

Nutritional Status of Vegetarian and Non-Vegetarian Children

1st Susianto
 Graduate School of Public Health
 STIKes Kuningan
 Indonesia
susiantostikku@gmail.com

Abstract—Introduction: There was no official study on nutritional status of vegetarian children in Indonesia. Vegetarian children have risk of nutrient deficiency affecting their physical growth and mental development. The objective of this study was to investigate the difference between nutritional status of vegetarian and non-vegetarian children. **Methods:** Cross-sectional design with *purposive sampling* from vegetarian and non-vegetarian children under-five in Jakarta, February to March 2008. There were 148 samples collected (75 vegetarians and 73 non-vegetarians). Data collected include children and mothers characteristics, weight, length / height. A 24-hour food recall was used for dietary intake. Weight-for-Age (WAZ), Height-for-Age (HAZ), Weight-for-Height (WHZ) and BMI-for-Age (BAZ) were used for nutritional status. **Results:** 5.3% of vegetarian and 12.3% of non-vegetarian children under-five were obese, 13.3% of vegetarian and 8.2% of non-vegetarian were overweight, 25.3% of vegetarian and 21.9% of non-vegetarian were at risk of overweight, 56% of vegetarian and 57.5% of non-vegetarian were normal. There was no significant relationship between diet (vegetarian, non-vegetarian) and nutritional status (BAZ). **Conclusion:** There was no significant difference in nutritional status (WAZ, HAZ, WHZ, BAZ) between vegetarian and non-vegetarian children under-five.

Keywords—*vegetarian, children, nutritional status*

I. INTRODUCTION

Vegetarians are people who live from consuming plant-based foods with or without milk and/or eggs, but avoid the consumption of meat, poultry and seafood. Vegetarians who only consume plant-based foods are called vegan, while vegetarians who consume plant-based foods, milk and processed products are called lacto-vegetarian. Vegetarians who consume plant-based foods, milk and eggs and their processed products are called lacto-ovo-vegetarian [1]. Aspects of vegetarians are healthy lifestyle, religious teachings, care for animals and the environment [2].

The 1997 survey reported that 1% of the population of the United States was vegetarian. This figure increased to 2.5% in 2000 and 2.8% in 2003 [3]. The population of British vegetarians in 1987 was 3%, almost doubling in

1997 to 5.4% [2]. Newpoll Survey in 2000 reported 2% of Australians were vegetarians and 18% of the population preferred vegetarian food [4], and more than 50% of the population in India in 2003 were vegetarian [5]. The number of vegetarians registered with the Indonesian Vegetarian Society (IVS) when it was founded in 1998 was around five thousand people and increased to sixty thousand people in 2007 [6]. Data showed that there were an increasing number of vegetarian children in North America, Western Europe and Australia [9]. According to the survey of IVS in 2007, there were around three hundred lacto-ovo-vegetarian children under-five in Indonesia with about one third of them lived in Jakarta [6].

Research on the growth and development of vegetarian children was first carried out by Hardinge in 1954 with a large sample of 30 vegetarian children aged 13-17 years. The study design used was cross-sectional to assess nutritional status based on anthropometric indices. Hardinge reported that the growth of lacto-ovo-vegetarian children was similar to the group of non-vegetarian children of the same age, whereas vegan children had smaller bodies with body weight and height which were lower than the group of non-vegetarian children of the same age [7] [8] [9] [10]. Research in the United Kingdom showed that pre-school vegetarian children (1.5-4.5 years old) had lower energy intake of protein and fat, cholesterol, niacin, sodium and serum ferritin than non-vegetarian children, but higher intake of carbohydrate, vitamin A, C, E and potassium, and sufficient Fe, Zinc and vitamin B12 [11]. Vegan children compared to children who consume meat will tend to be shorter and thin, and at risk of nutrient deficiency for growth [10]. Research in India, the United Kingdom and the United States showed that vegan groups and other types of vegetarians suffered from vitamin B12 deficiency [5].

Lack of energy and protein were factors that influence the nutritional status of children under-five [12]. Orisinal and Supriatna reported that there was a significant relationship between energy and protein consumption with nutritional status [13] [14]. Infectious disease was a direct cause of malnutrition in children under-five in addition to

lack of nutrient intake [12]. Hermansyah reported that there was a significant relationship between the incidence of malnutrition in children under-five with infectious diseases [15]. Study of Basuki showed that education indirectly affected the nutritional status of children under-five, where low education was one of the causes of malnutrition problems in children under-five [16]. Mother's nutritional knowledge related to nutritional status in the Harsiki study [17]. According to a study of Hadi, families who had one or two children would have children with better nutritional status than families who had more than two children [18].

Children under-five are prone to malnutrition because they are in the period of rapid physical growth and mental development that will affect the nutritional status of the next life phase [19]. Theoretically, children under-five are not recommended to be vegetarians because of higher risk of suffering from malnutrition. Parents especially mothers will determine the eating habit of their children. Vegetarian parents usually tend to raise their children on a vegetarian diet as well. The objective of this study was to investigate the difference between nutritional status of vegetarian and non-vegetarian children under-five.

II. METHODOLOGY

The research design used in this study was Cross-sectional in which the independent and dependent variables were measured simultaneously [20]. The study was conducted in Jakarta in February to March 2008 to investigate the difference between nutritional status of vegetarian and non-vegetarian children under-five.

The sample in this study consisted of two groups, namely lacto-ovo-vegetarian and non-vegetarian children under-five groups. Samples for the group of lacto-ovo-vegetarian children under-five were taken by purposive sampling from a survey conducted by the Indonesia Vegetarian Society (IVS) in Jakarta in 2007. Lacto-ovo-vegetarian children consume only plant-based foods, milk, eggs and their processed products. The term of "vegetarian" used in this study referred to "lacto-ovo-vegetarian".

All of the vegetarian children under-five were Chinese ethnicity, most of them lived in West Jakarta and the rest were scattered in Central Jakarta, North Jakarta and East Jakarta with middle economic status. Non-vegetarian children were taken by purposive sampling from the play group and kindergarten students of Mutiara Bangsa School located in West Jakarta who had similar geographical background (place of residence) and economic level (family income) with the vegetarian children under-five group. This was done to reduce bias in assessing nutritional status that might occur due to ethnic, geographical and economic status differences [21].

The minimum samples required were 70 vegetarian children under-five and 70 non-vegetarian children under-five (minimum total samples = 140 children under-five) calculated by using the sample size formula for testing hypotheses for two different two-sided proportions. The minimum samples required for testing the difference in Z-scores between vegetarian and non-vegetarian children were 21 vegetarian children under-five and 21 non-

vegetarian children under-five (minimum total samples = 42 children under-five) calculated by using the sample size formula for mean different hypothesis test in two independent groups [22]. A total of 75 vegetarian children under-five in Jakarta [6] and 73 non-vegetarian children under-five from Mutiara Bangsa School Jakarta were taken by purposive sampling as samples in this study with total samples of 148 children under-five.

Body weight was weighed with the Seca model 872 scale (accuracy of 0.01 kg). Length / height were measured by length board / microtoice (accuracy of 0.1 cm). All anthropometric indices: Weight-for-Age (WAZ), Height-for-Age (HAZ), Weight-for-Height (WHZ) and BMI-for-Age (BAZ) were calculated using "WHO Anthro" software v3.2.2 based on the WHO Child Growth Standards 2005 [23]. Food consumption was collected using 24-hour food recall forms and food models, while data on characteristics of mothers and children under-five were collected using questionnaires.

Statistical analysis used in this study was an independent-T test to link numerical variables (Z-score, age, number of children under-five, nutrient intake) with categorical variables (sex, dietary patterns, infectious diseases, breastfeeding, education, job, nutritional status). Chi-square test was used for two categorical data groups (sex, dietary patterns, infectious diseases, breastfeeding, education, job, nutritional status). Numeric variables can be changed to categorical if they are grouped into two or more categories, so that analysis can be done with Chi-square. In general, public health research uses a 95% confidence level ($\alpha = 0.05$) [24].

III. OUTCOMES AND DISCUSSIONS

In this study, the number of boys under-five was higher than that of girls under-five in both the vegetarian and non-vegetarian groups, each a ratio of 60.0%: 40.0% and 53.4%: 46.6%. The number of vegetarian children younger than two years (42.7%) was higher than non-vegetarian children (13.7%), while the number of non-vegetarian children older than three years (74.0%) was higher than vegetarian children (42.7%). The average age of the mothers in this study was 31.9 ± 4.2 years with a median of 31 years, a minimum of 22 years and a maximum of 43 years. There was a significant difference ($p = 0.005$) in education between vegetarian mothers and non-vegetarian mothers, especially at the higher education level of 62.7% compared to 41.1%. More than half of the mothers (62.7% vegetarian and 60.3% non-vegetarian) were housewives (Table 1).

The number of vegetarian families who had income above five million rupiah per month (83.6%) was more than double that of non-vegetarian families (40.9%). Almost all mothers had a maximum of two children under-five, namely 96.0% of vegetarian mothers and 98.6% of non-vegetarian mothers. The number of obese vegetarian mothers (66.7%) was higher than non-vegetarian mothers which were only 33.3%, while those suffering from under nutrition were more common in non-vegetarian mothers (60.0%) compared to vegetarian mothers who were only 40.0% (Table 1).

Table 2 showed that more than half of vegetarian children under-five (57.3%) had energy intake above 100% AKG (Angka Kecukupan Gizi = Recommended Dietary Allowances) published by Ministry of Health, Indonesia in the year of 2004 [25], higher than non-vegetarian children under-five (35.6%). Non-vegetarian children under-five who consumed protein above 100% AKG were slightly more than vegetarian children under-five with the ratio of 82.2% versus 72%. Infectious diseases in this study were referred to diarrhea or acute respiratory infection (cough or influenza) suffered by the vegetarian and non-vegetarian children under-five within two weeks period of time before interviewed was done by a questionnaire. The number of vegetarian children under-five suffering from infectious

diseases was 50.7%, slightly above non-vegetarian children under-five as much as 43.8%, so there was no significant difference between infectious diseases in vegetarian and non-vegetarian children under-five.

Breastfeeding is very important for every child. However, in this study there were still almost a third of non-vegetarian children under-five (31.5%) who did not get breastfeeding from their mothers. There were 88.0% of vegetarian children under-five got breastfeeding from their mothers, significantly more than non-vegetarian children under-five (68.5%). Breastfeeding in this study was divided into two categories, 'Yes' for 'given' and 'No' for 'not given' without distinguishing whether exclusive or non-exclusive breastfeeding and also the duration of breastfeeding (Table II).

TABLE I. CHARACTERISTICS OF MOTHERS, VEGETARIAN AND NON-VEGETARIAN CHILDREN UNDER-FIVE.

Variables	Diet				p
	Vegetarian (n=75)		Non-vegetarian (n=73)		
	n	%	n	%	
Children characteristics					
Sex					
Boy	45	60.0	39	53.4	0.521
Girl	30	40.0	34	46.6	
Age					0.0001 ^a
0 - 23 months	32	42.7	10	13.7	
24 - 35 months	11	14.7	9	12.3	
36 - 59 months	32	42.7	54	74.0	
Mothers characteristics					
Age					1.000
≤ 31 years (median)	39	52.0	38	52.1	
> 31 years (median)	36	48.0	35	47.9	
Education					0.005 ^a
Low	12	16.0	9	12.3	
Medium	16	21.3	34	46.6	
High	47	62.7	30	41.1	
Job					0.896
Housewife	47	62.7	44	60.3	
Worker	28	37.3	29	39.7	
Family income					0.0001 ^a
≤ IDR 5 millions/month	11	16.4	39	59.1	
> IDR 5 millions/month	56	83.6	27	40.9	
Number of children					0.632
Big, if > 2	3	4.0	1	1.4	
Small, if ≤ 2	72	96.0	72	98.6	
Nutritional status					0.532
Obesity (BMI>27)	8	66.7	4	33.3	
Fat (25<BMI≤27) Normal(18.5≤BMI≤25)	8	57.1	6	42.9	
Thin (BMI<18.5)	53	49.5	54	50.5	
	6	40.0	9	60.0	

Variables with p < 0.05

Based on the Weight-for-Age (WAZ) index, there were no children under-five who had undernourished status, there were more than half (62.7%) vegetarian children under-five and 65.8% of non-vegetarian children under-five had good nutritional status. However, we need to be vigilant because there were almost a quarter (24.0%) of vegetarian children under-five and 20.5% of non-vegetarian children under-five had the risk of overweight. In fact, there were 4.0% of vegetarian children under-five and 6.8% of non-vegetarian children under-five who suffered from obesity (Table 3). The Z-score of Weight-for-Age (WAZ) was $+0.66 \pm 1.19$ with a median value of +0.63, minimum = -1.58 and maximum = +3.95 in vegetarian children under-five group, and Z-score = +0.70

± 1.31 with a median = +0.46, minimum = -1.53 and a maximum = +4.47 in non-vegetarian children under-five group.

Almost all vegetarian children under-five (94.7%) and 97.3% of non-vegetarian children under-five had normal height even there was one vegetarian children under-five who was classified as very tall, and only a few were still relatively short namely 4.0% of vegetarian children under-five and 2.7% of non-vegetarian children under-five (Table 3). Z-score of Height-for-Age (HAZ) in vegetarian children under-five group was $+0.19 \pm 1.13$ with a median = +0.22, minimum = -2.61 and maximum = +3.19, while the non-vegetarian children under-five group had Z-score = + 0.01

± 1.07 with a median value of -0.03 , minimum = -2.27 and maximum = $+2.71$.

The nutritional status of children under-five based on the Weight-for-Height (WHZ) index showed that there were 5.3% of vegetarian children under-five and 12.3% of non-vegetarian children under-five suffering from obesity. More than a quarter of vegetarian children under-five (29.3%) and 19.2% of non-vegetarian children under-five had a risk of fat. The number of children under-five with normal nutritional status were more than half consisting of 54.7% vegetarian children under-five and 60.3% non-vegetarian children under-five. However, there were no skinny children under-five in this study (Table 3). The Z-score of Weight-for-Age (WHZ) obtained was $+0.76 \pm 1.55$ with a median = $+0.79$, minimum = -2.00 and maximum = $+5.68$ in the vegetarian children under-five group, and the non-vegetarian children under-five group had a Z-score of $+0.99 \pm 1.52$ with a median = $+0.47$, minimum = -1.58 and maximum = $+5.63$.

The nutritional status of children under-five based on the BMI-of-Age (BAZ) index gave a picture almost similar to the Weight-for-Height (WHZ) index as seen in table 3, where there were 56.0% of vegetarian children under-five and 57.5% of non-vegetarian children under-five had normal nutritional status, 25.3% of vegetarian children under-five and 21.9% of non-vegetarian children under-five were at risk of getting fat, 13.3% of vegetarian children under-five and 8.2% of non-vegetarian children under-five who were obese, 5.3% of vegetarian children under-five and 12.3% of non-vegetarian children under-five suffering

from obesity (Table 3). The Z-score of BMI-for-Age (BAZ) in the vegetarian children under-five group was $+0.78 \pm 1.56$ with a median = $+0.70$, minimum = -2.00 and maximum = $+5.76$ while in the non-vegetarian children under-five group had Z-score = $+1.04 \pm 1.55$ with a median = $+0.51$, minimum = -1.54 and maximum = $+5.82$.

TABLE II. DIETARY INTAKE, INFECTIOUS DISEASE AND BREAST FEEDING OF VEGETARIAN AND NON-VEGETARIAN CHILDREN UNDER-FIVE.

Nutritional status	Vegetarian (n=75)		Non-vegetarian (n=73)	
	n	%	n	%
Weight-for-Age (WAZ)				
Obesity (Z-score > +3 SD)	3	4.0	5	6.8
Overweight (+2 SD < Z-score ≤ +3 SD)	7	9.3	5	6.8
Risk of overweight (+1 SD < Z-score ≤ +2 SD)	18	24.0	15	20.5
Normal (-2 SD ≤ Z-score ≤ +1 SD)	47	62.7	48	65.8
Height-for-Age (HAZ)				
Stunting (Z-score < -2 SD)	3	4.0	2	2.7
Normal (-2 SD ≤ Z-score ≤ +3 SD)	71	94.7	71	97.3
Very tall (Z-score > +3 SD)	1	1.3	0	0
Weight-for-Height (WHZ)				
Obesity (Z-score > +3 SD)	4	5.3	9	12.3
Fat (+2 SD < Z-score ≤ +3 SD)	8	10.7	6	8.2
Risk of fat (+1 SD < Z-score ≤ +2 SD)	22	29.3	14	19.2
Normal (-2 SD ≤ Z-score ≤ +1 SD)	41	54.7	44	60.3
BMI-for-Age (BAZ)^a				
Obesity (Z-score > +3 SD)	4	5.3	9	12.3
Fat (+2 SD < Z-score ≤ +3 SD)	10	13.3	6	8.2
Risk of fat (+1 SD < Z-score ≤ +2 SD)	19	25.3	16	21.9
Normal (-2 SD ≤ Z-score ≤ +1 SD)	42	56.0	42	57.5

BMI: ^A VARIABLES WITH P < 0.05

TABLE III. ANTHROPOMETRIC INDICES OF VEGETARIAN AND NON-VEGETARIAN CHILDREN UNDER-FIVE.

VARIABLES	DIET				P
	VEGETARIAN (N=75)		NON-VEGETARIAN (N=73)		
	N	%	N	%	
ENERGY INTAKE					0.007 ^A
> 100% AKG (RDA)	43	57.3	26	35.6	
80-100% AKG (RDA)	18	24.0	17	23.3	
< 80% AKG (RDA)	14	18.7	30	41.1	
PROTEIN INTAKE					0.259
> 100% AKG (RDA)	54	72.0	60	82.2	
80-100% AKG (RDA)	14	18.7	7	9.6	
< 80% AKG (RDA)	7	9.3	6	8.2	
INFECTIOUS DISEASE					0.504
YES	38	50.7	32	43.8	
NO	37	49.3	41	56.2	
BREASTFEEDING					0.007 ^A
NO	9	12.0	23	31.5	
YES	66	88.0	50	68.5	

^A Bmi: Body Mass Index (Kg/M²)

TABLE IV. MEAN Z-SCORE TEST BETWEEN VEGETARIAN AND NON-VEGETARIAN CHILDREN UNDER-FIVE.

Two different mean test	P
Z-score of vegetarian with non-vegetarian children (WAZ)	0.851 ^a
Z-score of vegetarian with non-vegetarian children (HAZ)	0.331 ^a
Z-score of vegetarian with non-vegetarian children (WHZ)	0.364 ^a
Z-score of vegetarian with non-vegetarian children (BAZ)	0.314 ^a

^a Independent-T: p > 0.05

TABLE V. THE RELATIONSHIP BETWEEN DIET AND NUTRITIONAL STATUS (BMI-FOR-AGE).

Nutritional status (BMI-for-Age)	Vegetarian		Non-vegetarian		P
	n	%	n	%	
Fat & obesity	14	18.7	15	20.5	0.876 ^a
Risk of fat	19	25.3	16	21.9	
Normal	42	56.0	42	57.5	
Total	75	100	73	100	

^a Chi-square: p > 0.05

The significant higher family income in vegetarian children under-five group may contribute to the higher energy intake, and the significant higher education level of the vegetarian mothers may contribute to the better breastfeeding practice.

The results of two different mean test with independent-T test proved that there was no significant difference in mean Z-score between vegetarian and non-vegetarian children under-five based on all anthropometric indices namely Weight-for-Age (p = 0.851), Height-for-Age (p = 0.331), Weight-for-Height (p = 0.364) and BMI-for-Age (p = 0.314) as described in Table 4. There was no significant difference between the nutritional status of vegetarian and non-vegetarian children under-five. Chi-square test results proved that there was no significant relationship between diet (vegetarian, non-vegetarian) and nutritional status (BMI-for-Age) with p = 0.876 as presented in table 5.

This finding was consistent with the results of research in Britain and Madras which reported that there were no differences in nutritional status between vegetarian and non-vegetarian children under-five, but slightly different from the studies in Boston and the Netherlands which reported significant differences in nutritional status between vegetarian and non-vegetarian children under-five based on Weight-for-Age (WAZ) and Height-for-Age (HAZ) indices but were still within normal limits based on Weight-for-Height (WHZ) indices [9].

The results of this study were relevant with the journal of the American Dietetic Association and the Dietitians of Canada which stated that a properly planned vegetarian diet was healthy, nutritionally adequate, and provides health benefits for preventing and treating certain diseases. A vegetarian diet including vegan can meet the needs of

protein, iron, zinc, calcium, vitamin D, riboflavin, vitamin B12, vitamin A, n-3 fatty acids and iodine [26].

Many pros and cons about the comparison between vegetarian and non-vegetarian diets, especially for children. Sizer & Whitney discussed this topic extensively in their book with a title of 'Nutrition - Concepts and Controversies' [10]. The American Dietetic Association also reviewed this topic in its journal [26]. Likewise, journals published by the American Journal of Clinical Nutrition [27] and Physicians Committee for Responsible Medicine [28].

IV. CONCLUSION

There was no significant relationship between diet (vegetarian, non-vegetarian) and nutritional status (BMI-for-Age). There was no significant difference in nutritional status (Weight-for-Age, Height-for-Age, Weight-for-Height, BMI-for-Age) between vegetarian and non-vegetarian children under-five.

CONFLICT OF INTEREST

Author has declared no conflict of interest.

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