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Original Article

Maternal Nutrition Status are Strongly Associated to Schoolchildren Z-Scores for Height and BMI in Rural Settings

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ABSTRACT

Background and Objectives: Parental factors, including social and anthropometric factors, play a vital role in children longterm nutritional status. The objective of this study was to investigate correlations between parental factors and nutritional status of the schoolchildren in a rural setting of Indonesia.

Materials and Methods: This cross-sectional study was carried out during May 2018. Totally, 146 schoolchildren from ten primary public schools in Sepatan Timur, Tangerang, Indonesia, were involved in the study. Structured questionnaires were used to collect socio-demographic data (educational level, employment status and number of children) and estimated anthropometric measures (body weight and height). Digital weighing scales and standard microtoises were used to measure children weight and height, respectively. Anthropometric indices, height for age (HAZ) and body mass index for age (BAZ) Z-scores were calculated using WHO AntroPlus. Moreover, multiple regression analysis was used in the study.

Results: Nearly 19.2, 11.6 and 16.4% of the schoolchildren were stunting, wasted and overweight, respectively. Maternal nutrition status were significantly associated with schoolchildren HAZ (β 95% CI = 0.367 [0.009–0.724]) and BAZ (β 95% CI = 0.926 [0.428–1.423]) scores. The BAZ scores of the children were inversely associated with maternal education levels (β 95% CI = -1.206 [-2.000; -0.441]). Paternal nutrition status were significantly associated with children HAZ (β 95% CI = 0.419 [0.075; 0.762]) scores.

Conclusions: Parental anthropometric measure and educational status significantly contribute to development of schoolchildren nutritional status in the rural setting.

Keywords: Social factor, Anthropometric factor, Schoolchildren, Nutritional status, Rural setting

Introduction

National Nutritional Status Survey (1) (2017) reported a lower prevalence of stunting (27.2%) and thinness (10.9%) within Indonesian children aged 5–12 years old compared to that the previous national survey did (stunting 30.7% and thinness 11.2%) (2). Based on the public health cutoffs, the prevalence of stunting was classified as medium (20–29%) (3). Schoolchildren with malnutrition (stunting, thinness) may perform poorly in classroom activities (4), experience impaired immune system responses and reduced physical growth potencies (5). Nowadays, researchers investigate causes of nutritional problems, especially those that can be solved by means of sensitive nutritional interventions. Sensitive nutritional interventions are linked to indirect factors (such as parents educational level, parenting style and other socio-demographic characteristics) that lead to wider consequences in tackling malnutrition (6). However, different setting areas (rural against urban, developing against developed) may result in different determinant factors of the children nutritional status (7–10). Studies in rural settings reported that parents educational level and employment were associated to children nutritional status (11,12). Other studies found that parental anthropometric and socioeconomic factors were associated to children nutritional status (13,14) in similar settings. The current study was carried out in a rural setting of Banten Province, Indonesia, to investigate

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correlations between parental social and anthropometric factors and schoolchildren nutritional status. Eventually, investigation of the parental social and anthropometric factors and their correlation with schoolchildren nutritional status is suggested.

Materials and Methods

This cross-sectional study derived from the baseline survey of an umbrella study entitled "The Effect of School Nutrition and Health Education (GISEL) and Its Report Administration to Parent on Children Weight in Rural Area of Tangerang Region". The baseline survey was carried out during May 4–15, 2018, purposively in ten out of 18 public elementary schools located in Sepatan Timur Sub-district, District of Tangerang, Banten Province, Indonesia. Using G*Power Sample Size Calculator for the survey with 95% confidence level, 5% precision, 5% nonresponse rate and an effect size of 0.20, a minimum sample size of 134 were calculated. Samples included schoolchildren aged 10–13 years old from 4th and 5th grades. They were selected purposively by considering the representative number of students of each class at the selected schools. Children who did not return the consent forms, had a physical disability or suffered from a severe infectious disease such as tuberculosis were excluded from the study. Parental socio-demographic factors were assessed using a structured questionnaire provided to all parents. The questionnaire included questions on parental education level, employment status and number of children. All parents were asked to best estimate their current weight and height. Parental body mass index (BMI) was calculated by dividing weight to square of their height (in meters). Results were classified as underweight (BMI < 18.5 kg/m^2), normal weight (18.5–22.5 kg/m^2) and overweight (BMI > 22.5 kg/m^2) (2). Children nutritional status was determined by actual measures of their weight and height. Trained personnel measured the children weight and height using digital weighing scales and standard microtoises, respectively. Anthropometric indices of height for age (HAZ) and body mass index for age (BAZ) were calculated using WHO AnthroPlus Software (15). Children with HAZ scores below -2.0 were classified as stunting, those with BAZ scores of -2.0 as wasted and those with BAZ scores above 1.0 as overweight (15). Furthermore, multiple regression analysis was used in this study. The current study received an ethical approval from the Ethical Committee of Health Sciences Faculty, Esa Unggul University, No. 0173-18.148/DPKE-KEP/FINAL-EA/UEU/IV/2018. Permissions were received from the local authority (Tangerang District) and district health offices at Tangerang, Kedaung Barat Public Health Center and involved schools.

Results

Totally, 146 pairs of school-age children and parents were involved in the analysis. Parental characteristics of sociodemographic and nutritional status are shown in Table 1 and reported as *n* (%). More than half of the parents aged above 35 years old. Most parents did not complete the national minimum educational level (nine years of schooling) and the percentage of mothers with low educational levels (83.6%) was higher than that of fathers with low educational levels (69.9%). Most of the mothers did not work while most of the fathers did. Based on the nutritional status, both mothers and fathers were dominantly overweighed with the percentage of overweight mothers was higher than that of overweight fathers. Table 2 describes students' characteristics and nutritional status. The mean children age included nine years old, ranging 9.7–10.2. Nearly, 19.2, 11.6 and 16.4% of the children experienced stunting, wasted and overweight circumstances, respectively. Using multivariable analysis, no correlations were found between socio-demographic factors and children HAZ scores after adjustment with other potential confounding factors, including maternal age, educational level, employment status, paternal age, educational level and number of children. Parents BMIs were positively correlated with children HAZ scores. Schoolchildren whose fathers BMI were > 22.5 kg/m^2 (overweighed) had 0.427 HAZ score higher than that children with fathers BMI of normal or underweight had. A similar correlation was seen between the mothers BMI and children HAZ scores, but the decrease value was only 0.383 higher in children of overweight mothers, compared to that in children of normal/underweight mothers. Interestingly, maternal education level and BMI were

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significantly correlated with the children BAZ scores. Children whose mothers schooling years were < 9 had 0.753 HAZ score lower than that children with mothers schooling years of > 9 years had. Overweight mothers might increase their children BAZ scores by 0.926 point, compared to children with normal/underweight mothers.

Table 1. Parental characteristics and nutritional status[1] (*n* = 146)

Variable(s)	*n* (%)
Socio demographic factors	
Maternal age, years	35.4 (31.7-39.1)[2]
21-35	68 (46.6)
>35	78 (53.4)
Maternal educational level[2],	
<9	122 (83.6)
≥9	24 (16.4)
Maternal employment	
Not working	123 (84.2)
Working	23 (15.8)
Paternal age, years	39 (35.4-44.7)[5]
21-35	31 (21.2)
>35	115 (78.8)
Paternal educational level[3]	
<9	102 (69.9)
≥9	44 (30.1)
Paternal employment	
Not working	4 (2.7)
Working	142 (97.3)
Number of children	
≤3	110(75.3)
>3	36 (24.7)
Parental anthropometric status	
Maternal weight, kg	60 (50-65)[3]
Maternal height, cm	155 (150-160)
<150.1	58 (39.7)
≥150.1	88 (60.3)
Maternal BMI, kg/m^2	24.4 (21.3-27.0)[4]
<18.5	12 (8.1)
18.5-22.5	40 (27.4)
>22.5	94 (64.4)
Paternal weight, kg	60 (54-68)[6]
Paternal height, cm	165 (160-170)[7]
<160.1	57 (39.0)
≥160.1	89 (61.0)
Paternal BMI, kg/m^2	23.3 (20-25.3)[8]
<18.5	14 (9.5)
18.5-22.5	51 (34.9)
>22.5	81 (55.5)

[1]All values are *n* (%) otherwise indicated, [2-8]median (Q25th-Q75th)

Table 2. Schoolchildren characteristics and nutritional status[1] (*n* = 146)

Variable(s)	***n* (%)**
Age, years	9.9 (9.7–10.2)[2]
Sex	
Female	77 (52.7)
Male	69 (47.3)
Body weight, kg	26.4 (23.2–31.7)[3]
Body height, cm	130.5 (125.8–134.2)[4]
HAZ Z-score	-1.17 (-1.81; -0.57)[5]
Stunting	28 (19.2)
Normal	118 (80.8)
BAZ Z-score	-0.59 (-1.33; 0.49)[6]
Thin + Severe wasted	17 (11.6)
Normal	105 (71.9)
Overweight	24 (16.4)

[1]All values are presented as *n* (%) otherwise indicated, [2-6]median (Q25th-Q75th)

Discussion

In this study, a lower prevalence of stunting schoolchildren was reported, compared to that of students at national levels (2) and those from previous studies (15,16). Although the prevalence of overweight students was slightly higher (16.4%) than that of students in previous studies (12.2%) (15), it was still lower than national levels (2). In the current study, a significant correlation was seen between the parental nutrition and the schoolchildren HAZ scores. Compared to maternal BMIs, paternal BMIs included a stronger correlation with the children HAZ scores. This finding is similar to findings from previous studies, which showed that paternal and maternal nutrition status were significantly correlated with young children (< 7 years old) nutritional status (17,18). Interestingly, a study reported that maternal nutrition status further contributed to young children nutritional status, compared to that paternal nutrition status did (19,20). The maternal BMI was responsible for the development of children BAZ scores as well as children HAZ scores (14,21) and higher child survival rates within young children (18). Their nutritional status were still determined by the parental nutrition status even within older children or adolescents (22,23). This result revealed that genetic factors from parents previous nutritional status and current environment were transmitted cross-generationally even over three generations (19). However, it is still unclear that to which extent correlations between parental and children anthropometries are originally genetic, epigenetic or phenotypic (17).

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Table 3. Multivariable analysis of the paternal socio-demography and anthropometry with schoolchildren nutritional status[1] (*n* = 146)

Predictors	HAZ[2]				BAZ[3]			
	Unadjusted β[4] (95% CI)	P-value	Adjusted β[5] (95% CI)	P-value[6]	Unadjusted β[4] (95% CI)	P-value	Adjusted β[5] (95% CI)	P-value[7]
Socio and demography factors								
Maternal age,	0.114 (-0.224; 0.453)	0.505	0.223 (-0.203; 0.649)	0.303	-0.381 (-0.862; 0.100)	0.120	-0.402 (-0.995; 0.192)	0.183
Maternal educational level	-0.219 (-0.673; 0.236)	0.343	-0.168 (-0.739; 0.404)	0.563	-0.753 (-1.394; -0.112)	0.022	-1.206 (-2.000; -0.441)	0.003
Maternal employment	-0.181 (-0.644; 0.282)	0.441	-0.265 (-0.727; 0.196)	0.258	-0.274 (-0.936; 0.289)	0.416	-0.214 (-0.856; 0.428)	0.510
Paternal age	-0.083 (-0.496; 0.330)	0.691	-0.175 (-0.651; 0.301)	0.469	-0.326 (-0.915; 0.263)	0.276	-0.056 (-0.719; 0.607)	0.867
Paternal educational level	-0.285 (-0.651; 0.080)	0.125	-0.082 (-0.549; 0.385)	0.730	-0.168 (-0.695; 0.358)	0.529	0.412 (-0.237; 1.062)	0.211
Number of children	-0.046 (-0.438; 0.346)	0.818	-0.087 (-0.497; 0.322)	0.675	-0.312 (-0.871; 0.248)	0.273	-0.128 (-0.698; 0.442)	0.658
Anthropometric factors								
Maternal BMI	0.383 (0.036; 0.730)	0.031	0.367 (0.009; 0.724)	0.044	0.702 (0.210; 1.194)	0.005	0.926 (0.428; 1.423)	0.001
Paternal BMI	0.427 (0.094; 0.759)	0.012	0.419 (0.075; 0.762)	0.017	0.138 (-0.348; 0.625)	0.575	0.079 (-0.399; 0.557)	0.744

[1]Enter method; [2]height for the age Z score; [3]body mass index for the age Z score; [4]simple linear regression; [5]adjuster for maternal age, educational level, employment status, paternal age, educational level and number of children; [6]R Square = 0.097; [7]R Square = 0.147; *siginificance P < 0.05

Another interesting finding, the low BAZ score, is linked to the maternal low education level (< 9 years of schooling). Similarly, Bernardo and Vasconcelos (2012) reported that overweight status of 2826 children aged 7–14 years old was inversely associated to high maternal education level (22). Maternal literacy is reported to be independently associated to children weight (24). in 2012, Srivastava et al. demonstrated that schoolchildren from an urban slum area in India were at higher risks of malnutrition if mothers had lower schooling years (12). A study on under five-year-old children in Bangladesh showed that upgrading parental education levels is needed for improving children nutritional status (WAZ) (21). Educated parents, particularly mothers, are important for the successful practice of healthy diets in children. Since parents are responsible for purchasing and preparing foods at homes, it can affect children food preferences (25,26). Chong et al. (2017) reported that the more educated parents, the greater children fruit intakes (27). Educated parents can be good role models for their children, having better parenting styles that can influence their children to have better eating habits (25,28,29). As a summary, these findings reveal the importance of good parental nutrition status and literacy that contribute to children nutritional status at school age. However, the current study did not include other potential parameters such as household hygiene and sanitation practices. It was suggested that the hygiene and sanitation conditions were similar within the households in the study area. Another limitation of the present included the small sample size due to the missing parental estimation of their anthrophometric values.

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Financial disclosure

The authors declare no competing interests.

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