. Regionally, data from West Java Riskesdas 2018[3] showed 16.43% of primary school-aged children were stunted, 6.45% were severely stunted, 5.16% were underweight, 1.88% were severely underweight and 8.9% were obese. In Bandung, the capital city of West Java, 20.64% school-aged children were classified as stunted, 6.51% were severely stunted, 4.54% were underweight, 0.47% were severely underweight and 7.95% were obese. Malnutrition in children may affect physical and mental development. A research regarding a relationship between nutritional status and learning performance in Nairobi, Kenya, Africa, shows that children with low nutritional status or obese demonstrated poor learning performance, poor classroom and out-of-class activity, and low attendance.[4] In addition, several studies indicate that children with short stature (stunting) suffered from

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impairment in brain and motor development, lower levels of intelligence, and learning difficulties.[5–7]
The reason behind the underweight status in school-age children is the lack of fulfilment of nutritional requirements. This involves the interaction between the lack of nutrition intakes from food and impaired absorption of nutrients. On the contrary, the cause of overweight in school-aged children is the interaction between the excessive calorie intakes and the lack of physical activity. To overcome this, it is necessary to ensure children have appropriate food intakes according to the recommended dietary allowances/*angka kecukupan gizi* (AKG) for 7 to 12-year-old children.[7] Supports from various parties such as local governments, teachers, parents, and school cafeteria managers are crucial to the sustainability of the school's nutritional support program. Programs and facilities that are applicable in accordance with the school conditions are also necessary. School of advanced generation/*Sekolah Generasi Maju* is a school that will provide facilities for children to gain the best nutritional support as well as knowledge improvement. Through nutritional support programs and facilities in school cafeteria, schoolchildren are expected to gain proper knowledge on nutrition and health, as well as to secure healthy nutritional status that will improve their learning potential at schools. Therefore, this narrative review is compiled as a guideline on various important nutritional requirements of school-age children and food ingredients that can be made into healthy and nutritious snacks sold in the school cafeteria.

Nutritional status of primary school-age children in various cities in Indonesia

Researches conducted in Indonesia have shown varying numbers on the nutritional status of primary school-aged children. One of them is a study in Tangerang Regency, West Java, where the figure shows that 17.8% of school-aged children were underweight and very underweight, while 7.3% of them were overweight.[8] A study on 50 primary school children in Serang City, Banten, West Java, shows that 3% of them were very underweight, 6% were underweight, 13% were overweight, and 8% were very overweight.[9] Another study in a primary school in Surakarta shows that 6.59% of the schoolchildren were underweight and 21.97% were overweight.[10]
A Study by Yurni et al.[11] on a primary school in Bogor city, West Java, concluded that out of 52% of primary school children, 3.8% were underweight, 11.5% were overweight, and 11.5% were obese. Another study by Sekiyama et al.[12] on a primary school in a village in West Java shows that out of 68 children, 2.9% were underweight, while 17.6% of them were overweight and very overweight. A research conducted in Makassar, the capital city of South Sulawesi, by Syahrul et al.[13] on 877 primary school children shows that 14.5% of them were overweight and 20.4% were underweight. Jahri et al.[14] conducted a research on 350 primary school children in Bengkalis Region, Riau, Sumatra and found 1.7% of the children were very underweight, 12% were underweight, 5.7% were overweight, and 4.6% were obese.

What about Bandung city? A cross-sectional study by Yulia et al.[15] on 7 public schools in Bandung shows that 21.7% of the children were overweight and 19.7% were very overweight. Another study by Riana et al[16] in a primary school in Bandung shows that out of 145 schoolgirls, 2.1% of them were very underweight, 6.9% were underweight, while 11.7% were overweight, and 4.8% were very overweight.

Unfortunately, there have not been many studies that uncover the problem of micronutrient deficiency in primary school-age children. A study by Bardosono et al[17] on 245 primary school-age children with underweight status in Jakarta and Surakarta shows that about 12% of the children had iron and zinc deficiencies. Southeast Asian Nutrition Survey (SEANUT)[18] research in 48 cities in Indonesia on children aged 0—12 years shows that 55% of the children were anemic, 4.1—8.8% of children suffered from iron deficiency, and 25.2—39.2% of children were stunted. This condition indicates that school-age children are not different from toddlers, who experience the triple burden of malnutrition, with undernutrition, overnutrition, and micronutrient deficiency.

The energy and nutritional requirements of Indonesian primary school-aged children

In the primary school-age period (7—12 years), children's physical growth occurs gradually and continuously. However, their cognitive, emotional, and social development happen very rapidly. Appropriate nutritional intakes are essential for the children to achieve optimal growth, development, and health, as well as to prepare themselves for changes in the body during adolescence.[19]

Nutrients particularly required by primary school-aged children are carbohydrates, proteins, fats, vitamins, iron, zinc and iodine. Carbohydrates are important sources of energy for the body and brain. Proteins are necessary for cell growth and brain development. Fat is a source of energy that helps with the absorption of vitamin A, D, E and K, and brain development, as well as provides good taste in food. Unsaturated fats, which are omega 3 and 6 fatty acids, help with brain development, learning concentration, allergy prevention, as anti-inflammatories, and brain cells protection. Vitamins, especially vitamin A and C, help to maintain immunity. Vitamin D helps with calcium absorption, which is important for bone and teeth growth. Vitamin D also plays as an anti-inflammatory and improves immunity. Minerals, such as calcium, iron, zinc and iodine, are important for bone, muscle, dental, and cell growth, anemia prevention, as well as brain development. Fibers help to maintain gastrointestinal health and help to facilitate bowel movements.[19–21] Energy and nutritional requirements for primary school children must correspond with Indonesian AKG, as stated in **Table 1.**

Regarding special nutrients to support school-age children's physical growth and cognitive development, research by Bardosono et al.[17] on 245 primary school-age children shows that milk supplementation fortified with iron and zinc for 6 months has improved the scores of fast thinking compared to the control group. A systematic study by Falkingham et al.[22] shows that iron supplementation improved children's attention and learning concentration, as well as improved the intelligence quotient (IQ) in school-age children with anemia.

Food that contain both nutrients are listed in **Table 2**. Those special nutrients can be obtained from basic food ingredients or fortified food (e.g. milk or flour).

Factors determining primary school children's nutritional status

The nutritional status of school-age children is affected by several factors, such as adequate nutritional intake, parents' level of education, breakfast habits, and homemade meals they bring to school. According to Riskesdas 2010,[23] 44.4% of primary school-age children consumed food with inadequate energy. About 30.6% of them had protein intake below minimal requirement. There is no national data available on excessive consumption of energy and protein on school-age children.

Study by Syahrul et al.[13] conducted in Makassar, found that there was a significant correlation between mothers' level of education to undernutrition status (*underweight*) in school children. Meanwhile, mothers with a high level of education were significantly correlated to overnutrition status (*overweight*). This suggests that a highly educated mother tends to prevent undernourishment while simultaneously increases their children's risk of having overnutrition since every mother plays a vital role in their child's dietary intake. Wolde et al.[24] indicated that parents with lower level of education tend to have children with undernutrition due to the lack of a healthy lifestyle, including the absence of healthy breakfast with balanced nutrition. Therefore, addressing the level of education alone is not sufficient to overcome nutritional problems. It must be accompanied by an improvement in health and nutrition knowledge.

Concerning breakfast, research by Anzarkusuma et al.[8] indicates that 94.4% of the children stated that they always have breakfast before going to school. Similarly, a study by Nuryani et al.[25] shows that 64.9% of the children always eat breakfast before school. Breakfast supposedly contributes 20–30% of total calorie requirement for a day, or about 300–600 kcal, which in balanced nutrition composition consists of 50–65% carbohydrate, 15–20% protein, and < 30% fat.[20] In general, schoolchildren consume rice, bread, instant noodles, or fried rice as breakfast,[26] of which appear to be lacking in protein,

fiber, iron and vitamins. An example of breakfast menu that fulfills school children's nutritional needs is a portion of fried/uduk/turmeric/white rice, with egg side dish, slices of tomato, carrot, and cucumber, and a glass of milk or fruit juice; or 2 pieces of bread filled with omelette and a slice of cheese, tomato, and cucumber.

To help fulfilling daily nutritional requirements, lunch box meals or snacks sold in school should contribute about 10% of total calorie needs in a day, or about 160–200 kcal. However, research by Anzarkusuma et al.[8] indicates that 79% of school children do not have the habit of bringing their own meals from home. This is similar to a study of school children Serang City that shows only 25% of the children have the habit of bringing homemade meals and only 54% are accustomed to bring their own drink to school. This study also revealed that the common content of their lunch boxes are rice, a side dish, and water. While the 5 preferred types of snacks to buy in school are bread, biscuits, wafers, packaged snacks, and sausages. For drinks, the 5 most preferred types are ice cream, bottled water, bottled tea, carbonated drinks, and unpackaged fruit juice/drink.[9]

The small number of children who bring their own homemade meals to school indicates that they need snacks at school as breakfast substitute in order to be able to meet 20% of their total daily calorie needs (300 kcal). Schools need to provide or sell food with balanced nutrition that can fulfill the calorie needs. Some good examples would be fried/uduk/turmeric rice with side dishes like eggs, fried chicken/nuggets, sausages, sauteed tempeh, sauteed anchovies and peanuts, as well as urap veggies/sauteed kangkung/sauteed carrot and green beans, or fried noodle/vermicelli with side dishes of eggs/nuggets/sausages and vegetables. Examples of snacks are rice cake/rice/pastry/rissoles/fried bread filled with minced vegetable (carrots, beans, etc.), milk and fruit egg pudding, mambo ice with fruit or milk and mung beans, fruit soup with milk and mung beans/chocolate sprinkles/kidney beans topping, or fresh fruit juice with milk and no sugar.

Based on the observation in some schools, school cafeterias and hawkers outside the school sell similar types of food: unhealthy snacks with questionable hygiene that contain food additives (dyes, preservatives, seasoning, etc.). As a result, those food only fulfill the calorie needs but lacking in nutrients, thereby negatively impacting the health and nutritional status of school children. The existence of school cafeteria is expected to help addressing this problem by exclusively providing affordable, healthy and nutritious snacks that the children would like. Healthy means free from various biological contamination (germs and dust) and chemical contamination (food additives),[27] as well as nutritious as it is made from food ingredients that contain complete nutrients required by school-age children. The cafeteria manager can also educate schoolchildren on how to select healthy and nutritious snacks, so they will gradually prefer to buy snacks only from the school cafeteria/canteen.

Conclusion

Primary school-aged children in Indonesia are experiencing triple burden of malnutrition, with undernutrition, overnutrition and micronutrient deficiency. Such problems are due to their lack of appropriate nutritional intakes, parents' poor knowledge on children nutritional needs, absence of breakfast, as well as the availability of unhealthy food and snacks sold at school. Therefore, there is an urgent need to immediately continue the nutritional improvement program in schools that are more practical, independent, and sustainable in order to support the foundation of *Sekolah Generasi Maju* in Indonesia. Recommended activities would be introducing healthy and nutritious ingredients to make snacks sold in the school cafeteria that schoolchildren will like, as well as nutrition education activities for school children and cafeteria/canteen managers.

Table 1. Recommended dietary intakes for school-age children

Age Group (year)	Energy (kcal)	Protein (g)	Total Fat (g)	Unsaturated fat (g)		Carbohydrates (g)	Calcium (mg)	Iron (mg)	Zinc (mg)	Iodine (mcg)	Fiber (g)	Vit A (mcg)	Vit C (mg)	Vit D (mcg)
				Omega 3	Omega 6									
7—9	1650	40	55	0.9	10	250	1000	10	5	120	23	500	45	15
Male														
10–12	2000	50	65	1.2	12	200	1200	8	8	120	28	600	50	15
Female														
10–12	1900	55	65	1.0	10	280	1200	8	8	120	27	600	50	15

Source: Regulation of Minister of Health of the Republic of Indonesia (Permenkes RI) No. 28 of 2019 on the Recommended Dietary Allowances (AKG) recommended for the people of Indonesia[28]

Table 2. Iron and zinc content in food ingredients

Nutrients Nutrient	Recommended intakes based on AKG		Food Ingredients	Household Measurements	Measurement in grams	Nutrient per Household Measurement	Nutrient per gram	Calories
Nutrients Iron (mg)	7—9 yo	10	Chicken liver	1 medium piece	30	2.2	0.07	75
	Male		Tuna fish	(canned)	200	1.5	0.01	116
	10–12 yo	8	Ground	3 ounces	85	2.2	0.03	180
	Female		Spinach	1 cup	30	0.8	0.03	6
	10–12 yo	8	Beet root	3/4 Cup	100	0.8	0.01	43
			Clams	1/2 Cup	90	3.6	0.04	150

Nutrients Nutrient	Recommended intakes based on AKG		Food Ingredients	Household Measurements	Measurement in grams	Nutrient per Household Measurement	Nutrient per gram	Calories
			Mackerel	1 whole piece	90	0.9	0.01	150
			Shrimp	5 medium shrimps	35	0.9	0.03	50
			Mackerel Tuna	1 ounce	100	0.7	0.01	30
			Kidney Beans	2 tablespoons	20	1.5	0.08	75
			Kangkung	1 ounce	100	1.1	0.01	25
			Long beans	1 ounce	100	1.3	0.01	25
			Red spinach	1 ounce	100	3.1	0.03	50
			Katuk leaf	1 ounce	100	2.3	0.02	50
			Snow peas	1 ounce	100	1.5	0.02	50
Zinc (Zinc, mg)	7—9 yo	5	Oyster	1 whole piece	28	12.8	0.46	30
	Male		Clams	1/2 Cup	90	1.4	0.02	50
	10–12 yo	8	Crab	1 medium chicken	30	3.8	0.13	50
	Female		Shrimp	5 medium shrimps	30	1.8	0.06	50
	10–12 yo	8	Skinless chicken	1 medium chicken	40	2.4	0.06	50
			Ground beef	3 ounces	30	3.8	0.13	75
			Kidney Beans	2 tablespoons	20	0.6	0.03	75
			Katuk leaf	1 ounces	100	0.5	0.01	50
			Snow peas	1 ounces	100	1.2	0.01	50

Source: reference no.28–30

Conflict of Interest

Authors declared no conflict of interest regarding this article.

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