

The Malnutrition Status of Children Aged 7-15 Years Old in Rongkop Gunung Kidul and Yogyakarta, Indonesia

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Abstract

Undernutrition is threatening health problem that affect children and adolescence in Indonesia. They may experience impaired growth and development because of inadequate nutrition during childhood and adolescence. This study aimed to assess the nutritional status and to determine the prevalence of malnutrition (stunting, underweight, and thinnes) in children aged 7-15 years in the Rongkop Gunungkidul and Yogyakarta. Cross sectional data from 606 children aged 7-15 years in Rongkop Gunungkidul (335) and Yogyakarta (284) were obtained in 2012. Anthropometric measurements were performed in all subjects, including height and weight. The statistical analyse used were ANOVA and Chi Square test. The results showed that the prevalence of malnutrition status (stunting, underweight and thinnes) in Rongkop children (boys: 22.8%, 21.1%, 21.9% and girls: 25.2%; 21.8%; 22.7%) were significantly different from Yogyakarta children (boys: 17.2%, 6.2%, 14.1% and girls: 13.9%, 6.6%, 12.5 %). Body mass index (BMI) at age of 10 and 13 years, also height and weight at age of 13 years were significantly different between boys in Rongkop and Yogyakarta. In girls, significant differences in BMI, height and weight were identified at age of 14 years between Rongkop and Yogyakarta. Children living in urban areas of Yogyakarta had better nutritional status compared to children living in rural area of Rongkop. It was suggested that socioeconomic factors have a major effect on the differences.

Keywords: Nutritional Status, Stunting, Underweight, Thinnes, Body Mass Index.

1. Introduction

Nutrition is one of the key factors that affect physical growth. Jellife (1966) stated that environmental influences, especially nutrition and socioeconomic status; where the two factors were more important role than genetic factors in determining somatic growth in children. Nutrition also plays essential role in health and disease fighting, as proposed by Rivera *et al.* (1999). Thus state of malnutrition in the early years of life increases the risk of

disease and mortality, as well as interferes with growth and development in childhood. Determination of nutritional states can be performed using anthropometric measurements. It can also be used in monitoring postnatal growth and development, detecting anomalies and predicting adult height. In addition, for the determination of body weight and height, Harvard standard designed for Indonesia can be used, with 100% Indonesian standard = 50 percentile Harvard standard (Supriasa *et al.* 2002).

Environment factors including biological environment, physical environment, family, and customs may affect children's growth. The physical environment can affect growth are weather, geography, environmental sanitation, housing, and radiation. The weather and geographical conditions are closely related to agriculture and mineral elements content in the soil, which can lead to malnutrition and stunted growth in children. Calcareous geographical condition can cause depletion in soil iodine content; therefore, the population growth is very stunted. Those may also affect the anthropometric characteristics and physical fitness level of children during growth.

Rongkop is one of the districts in Gunungkidul located approximately 10 miles from Ocean coast of Indonesia, and 200 m above sea level. It has hot climate, with average temperatures above 30 ° C during the day, and is known as an arid region, where the land is dominated by limestone. Nguyen-Thi-Anh-Tuyet (1981) stated that the population of Java in Rongkop largely classified as comesomic (short) population, and this group was under the average of Indonesia and Southeast Asia population. In contrast, the city of Yogyakarta is one of the major cities in Indonesia, where geographically located between 110° 24' 19" - 110° 28' 53" East Longitude and 07° 15' 24" - 07° 49' 26" South Latitude, and the average is 91 m - ± 117 m above sea level. Temperate to hot, with an average temperature of 27° C during the day, and the regosol soil types which is easy to absorb water surface, thus under certain conditions is able to serve as a good percolation for groundwater recharge.

Several studies on nutritional status in children and adolescents has been done, including by Beat *et al.* (2010), Drake *et al.* (2002), Foster *et al.* (2005), Medhi *et al.* (2006), Nwokoro *et al.* (2006), Rahmawati *et al.* (2010) and Willey *et al.* (2006). Based on the facts above and the existence of striking geographical differences between the two populations, this study describes the nutritional status and to determine the prevalence of malnutrition (stunting, underweight, and thinnes) in children aged 7-15 years in the Rongkop Gunungkidul and Yogyakarta.

2. Subjects

The study was a descriptive study with a cross sectional design. Subjects were boys and girls at the age of 7 to 15 years, and lived in Rongkop Gunungkidul, and Yogyakarta City. Inclusion criteria include: children aged between 7 to 15 years old, born and living in the Rongkop Gunungkidul and Yogyakarta city; healthy; not physically and mentally disabled; and willing to sign a letter of consent. During 2012, we obtained 335 children (165 boys and 170 girls) from Rongkop Gunungkidul and 284 children (138 boys and 146 girls) from Yogyakarta who met the inclusion criteria of subject.

The majority of children living in Rongkop have fathers who were farmers (42.1%), employees (30.1%), civil servants (16.3%) and workers (11.2%). The children's mothers were farmers (45.4%), housekeepers (24.4%), employees (12.2%), civil servants (10.2%), and merchants (7.4%). Whereas, children living in Yogyakarta, the majority of their fathers were employees (53.4%), civil servants (31.6%), and merchants (15%). The children's mothers were housekeepers (60.3%), employees (20.7%), civil servants (10.1%), and merchants (8.9%).

3. Methods

Subsequent measurement of weight and height from all subjects was done after filling out the questionnaire and signing informed consent. The weight and height was measured according to the International Standards for Anthropometric Assessment (2006).

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS), version (20). Anova and Chi square test were used to examine the data and malnutrition status was determined using the z-score according to WHO (1995).

4. Results

Table 1 and 2 present the characteristics of study subject including mean and standard deviation of height, weight and BMI in boys and girls at age 7 to 15 years in Rongkop (Gunungkidul) and Yogyakarta. Table 1 showed that there were significant difference in height, weight, and BMI was found among boys at 13 years in Rongkop and Yogyakarta. In contrast, boys at 10 years, only BMI was significantly different as shown in Table 1. In girls, there were significant differences seen in height, weight and BMI from both populations living in Rongkop and Yogyakarta (Table 2.). Of our interest, the 14 years old girls in Rongkop have height, weight and BMI smaller than Yogyakarta as presented in Table 2. The possibility that significant differences occurred in the age of 13 years in boys and 14 years in girls, due to the relatively large difference in height (Rongkop: 146.87 ± 9.83 cm; Yogyakarta: $154.08 \text{ cm} \pm 10.12$ respectively) and weight (Rongkop: 38.2 ± 10.52 kg; Yogyakarta: 49.1 ± 17.03 kg respectively) between the two populations. It also led to significant differences in body mass index (BMI). At the age of 10 to 15 years, mean BMI of boys and girls in Rongkop were 17.51 ± 2.97 kg/m², 15.11 ± 1.95 kg/m² respectively. Based on the CDC's BMI curve, we found that 55 boys and girls in Rongkop were low nourished. Yogyakarta boys had a mean BMI 18.37 ± 3.92 kg/m², and for girls 18.12 ± 3.89 kg/m². Based on the CDC's BMI curve, 35 boys and girls had low nutritional status of Yogyakarta.

Table 1. Mean and standard deviation of height, weight and body mass index (BMI) of the boys in Rongkop and Yogyakarta, Indonesia.

Areas	N	Ages (years)		Height (cm)		Weight (kg)		BMI (kg/m ²)	
		mean	sd	mean	sd	mean	sd	mean	sd
Yogyakarta	25	6.90	0.37	115.06	6.77	23.71	6.93	17.66	3.61
Rongkop	22	7.00	0.35	117.19	4.01	23.43	5.26	17.00	3.39
Yogyakarta	24	8.06	0.33	125.06	9.46	28.84	9.17	18.06	3.63
Rongkop	21	8.09	0.17	123.10	5.39	27.00	6.05	17.63	2.47
Yogyakarta	26	8.81	0.17	126.98	5.42	27.08	4.52	16.74	2.23
Rongkop	21	9.07	0.28	124.04	4.77	23.3	2.67	15.12	1.32
Yogyakarta	26	9.94	0.28	133.21	7.77	32.06	9.42	17.73 *	3.15
Rongkop	24	10.22	0.12	132.05	4.39	23.38	3.25	13.44	1.97
Yogyakarta	23	10.98	0.23	134.70	3.26	33.38	7.59	18.33	3.75
Rongkop	20	11.00	0.11	137.28	7.6	36.5	10.26	19.08	3.54
Yogyakarta	28	11.97	0.30	143.97	10.65	37.71	10.23	18.21	4.55
Rongkop	24	12.30	0.12	146.57	7.34	38.71	10.46	17.92	4.42
Yogyakarta	20	13.02	0.31	154.08 *	10.12	49.10 **	17.03	20.20 *	4.94
Rongkop	27	12.99	0.29	146.87	9.83	38.2	10.52	17.42	3.12
Yogyakarta	26	13.94	0.26	152.29	9.06	42.84	10.63	18.25	2.98
Rongkop	29	14.10	0.30	154.82	8.01	43.31	7.98	17.92	1.81
Yogyakarta	25	14.84	0.22	161.80	4.05	52.19	14.23	19.85	4.97
Rongkop	20	14.85	0.31	157.59	8.90	46.47	10.85	18.86	3.31

*p<0.05; **p<0.01

Table 2. Mean and standard deviation of height, weight and body mass index (BMI) of the girls in Rongkop and Yogyakarta, Indonesia.

Ares	Age (years)		Height (cm)		Weight (kg)		BMI (kg/m ²)	
	mean	sd	mean	sd	mean	sd	mean	sd
Yogyakarta	6.85	0.44	114.65	4.01	20.08	2.56	15.25	1.52
Rongkop	6.80	0.46	111.53	3.94	18.75	3.3	15.06	2.51
Yogyakarta	8.02	0.24	122.05	6.51	24.85	5.94	16.52	2.96
Rongkop	8.06	0.27	118.93	5.37	21.00	4.71	14.70	2.11
Yogyakarta	9.05	0.34	128.71	8.47	28.97	10.26	17.16	4.43
Rongkop	9.00	0.15	126.00	6.22	24.33	4.01	15.27	1.79
Yogyakarta	9.95	0.30	134.85	7.45	32.44	9.90	17.47	3.53
Rongkop	9.90	0.42	131.80	9.29	26.9	5.81	15.06	2.08
Yogyakarta	10.98	0.29	139.63	7.61	36.72	10.91	18.59	4.39
Rongkop	11.16	0.24	136.83	9.62	29.83	4.16	15.90	0.86
Yogyakarta	12.15	0.27	145.95	8.86	39.85	9.62	18.42	2.58
Rongkop	12.19	0.22	143.36	5.80	35.61	10.96	17.10	4.00
Yogyakarta	12.98	0.35	148.07	4.49	43.57	11.77	19.80	4.93
Rongkop	13.05	0.27	147.97	5.35	41.30	8.16	18.78	3.03
Yogyakarta	14.09	0.23	151.73 **	4.16	45.98*	9.35	19.98*	4.01
Rongkop	13.91	0.34	147.8	4.03	39.32	5.41	17.98	2.33
Yogyakarta	14.86	0.23	154.51	4.79	48.78	7.17	19.55	2.04
Rongkop	14.96	0.28	152.39	4.42	44.94	9.63	19.33	3.93

*p<0.05; **p<0.01

Figure 1 showed that among boys of Rongkop and Yogyakarta have significant differences in the percentage of low nutritional status (stunting, underweight, and thinnes). The possibilities are due to the differences in socio-economic status, residence and level of parental education. Similarly, the girls in Figure 2 show a very significant difference in the percentage of low nutritional status (stunting, underweight and thinnes) between the two populations in Rongkop and Yogyakarta.

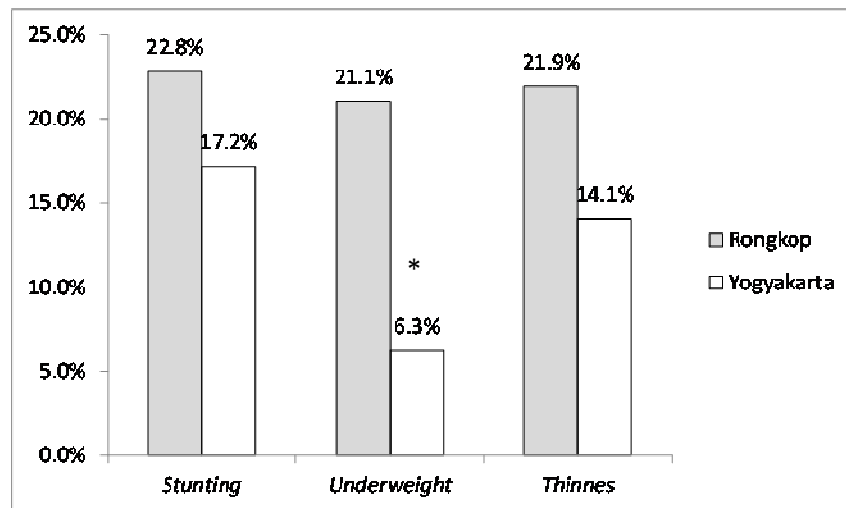


Figure 1: Comparison of the prevalence of malnutrition status between boys in Rongkop and Yogyakarta (* $p < 0.05$)

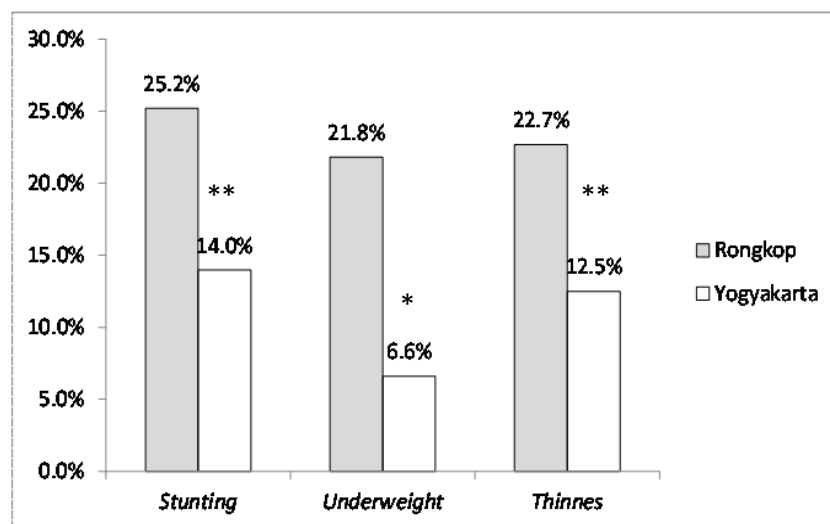


Figure 2: Comparison of the prevalence of malnutrition status between girls in Rongkop and Yogyakarta (* $p < 0.05$; ** $p < 0.01$)

5. Discussion

The prevalence of malnutrition among Rongkop children was higher than Yogyakarta children. The proportion of low nutritional status (stunting, underweight, and thinnes) in children aged 7 to 15 years living in Rongkop shows percentage over 20%. In comparison to children living in Yogyakarta, the severity of malnutrition problem among children Rongkop shows a greater rate than children in Yogyakarta (under 15% except the stunting criteria).

Stunting is an indicator for long-term malnutrition disorder. It is thought to occur mainly in the early childhood (Drake *et al.*, 2002), and is very likely caused by insufficient nutrition during growth period. The high prevalence of stunting children in Rongkop is possibly caused by the insufficient nutrition among school children at the beginning of childhood. In addition, the chronic and acute malnutrition may become a consequence of lacking food intake or

severe disease. This particular condition tend to increase the degree of stunting during school (5 to 14 years), but may reverse when the environment is repaired (Drake *et al.*, 2002). It also known that malnutrition interfere with cognitive abilities at the later ages; therefore primary prevention is necessary to tackle this problem. Beaton *et al.* (1990) suggested that in areas with a low prevalence of stunting, the principal cause of stunting consists of genetic factors, the variation of normal growth occurs, and environmental factors, such as inadequate nutrition and recurrent infections. However, when it gets a high prevalence of stunting, environmental factors become the main cause of the growth failure.

Underweight is an anthropometric indicator that describes general malnutrition and recommended as an indicator in assessing malnutrition problem in certain area. The prevalence of underweight children in Rongkop children was 21% and it was higher than the children in Yogyakarta ($\pm 6.5\%$). This result indicated that the nutritional problem in Rongkop children was greater than Yogyakarta children. A study conducted by a Partnership of Child Development (2008) in five countries (Ghana, Tanzania, Indonesia, Vietnam, and India) showed that school-age children who live in rural areas, have a high prevalence of underweight, which is about 34 - 36%. Strikingly, the percentage of underweight children in Rongkop is approaching the prevalence of underweight children of school age in Southeast Asia countries that ranged between 22-56% (Best *et al.*, 2002). It was reported by Drake *et al.* (2002) that underweight children at school age might reflected various factors, including prenatal malnutrition, micro- and macronutrient deficiency, and illness or infection.

Thinnes represents as body mass of an individual which less than the average body mass of the majority population. An individual is classified into thinnes when his/her body mass index is below the five percentile of the reference BMI according to age (WHO, 1995). Our result showed that the prevalence of thinnes children in Rongkop were higher than children in Yogyakarta. Prior study by Best *et al.* (2002) reported that thinnes in adolescents were caused by factors that occur during close relative, such as insufficient energy and protein intake, impaired absorption, and weight loss. Furthermore, according to WHO (1995) result thinnes-inducing factors could have shorter onset compared to stunting-inducing factors. It is indicated that adolescent with thinnes is more responsive to short-term changes in the environment compared to adolescents with stunting.

In relation with the result of height, weight and BMI data above, there is interaction between genetic and environmental influences a person's growth and development after birth, but the influence of the environment is becoming more important because children are less well protected by his mother than before birth. Child's height is largely influenced by, one of them from, parents' height. Pattern of growth of the children also varies, in which physical differences when an adult is not only the result of the genetic characteristics of each individual, but also because of the interaction between heredity and environment. However, this research did not investigate the genetic; therefore it is suggested for further study.

Environmental factors, such as nutrition and social status, are very important in the growth of a child. Overall, the Rongkop children have an average of body height and weight which are smaller than the Yogyakarta children. This may occur because the parents of children on Yogyakarta have a socio- economic level higher according to their parents's occupation. The results was accordance with some researchers that children with high social status have better growth patterns than the low social status (Rahmawati *et al.*, 2003, 2004, 2010; Malina *et al.*, 2004). A study by Rahmawati *et al.* (2010) on urban, rural and fishermen's children indicated that urban children's height and weight were greater than rural and fishermen's children.

Our study showed that different nutritional status and growth rates in urban area of Yogyakarta compared to rural area of Rongkop, was largely caused by disparity in socio-economic factors which refer to rural and urban categories. In addition, the availability of clean water, high sanitation, and better health facilities make children living in city can grow

better and fit than children living in rural. Of our interest the parent's job may also affect children growth rate as shown that percentage of working mother in rural area was higher than in urban area. Reported previously by Willey *et al* (2005) stated that the working mothers could have a protective role on the nutritional status of their children.

6. Conclusions

The conclusion, the prevalence of malnutrition status in children at the age of 7 to 15 years in Rongkop is higher than children in Yogyakarta. The children living in Yogyakarta have better nutritional status than children living in Rongkop that possibly due to the differences in socio-economic factors between urban and rural areas.

Limitation and Future Research

The study has several limitations, including only parental and medical histories were used to collect information from subjects. It is important to collect data on subjects' nutrition, hygiene, parents' education and medical service in relation with environmental influences on malnutrition in children.

Studies comparing children with different ethnic and social background to interpret common knowledge about the influence of the malnutrition are worth taking into consideration.

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