EFFECTS OF PARENTAL ECONOMIC LEVEL TRAJECTORIES ON CHILDREN'S BMI Z-SCORE TRAJECTORIES IN INDONESIA

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Abstract

Introduction: Children in developing countries, including Indonesia, have an increased prevalence of overweight and obesity. Parental socioeconomic status is one of the substantial risk factors. Objectives: To examine the presence of distinct developmental trajectories of BMI z-score in Indonesian children from age 5 to age 19 and assess whether their father's and mother's economic level trajectories influences them. Method: This study used four waves of data from the Indonesian Family Life Survey (1997-2014). Children's BMI Z-score and parental economic level trajectories were analyzed by group-based trajectory modelling (GBTM). This study also constructed multinomial logistic regression models while controlling other demographic, health, and socioeconomic characteristics. Results: Out of the 1,065 eligible children, it ends up 1,046 children for further analysis. The best model identified by the GBTM includes four trajectories for children's BMI z-score. For the parental economic level, the best-fit trajectories are the 2 group trajectories for father's and the 4 group trajectories for mother's. There was no association between father's economic level trajectories and children's BMI z-score trajectories. For mother's economic level trajectories, the increasing economic trajectory was associated with increased risk of becoming obese trajectories of children's BMI z-score. Conclusion: Overweight and obesity develop with distinguishable BMI z-score trajectories across childhood to adulthood. This work suggests that the mother's characteristics have more impact on children's development.

Keywords: BMI z-score trajectories, economic level trajectories, GBTM, childhood obesity

INTRODUCTION

Children in developing countries have a high prevalence of overweight and obesity, and these rates are expected to rise further in the future years (Gupta et al., 2012). In Indonesia, the prevalence of obesity in children aged 5–12 years has risen from 8.0% in 2013 to 9.2% in 2018 (Hadi et al., 2020). In this increasing trend of obesity among children, parental socioeconomic status (SES) is arguably one of the strongest risk factors (Hemmingsson, 2018).

Studies have shown that individuals with lower socioeconomic status are more likely to be born with low birth weight, to have unhealthy diets, and to be less physically active during leisure time (Vieira et al., 2019). Persistence and trajectory of the family's low-income proved to be associated with children's health and development, which suggests interventions targeting child obesity need to address family SES from a life course perspective (Bonaccio et al., 2021).

Some empirical studies have established the relationship between family SES trajectory and child obesity, but in in inconsistent pattern. Most of these previous studies consider only father's income or family income to analyze intergenerational socioeconomic mobility. Mother's income, specifically, can be a proximate indicator of a women's education and knowledge resources, which play a major role in a child's development (Cruz & Pero, 2020). No existing studies to date have been using trajectories of father's and mother's economic level separately to analyze the impact of SES trajectory on children's BMI trajectory. The present study aimed to examine the presence of distinct developmental trajectories of BMI z-score in Indonesian children from age 5 to age 19 and assess whether their father's and mother's economic level trajectories influences them.

METHODS

This study used data from the Indonesian Family Life Survey (IFLS), a longitudinal survey conducted by RAND Corporation in collaboration with several Indonesian research institutions. The IFLS original sample (IFLS 1) is representative for 83% of the Indonesian population. IFLS has gone through an ethical consideration process in the United States and in Indonesia (Strauss et al., 2016). This study used four waves of data from the IFLS (IFLS 2 in 1997, IFLS 3 in 2000, IFLS 4 in 2007, and IFLS 5 in 2014). The main analysis sample is children age 5-19 years in IFLS2. The inclusion criteria are that they have no missing data in "date of birth data", "height", and "weight" in all four waves and no missing data in "parental

economic level" in IFLS 2-5 and "parental height and weight" data in IFLS 2. Originally there were 2,822 children in IFLS 2, but only 1,065 children (37.74%) remained in the final analyses because of those inclusion criteria.

The dependent variable is 4-time-point children's BMI Z-score trajectories derived from IFLS 2 to IFLS 5. Independent variables are father's and mother's subjective economic level trajectory from 4 time-points available. Other covariates included in this study are about sociodemographic, economic, health status, and health behavior variables. All parental and household covariates were collected from IFLS 2, as well as children's sex, religion, and ethnicity.

Children's BMI Z-score and parental economic level trajectories was analyzed by using group-based trajectory modelling (GBTM). Model fit is evaluated using Bayesian Information Criterion (BIC) score and the overall interpretability of the model (Chadi et al., 2021). The number of groups is identified by the best BIC scores (Demment et al., 2014). The average posterior probability (APP) ≥ 0.70 shows the model accuracy (Donat-Vargas et al., 2021). The odds of correct classification (OCC) greater than 5.0 indicates that the model has a high assignment accuracy (Donat-Vargas et al., 2021). Data were analyzed by STATA software.

RESULTS

Table 1. Sample characteristics, the Indonesian Family Life Survey (IFLS) 2-5, 1997-2014

Characteristic	IFLS 2 (1997) Mean ±SD or n (%)	IFLS 3 (2000) Mean ±SD or n (%)	IFLS 4 (2007) Mean ±SD or n (%)	IFLS 5 (2014) Mean ±SD or n (%)
BMI z-score	-0.71 ±1.08	-0.72 ±1.09	-0.42 ±1.15	0.26 ±1.28
Father's economic level	2.92 ±0.86	2.96 ±0.75	3.01 ±0.76	3.07 ±0.92
Mother's economic level	2.93 ±0.86	2.96 ±0.75	3.06 ±0.81	3.20 ±0.93
Father's BMI (kg/m^2)	21.78 ±2.87			
Mother's BMI (kg/m^2)	23.34 ±3.67			
Father's age (year)	40.71 ±6.46			
Mother's age (year)	36.04 ±5.73			
Age (year)	10.93 ±3.87	13.78 ±3.87	21.25 ±3.88	28.19 ±3.87

After we excluded 19 outliers, it ends up 1,046 children for final analysis. The average BMI z-score was -0.71 (±1.08) in IFLS 2, -0.72 (±1.09) in IFLS 3, -0.42 (±1.15) in IFLS 4, and 0.26 (±1.28) in IFLS 5, respectively. The average father's economic level was 2.92 (±0.86) in IFLS 2, 2.96 (±0.75) in IFLS 3, 3.01 (±0.76) in IFLS 4, and 3.07 (±0.92) in IFLS 5. The average mother's economic level was 2.93 (±0.86) in IFLS 2, 2.96 (±0.75) in IFLS 3, 3.06 (±0.81) in IFLS

4, and 3.20 (±0.93) in IFLS 5. Mean of BMI was 21.78 (±2.87) for fathers and 23.34 (±3.67) for mothers. The average age was 40.71 (±6.46) for fathers and 36.04 (±5.73) for mothers. The average age was 10.93 ±3.87 years in IFLS 2, 13.78 ±3.87 years in IFLS 3, 21.25 ±3.88 years in IFLS 4, and 28.19 ±3.87 years in IFLS 5, respectively (Table 1).

The best model identified by the GBTM include four trajectories for BMI z-score (Fig. 1). For parental economic level, the best fit trajectories are the 2 group trajectories for father's and the 4 group trajectories for mother's (Fig. 2 and Fig. 3).
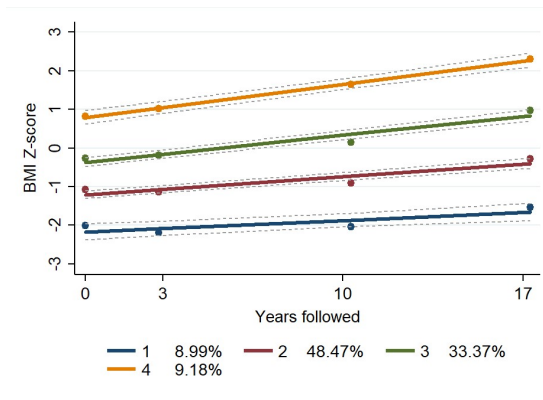

Figure 1. Four group-based trajectories of children's BMI z-score; IFLS 2-5, 1997-2014
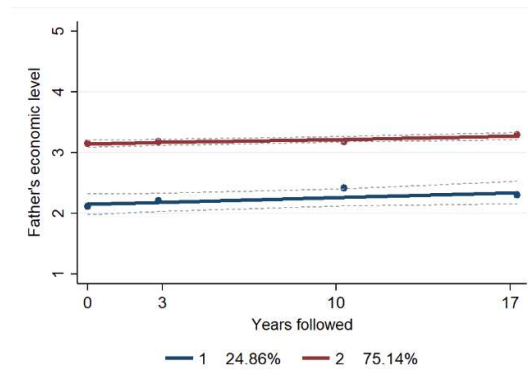

Figure 2. Two group-based trajectories of father's economic level; IFLS 2-5, 1997-2014
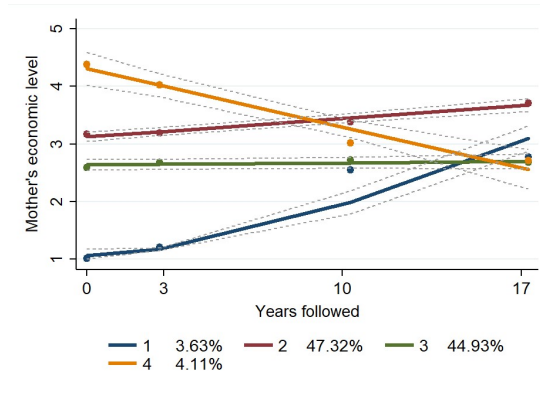
Figure 3. Two group-based trajectories of mother's economic level; IFLS 2-5, 1997-2014

Table 2. Results of multinomial logistic regression

Economic Level Trajectories	C1 vs C2		C3 vs C2		C4 vs C2	
	RRR (95% CI)	aRRR (95% CI)	RRR (95% CI)	aRRR (95% CI)	RRR (95% CI)	aRRR (95% CI)
Father's						
F1	1.43 (0.89, 2.31)	1.22 (0.71, 2.10)	1.01 (0.74, 1.39)	0.97 (0.68, 1.39)	0.71 (0.41, 1.22)	0.70 (0.37, 1.35)
F2	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Mother's						
M1	0.55 (0.12, 2.46)	0.43 (0.09, 2.03)	0.95 (0.44, 2.05)	1.07 (0.45, 2.51)	1.30 (0.50, 3.39)	1.64 (0.52, 5.21)
M2	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
M3	0.96 (0.61, 1.52)	0.71 (0.42, 1.18)	1.29 (0.97, 1.71)	1.21 (0.87, 1.66)	0.49** (0.30, 0.80)	0.50* (0.28, 0.90)
M4	1.25 (0.45, 3.49)	1.44 (0.47, 4.38)	1.01 (0.49, 2.08)	0.87 (0.38, 1.98)	0.78 (0.26, 2.36)	0.50 (0.13, 1.94)

Ref. = Reference group; * = p-value <0.05; ** = p-value <0.01.

Table 2 shows that there were no significant differences in the RRRs for the association of father's economic level trajectories with children's BMI z-score trajectories. For mother's economic level trajectories, only mothers grouped on "relatively stable at almost level 3" trajectories (compared to "started at level 3 and slightly increasing over time" trajectories) was associated with decreased relative risk of "normal becoming obesity" to "stay normal" trajectories of children's BMI z-score.

DISCUSSION

The use of economic level trajectory and BMI z-score trajectories was unique and offers a longitudinal perspective on the relationship between economic level and the development of obesity. Our main finding was that children who had mother in "started at level 3 and slightly increasing over time" group are more likely to develop a BMI z-score in the obese range.

A systematic review found that parenting style is an important risk factor of childhood overweight and obesity in higher SES families (Mech et al., 2016). High family income predicted a greater likelihood of permissive parenting style, and permissive parenting style predicted early and sustained childhood overweight and obesity (Lane et al., 2013; Topham et al., 2010). Parent gender seems to related with parenting styles. It seems that in most societies, mothers are expected to spend more time caring for children and showing affection, while fathers are expected to be providers and disciplinarians (Uji et al., 2014). In this study, we controlled parental employment without considering the work hours due to a lack of data. According to a prior study, children from high SES households were more likely to be overweight than children from low SES families for every 10 hours a mother worked per week (Hawkins et al., 2008). It implies that a more significant number of working hours was a risk factor for childhood overweight solely in high SES families.

Considerable changes took place in the period investigated in Indonesia. Indonesia's economy has improved significantly with a positive change in the wealth per capita in 1995-1997 and 2007-2014 (Kurniawan & Managi, 2018). Although the Indonesian economic growth has shown an increasing trend since 2004, such growth was not accompanied by equal income distribution. Even from 2000 to 2013, the Gini index had a rising trend (Saraswati et al., 2020). With the economic growth, the dietary patterns gradually shifted from the traditional type, which was dominated by cereals and vegetables, towards a pattern of high intake of fat and calorie-dense foods (Kimenju & Qaim, 2016). Increases in total calorie consumption associated with the economic improvement in Asian countries and the following obesity burden might have explained the temporal effect around the 2010s (Liang et al., 2020).

There are two limitations. First, the measure of economic level was a subjective measure of relative economic level using single item in the questionnaire. Second, we have high rate of attrition from the list-wise approach to get data from four time points. Future research is needed to identify economic level trajectories and BMI z-score trajectories using objective measures on nationally representative sample to examine their associations.

CONCLUSION

These findings demonstrate that overweight and obesity develops across childhood to adulthood with distinguishable BMI z-score trajectories. This work further supports the evidence that mother's characteristic compared to father's is having more impact on children's development. Therefore, mothers will be potential targets for the development of policies and interventions for preventing overweight and obesity in children.

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