Preventive Medicine Reports 34 (2023) 102262

Contents lists available at ScienceDirect

Preventive Medicine Reports

journal homepage: www.elsevier.com/locate/pmedr

Family economic trajectories and body mass index in Indonesia: Evidence from the Indonesian Family Life Surveys 2 to 5

Yoseph Leonardo Samodra, Hui-Chuan Hsu, Kun-Yang Chuang, Ying-Chih Chuang *

School of Public Health, Taipei Medical University, 250 Wu Hsing St., Taipei 11031, Taiwan

A R T I C L E I N F O

Keywords:
Body mass index
Childhood obesity
Family economic trajectory
Indonesia
Rurality

A B S T R A C T

Indonesia faces the double burdens of childhood obesity and malnutrition. A family's socioeconomic status has been suggested to be one of the most influential factors contributing to childhood nutritional problems. This study aimed to: 1) identify the distinct trajectories of family economics; and 2) assess whether a family's economic trajectory influences children's body mass index (BMI). We analyzed trajectory patterns of family economic levels from 1997 to 2015 among 846 children aged under 3 years in 1997 using data from Indonesian Family Life Surveys. Trajectory patterns were identified with Group-Based Trajectory Modeling using the traj plug-in in STATA software. The BMI was classified according to 2007 World Health Organization growth standards. Adjusted relative risk ratios (aRRRs) of family economic level trajectories and children's BMI were calculated using multinomial logistic regressions. We identified three distinct trajectories of family economic level: stable poorest, stable middle, and increasing richest. In the total sample, there were no significant relationships between a family's income trajectory and children's BMI in the adjusted models. A significant relationship existed for male children, but not for female children, of compared to the poorest family trajectory group, male children in the increasing richest trajectory group were more likely to be overweight/obese (aRRR 6.1, 95% confidence interval: 1.22–30.62) after adjusting for age and BMI. The present results highlight the importance of early interventions to minimize the potential adverse impacts of excessive BMI later in adulthood.

1. Introduction

Obesity in children and adolescents is a major and complex worldwide health issue causing millions of deaths yearly (Weihrauch-Bluher and Wiegand, 2018). Obesity has become more prevalent in Southeast Asia in the past decade. Notably, accelerated increases in the body mass index (BMI) were found in Malaysia, Brunei Darussalam, and Indonesia (Di Cesare et al., 2019). Obesity in children is a major health issue which leads to various harmful short- and long-term health effects. Children who are overweight or obese are more likely to still retain their weight status later in life and thus increase their risk of morbidities and chronic diseases (Coronado-Ferrer et al., 2022).

In most high-income nations, a low socioeconomic status (SES) has consistently been shown to be linked to being overweight and obese in childhood (Bridger Staatz et al., 2021). However, in low-income countries (LICs) and low-middle-income countries (LMICs), some studies showed that children from higher-income households were more likely to be overweight or obese (Buoncristiano et al., 2021). What makes the phenomenon more complicated is that LICs and LMICs may also carry a "double burden" of increasing numbers of overweight and obese children, as well as persistent childhood undernutrition (Ricardo et al., 2021). In Indonesia, the prevalence of obesity in children aged 5–12 years rose from 8.0% in 2013 to 9.2% in 2018 (Hadi et al., 2020). According to national health survey (RISKESDAS) data collected in 2010, 2013, and 2018, there has been little progress in reducing stunting and thinness among adolescents (Sparrow et al., 2021). The high proportion of wasted children (10.2%) in 2018 placed Indonesia as the country with the highest rate of wasting in Southeast Asia (Bella et al., 2022).

The importance of a family's SES in children's nutrition status is well established (Jansen et al., 2013; Noh et al., 2014). Studies showed that individuals with a lower SES are more likely to be born with a low birth weight, to have unhealthy diets, and to be less physically active during leisure time (Vieira et al., 2019). Researchers suggested that the complex relationship between SES and obesity during the transition to adulthood can be better understood using a trajectory approach (Scharoun-Lee et al., 2009). Most prior research used single-time-point measures to assess a family's SES influence, which may ignore the temporal nature of the association and led to a partial explanation of how SES contributes to

* Corresponding author.
E-mail address: yingchih@tmu.edu.tw (Y.-C. Chuang).

https://doi.org/10.1016/j.pmedr.2023.102262
Received 5 February 2023; Received in revised form 20 May 2023; Accepted 22 May 2023
Available online 25 May 2023

health outcomes (Vieira et al., 2019). The persistence and trajectory of a family's low income were proven to be associated with children's health and development (Bonaccio et al., 2021). However, those studies showed an inconsistent pattern of these relationships. One study indicated that individuals with upward socioeconomic mobility had higher BMIs than individuals with a high SES throughout life, suggesting that a low SES in childhood might be a critical factor determining one's chances of becoming obese in the future (Vieira et al., 2019). Another study, instead, showed that women were three times more likely to be obese if they were in the trajectory group of "persistent low life course SES" compared to women in other SES trajectory groups (Scharoun-Lee et al., 2009). One study also showed increased risks for adolescents to be overweight and obese when family income trajectories were identified as "remaining in low-income" and "moving into low-income" (Demment et al., 2014). On the other hand, few studies have focused on the effects of family income trajectories on undernutrition. One study showed that a persistently low economic status during childhood and adolescence was associated with shorter adult height but not with being underweight or with adiposity (Isasi et al., 2016).

As far as we know, no existing studies to date have used trajectories of a family's subjective economic level to analyze its influence on children's BMI in Indonesia. Therefore, the present study aimed to first identify distinct family economic trajectories in Indonesian families and then assess whether a family's economic trajectory influenced children's BMI while considering other parental and environmental covariates.

2. Methods

2.1. Study population

The Indonesian Family Life Survey (IFLS) collects data on individual, family, and community-level sociodemographic, economic, and health characteristics using a multistage stratified sampling design. Households were selected from 13 of 27 provinces. The sample has representativeness of the study population covering approximately 83% of the Indonesian population in 1993. The IFLS collects household-level and individual-level data in each wave. One or two members of a household aged 12 and above were selected to be interviewed by structured questionnaire. For children under age of 12, parents or caregivers were interviewed instead. In IFLS 5, the data collection method was switched from a pen-and-paper personal interview to a computer-assisted personal interview (CAPI) (Frankenberg and Thomas, 2000; Strauss et al., 2016; Strauss et al., 2009; Strauss et al., 2004). The anthropometric measurements for both children and parents were collected by trained health workers (i.e., nurses or doctors) in IFLS 2–4 and trained interviewers in IFLS 5 (Frankenberg and Thomas, 2000; Strauss et al., 2016; Strauss et al., 2009; Strauss et al., 2004). Further details of recruitment, response rates, and interview process for all waves are reported elsewhere (Strauss et al., 2016).

This was a panel study following the same respondents in wave 2 (IFLS 2, 1997–1998), wave 3 (IFLS 3, 2000), wave 4 (IFLS 4, 2007–2008), to wave 5 (IFLS 5, 2014–2015). Children under 3 years of age at the time of IFLS 2 were included as the main target sample. In IFLS 2, 1181 children aged under 3 years had at least one parent who reported their economic status. Among the 1181 children, only 847 children belonging to 809 families remained in this study due to missing characteristics of height, weight, and family SES. About 4.5% of the families have two children participating in this study. One extreme BMI z-core was excluded. The final sample size was 846 children. Since this study was based on the publicly available anonymized datasets, and thus exempt from ethical compliance.

2.2. Measures

2.2.1. Dependent variable

The dependent variable was children's BMI z-scores in IFLS 5. We used 2007 World Health Organization (WHO) growth standards to classify weight statuses into five groups (Bhargava et al., 2020; de Onis et al., 2007): severely thin (z-score < -3 standard deviations (SDs)), thin (z-score < -2 SDs), of a normal weight (-2 SDs $\geq$ z-score $\geq +1$ SD), overweight (z-score $> +1$ SD), and obese (z-score $> +2$ SDs).

2.2.2. Independent variable

The main independent variable consisted of family economic trajectories derived from IFLS 2 to 5. A family's economic level was measured based on the highest reported level either from the father's or the mother's answer of the question: "Please imagine a six-step ladder where on the bottom (the first step) stand the poorest people, and on the highest step (the sixth step) stand the richest people. On which step are you?" (Betcherman and Marschke, 2016; Oshiro et al., 2021). Since one or two household members were asked to provide household information (Frankenberg and Thomas, 2000; Strauss et al., 2016; Strauss et al., 2009; Strauss et al., 2004), we calculated family economic level based on the highest reported level either from fathers or mothers not only to estimate the influence of family SES on children's BMI but also to maximize our sample size (Betcherman and Marschke, 2016; Oshiro et al., 2021). The sample sizes for fathers' economic level were 753, 753, 720, 730, 640, and 642, while the sample sizes for mothers' economic level were 820, 822, 790, 789, 752, 753 for the year of 1997, 2000, 2002, 2007, 2009, and 2014, respectively. Using the highest reported level from either fathers or mothers, the sample sizes were increased to 834, 834, 831, 831, 815, and 815, respectively.

2.2.3. Other covariates

Sex, age, baseline BMI, parental BMI, parental educational levels, and residential setting were collected in IFLS 2. The BMI was calculated as the weight (kg)/square of the height (m^2). The baseline BMI in IFLS 2 was categorized into five groups based on z-scores for age: severely thin (z-score < -3 SDs), thin (z-score < -2 SDs), of a normal weight (-2 SDs $\geq$ z-score $\geq +1$ SD), with a possible risk of being overweight (z-score $> +1$ SD), overweight (z-score $> +2$ SDs), and obese (z-score $> +3$ SDs) (de Onis et al., 2007). Parental BMI was categorized into underweight (BMI $<$18.5 kg/m^2), of a normal weight (18.5 kg/m^2 $\leq$ BMI $<$23 kg/m^2), overweight (23 kg/m^2 $\leq$ BMI $<$25 kg/m^2), and obese (BMI $\geq$25 kg/m^2) according to the BMI cutoff points for Asian populations (WHO Expert Consultation, 2004). We controlled for the baseline BMI and parental BMI because they serve as biological and inherited influences of ones' nutritional status (Narciso et al., 2019). Parental educational level was regrouped into two groups: "junior high school or less" and "senior high school or above" (Prihartono et al., 2022). Residential setting was categorized into rural and urban (Fidyani and Wisana, 2021).

2.3. Statistical analysis

Data were analyzed using STATA software, and Group-based Trajectory Modeling (GBTM) with censored normal distribution was conducted using the traj plugin (Jones and Nagin, 2012). BMI-for-age z-scores were calculated using the WHO Anthro plugin (Donat-Vargas et al., 2021; Shackleton et al., 2019). GBTM was used to determine trajectories of family economic levels. GBTM is a particular case of mixture modeling that allows distinct family economic level trajectories to be identified. It is suggested to begin testing from the model with the smallest number of groups and then gradually move to a model with a maximum logical number of groups. The number of groups and polynomial order of the trajectories are based on the smallest Bayesian information criterion (BIC) (Pape et al., 2021), a sufficient number of individuals in each group (comprising more than 5% of the population) (Nguena Nguefack et al., 2020), the accuracy of the classification (measured as the average posterior probability of class membership for each trajectory of $\geq$0.70) (Donat-Vargas et al., 2021), and the overall interpretability of the model (Greene et al., 2022). We retained the cases that had at least two-time-points measures on economic level due to the requirement of GBTM. We utilized a first-order Taylor expansion method to approximate the standard errors for the model parameters (Jones and Nagin, 2007).

The Kruskal-Wallis test and Pearson's Chi-squared test were used to analyze differences in characteristic distributions between trajectory groups (Ferrer et al., 2021). Multinomial logistic regression models were constructed to estimate associations between parental economic trajectories and children's BMI z-score in IFLS 5 after controlling for other covariates. The multinomial logistic regression models were adjusted for children's age, children's baseline BMI in IFLS 2, parental BMI in IFLS 2, and the residential setting (Fidyani and Wisana, 2021; Susanto et al., 2019). Stratified analyses were also conducted by sex (Hernández-Cordero et al., 2017). All associations were expressed as relative-risk ratios (RRRs) with associated 95% confidence intervals (CIs).

3. Results

Table 1 provides descriptive statistics of the sample. The analysis included 846 children, of whom 50.24% were female. Their average age was 18.23 months in IFLS 2 and 18.76 years in IFLS 5. Just over 55% of the sample was found to have a normal BMI in IFLS 2, and the percentage increased to almost 78% in IFLS 5. A majority of family economic levels was identified as level 3. In IFLS 2, 52.6% of fathers and 53.78% of mothers were found to have a normal BMI. About 68% of fathers (68.44%) had a junior high school education or less, while 77.30% of mothers had a junior high school education or less. Approximately 63% of the families lived in urban settings.

We identified three distinct family economic trajectories as illustrated in Fig. 1. Families with a stable middle economic level formed the largest group ($n = 617$, 72.93%). The second largest group ($n = 120$, 14.18%) included families with a stable poorest economic level. Finally, the third group identified the richest families ($n = 109$, 12.88%), who not only had the highest family income level but also exhibited an increase in the economic gap from other groups throughout the years. The classification by GBTM was good, with an average probability of class membership ranging from 0.8 to 0.878.

Table 2 presents the bivariate analysis of sample characteristics and family economic trajectories. There were no significant differences in sex, age in IFLS 2, BMI in IFLS 2, BMI in IFLS 5, and mother's BMI in IFLS 2 by trajectory group. Father's BMI in IFLS 2 was associated with the economic level trajectories. The higher the economic level, the more likely the father was to be overweight or obese. Fathers and mothers who had a high school education or more in IFLS 2 were more likely to be in a trajectory group with a better family economic level. Similarly, children who resided in an urban setting were also more likely to be in a trajectory group with a higher family economic level.

Table 3 shows results of the multinomial regression analysis. In the unadjusted model (model 1), people in the trajectory group with an increasing family economic level were over twice (RRR 2.53, 95% CI: 1.03–6.22) as likely as ones of the poorest families to be overweight/obese in IFLS 5. However, the significant results disappeared in the adjusted models (models 2–4). We further conducted a stratified multinomial regression analysis by sex. We found a significant relationship for male children in that compared to the poorest family trajectory group, children in the "increasing richest" trajectory group were more likely to be overweight/obese (RRR 8.34, 95% CI: 1.73–40.22) in model 1. The significant effect remained significant in model 2 (aRRR 6.1, 95% CI: 1.22–30.62) after adjusting for age and BMI in IFLS 2. There were no associations between a family's economic level trajectories and BMI categories among female children. The baseline BMI and age in IFLS 2 were found to be positively associated with a risk of being overweight/obese among female children when parental BMI and residential setting were controlled for in models 3 and 4. Male children were less likely to be severely thin and thin than female children (aRRR 0.55, 95% CI: 0.43–0.71). The father's BMI was a more-significant characteristic that affected the child's nutritional status regarding both being

Table 1
Description of Sample Characteristics, the Indonesian Family Life Survey, 1997–2015.

Characteristics	n (%)/mean (SD)
Male, *n* (%)	421 (49.76)
Age in IFLS 2 (months), mean (SD)	18.23 (10.05)
Age in IFLS 5 (years), mean (SD)	18.76 (0.89)
BMI in IFLS 2, *n* (%)	
Severely thin	31 (3.66)
Thin	49 (5.79)
Normal	470 (55.56)
At possible risk of being overweight	78 (9.22)
Overweight	33 (3.90)
Obese	32 (3.78)
Missing	153 (18.09)
BMI in IFLS 5, *n* (%)	
Severely thin	17 (2.01)
Thin	70 (8.27)
Normal	658 (77.78)
Overweight	62 (7.33)
Obese	39 (4.61)
Economic level in 1997, *n* (%)	
1	23 (2.74)
2	134 (15.84)
3	428 (50.59)
4	215 (25.41)
5	33 (3.90)
6	1 (0.12)
Missing	12 (1.42)
Economic level in 2000, *n* (%)	
1	29 (3.43)
2	121 (14.30)
3	476 (56.26)
4	196 (23.17)
5	9 (1.06)
6	3 (0.35)
Missing	12 (1.42)
Economic level in 2002, *n* (%)	
1	44 (5.20)
2	221 (26.12)
3	382 (45.15)
4	152 (17.97)
5	31 (3.66)
6	1 (0.12)
Missing	15 (1.77)
Economic level in 2007, *n* (%)	
1	26 (3.07)
2	157 (18.56)
3	442 (52.25)
4	187 (22.10)
5	18 (2.13)
6	1 (0.12)
Missing	15 (1.77)
Economic level in 2009, *n* (%)	
1	62 (7.33)
2	212 (25.06)
3	317 (37.47)
4	168 (19.86)
5	45 (5.32)
6	11 (1.30)
Missing	31 (3.66)
Economic level in 2014, *n* (%)	
1	26 (3.07)
2	120 (14.18)
3	362 (42.79)

(*continued on next page*)

Table 1 (*continued*)

Characteristics	n (%)/mean (SD)
4	247 (29.20)
5	44 (5.20)
6	16 (1.89)
Missing	31 (3.66)
Father's BMI in IFLS 2, *n* (%)	
Underweight	71 (8.39)
Normal	445 (52.60)
Overweight	86 (10.17)
Obese	94 (11.11)
Missing	150 (17.73)
Mother's BMI in IFLS 2, *n* (%)	
Underweight	106 (12.53)
Normal	455 (53.78)
Overweight	121 (14.30)
Obese	127 (15.01)
Missing	37 (4.37)
Father's educational level in IFLS 2, *n* (%)	
≤ Junior high school	579 (68.44)
≥ Senior high school	247 (29.20)
Missing	20 (2.36)
Mother's educational level in IFLS 2, *n* (%)	
≤ Junior high school	654 (77.30)
≥ Senior high school	190 (22.46)
Missing	2 (0.24)
Urban, *n* (%)	529 (62.53)

BMI = body mass index; IFLS = Indonesian Family Life Survey; SD = standard deviation.

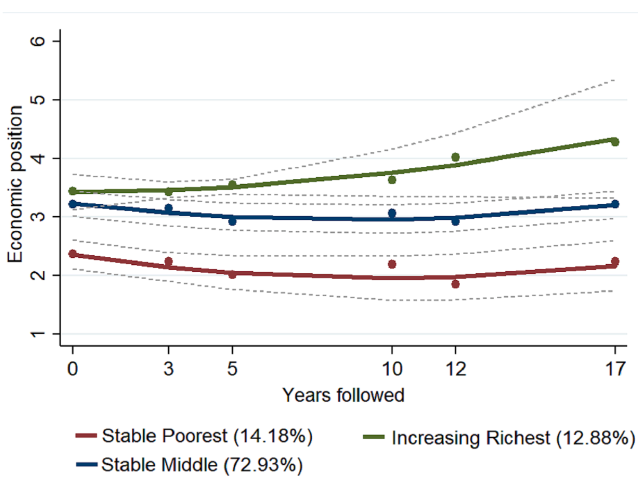

Fig. 1. Trajectories of family economic position, the Indonesian Family Life Survey, 1997–2015.

undernourished and overweight/obese compared to the mother's BMI, especially in male children. Living in an urban area during childhood showed a protective effect against being severely thin/thin in male children, but not in female children (aRRR 0.24, 95% CI: 0.11–0.53 vs. aRRR 1.12, 95% CI: 0.37–3.36, respectively). In additional analyses, we adjusted for the characteristics of parental education (not shown). However, parental educational characteristics were not significantly associated with children's BMI, possibly due to the fact that they represent part of the family socioeconomic status, which overlaps with the family's economic trajectory.

Table 2

Description of body mass index (BMI) and sociodemographic characteristics by family economic trajectories, the Indonesian Family Life Survey, 1997–2015.

	Stable Poorest (*N* = 120)	Stable Middle (*N* = 617)	Increasing Richest (*N* = 109)	*p* value
Male, *n* (%)	58 (48.33)	308 (49.92)	55 (50.46)	0.939[a]
Age in IFLS 2 (months), mean (SD)	16.91 (9.83)	18.32 (10.03)	19.16 (10.38)	0.208[b]
BMI in IFLS 2, n (%)	(*N* = 94)	(*N* = 506)	(*N* = 93)	0.368[a]
Severely thin/Thin/Normal	71 (75.53)	401 (79.25)	78 (83.87)	
At possible risk of being overweight/Overweight/Obese	23 (24.47)	105 (20.75)	15 (16.13)	
BMI in IFLS 5, n (%)				0.258[a]
Severely thin/Thin	12 (10.00)	61 (9.89)	14 (12.84)	
Normal	100 (83.33)	479 (77.63)	79 (72.48)	
Overweight/Obese	8 (6.67)	77 (12.48)	16 (14.68)	
Father's BMI in IFLS 2, *n* (%)	(*N* = 91)	(*N* = 507)	(*N* = 98)	<0.001[a]
Underweight/Normal	84 (92.31)	367 (72.39)	65 (66.33)	
Overweight/Obese	7 (7.69)	140 (27.61)	33 (33.67)	
Mother's BMI in IFLS 2, *n* (%)	(*N* = 115)	(*N* = 586)	(*N* = 108)	0.050[a]
Underweight/Normal	81 (70.43)	416 (70.99)	64 (59.26)	
Overweight/Obese	34 (29.57)	170 (29.01)	44 (40.74)	
Father's educational level in IFLS 2, *n* (%)	(*N* = 112)	(*N* = 605)	(*N* = 109)	<0.001[a]
≤ Junior high school	102 (91.07)	421 (69.59)	56 (51.38)	
≥ Senior high school	10 (8.93)	184 (30.41)	53 (48.62)	
Mother's educational level in IFLS 2, *n* (%)	(*N* = 120)	(*N* = 615)	(*N* = 109)	<0.001[a]
≤ Junior high school	110 (91.67)	475 (77.24)	69 (63.30)	
≥ Senior high school	10 (8.33)	140 (22.76)	40 (36.70)	
Urban, *n* (%)	58 (48.33)	393 (63.70)	78 (71.56)	0.001[a]

IFLS = Indonesian Family Life Survey; SD = standard deviation.
[a] Chi-squared test; [b]Kruskal-Wallis test.

4. Discussion

Three distinct family economic trajectory groups were identified in this study. Around one in eight children were classified in the richest trajectory group that featured a family income which increased over the years. The other two groups featured stable middle and low family economic levels over time. Considerable societal changes took place during the study period in Indonesia. The economy of Indonesia significantly improved with positive changes in the GDP per capita in 1995–1997 and 2007–2014 (Kurniawan and Managi, 2018). Although Indonesian economic growth has generally shown an increasing trend since 2004, the global financial crisis around 2008 might be reflected in

Table 3
Multinomial logistic regression analysis of family economic level trajectory group memberships and children's body mass index (BMI), the Indonesian Family Life Survey, 1997–2015.

	Model I[1] RRR (95% CI)		Model II[2] aRRR (95% CI)		Model III[3] aRRR (95% CI)		Model IV[4] aRRR (95% CI)	
	Severely thin/ Thin	Overweight/ Obese	Severely thin/ Thin	Overweight/ Obese	Severely thin/ Thin	Overweight/ Obese	Severely thin/ Thin	Overweight/ Obese
Total Sample	(*N* = 846)		(*N* = 693)		(*N* = 590)		(*N* = 590)	
Stable Middle vs. Stable Poorest	1.04 (0.54–2.02)	2.01 (0.94–4.30)	0.85 (0.42–1.72)	1.72 (0.75–3.91)	0.75 (0.34–1.68)	1.04 (0.43–2.49)	0.64 (0.28–1.44)	1.04 (0.43–2.51)
Increasing Richest vs. Stable Poorest	1.45 (0.63–3.36)	**2.53 (1.03–6.22)**	1.21 (0.50–2.94)	2.30 (0.87–6.09)	1.41 (0.53–3.77)	1.21 (0.43–3.43)	1.15 (0.42–3.14)	1.22 (0.43–3.50)
Males	**0.55 (0.43–0.71)**	1.03 (0.84–1.28)	**0.58 (0.44–0.76)**	1.01 (0.80–1.28)	**0.50 (0.37–0.68)**	1.03 (0.80–1.34)	**0.47 (0.34–0.65)**	1.03 (0.80–1.34)
Age in IFLS2			1.00 (0.98–1.02)	**1.03 (1.00–1.05)**	1.01 (0.98–1.04)	**1.03 (1.00–1.05)**	1.01 (0.98–1.04)	**1.03 (1.00–1.05)**
BMI in IFLS 2			0.70 (0.36–1.36)	**1.72 (1.02–2.92)**	0.74 (0.36–1.55)	**1.92 (1.08–3.42)**	0.72 (0.34–1.51)	**1.92 (1.08–3.42)**
Father's BMI					**0.29 (0.12–0.71)**	**2.89 (1.70–4.91)**	**0.24 (0.10–0.58)**	**2.91 (1.68–5.04)**
Mother's BMI					0.74 (0.38–1.44)	**1.79 (1.06–3.03)**	0.67 (0.34–1.32)	**1.80 (1.06–3.05)**
Urban							**0.40 (0.21–0.74)**	1.03 (0.58–1.83)
Males	(*N* = 421)		(*N* = 346)		(*N* = 294)		(*N* = 294)	
Stable Middle vs. Stable Poorest	0.97 (0.44–2.12)	3.34 (0.78–14.41)	0.73 (0.31–1.73)	2.17 (0.49–9.63)	0.58 (0.22–1.50)	1.32 (0.28–6.33)	0.41 (0.15–1.14)	1.23 (0.25–5.97)
Increasing Richest vs. Stable Poorest	2.19 (0.84–5.74)	**8.34 (1.73–40.22)**	1.77 (0.63–5.00)	**6.10 (1.22–30.62)**	1.70 (0.54–5.36)	2.63 (0.47–14.63)	1.21 (0.36–4.04)	2.45 (0.44–13.78)
Age in IFLS2			0.99 (0.96–1.02)	1.03 (0.99–1.07)	1.00 (0.96–1.03)	1.02 (0.98–1.06)	0.99 (0.96–1.03)	1.02 (0.98–1.06)
BMI in IFLS 2			0.90 (0.43–1.88)	1.52 (0.70–3.29)	0.88 (0.39–1.99)	1.58 (0.68–3.67)	0.80 (0.34–1.86)	1.54 (0.66–3.61)
Father's BMI					**0.30 (0.11–0.82)**	**3.00 (1.41–6.35)**	**0.22 (0.08–0.61)**	**2.62 (1.21–5.68)**
Mother's BMI					0.82 (0.38–1.74)	**2.13 (1.00–4.52)**	0.70 (0.32–1.53)	2.02 (0.95–4.32)
Urban							**0.24 (0.11–0.53)**	0.58 (0.25–1.38)
Females	(*N* = 425)		(*N* = 347)		(*N* = 296)		(*N* = 296)	
Stable Middle vs. Stable Poorest	1.29 (0.37–4.53)	1.57 (0.64–3.88)	1.18 (0.33–4.23)	1.59 (0.58–4.33)	1.41 (0.30–6.69)	0.97 (0.33–2.83)	1.43 (0.30–6.87)	1.10 (0.37–3.26)
Increasing Richest vs. Stable Poorest	0.37 (0.04–3.66)	0.92 (0.26–3.21)	0.33 (0.03–3.31)	0.86 (0.21–3.48)	0.52 (0.04–6.22)	0.58 (0.13–2.47)	0.53 (0.04–6.43)	0.68 (0.15–3.00)
Age in IFLS2			1.03 (0.98–1.08)	1.03 (0.99–1.06)	1.04 (0.99–1.10)	**1.04 (1.00–1.07)**	1.04 (0.99–1.10)	**1.04 (1.00–1.07)**
BMI in IFLS 2			0.24 (0.03–1.86)	2.06 (1.00–4.26)	0.37 (0.05–2.89)	**2.41 (1.09–5.33)**	0.36 (0.05–2.89)	**2.40 (1.08–5.33)**
Father's BMI					0.30 (0.04–2.37)	**2.85 (1.32–6.14)**	0.31 (0.04–2.48)	**3.24 (1.45–7.23)**
Mother's BMI					0.50 (0.11–2.34)	1.41 (0.66–3.00)	0.51 (0.11–2.37)	1.46 (0.68–3.14)
Urban							1.12 (0.37–3.36)	1.65 (0.74–3.69)

RRR = relative risk ratio; CI = confidence Interval; aRRR = adjusted relative risk ratio; IFLS = Indonesian Family Life Survey.
[1]Model I: adjusted RRR for sex. [2]Model II: adjusted RRR for sex, personal BMI, and age in IFLS 2. [3]Model III: adjusted for model II + parental BMI. [4]Model IV: adjusted for model III + residential setting.

Fig. 1 with a slight U-shape for the middle- and low-income groups indicating the pre-crisis period in 2002–2007 and the post-crisis period in 2008–2012 (Mohammad et al., 2021). In the same period of time, a similar pattern of trajectory groups of family income were identified in some other countries as well. Three groups of income trajectories were reported in a study from Brazil. Their trajectory groups were characterized as stable high income, stable middle income, and low and variable income, with no crossover of trajectories (Schuch et al., 2018). In contrast, a study in the US showed a more-heterogeneous pattern, which identified five trajectory groups including stable low income, unstable becoming low income, low becoming adequate income, unstable becoming adequate income, and stable adequate income (Kendzor et al., 2012).

Overall, regarding the influence of family economic trajectories on the BMI, our study found that the effect was modest, and most of the effect could be explained by biological influences such as parental BMI. Our study found that in the unadjusted model, only those in the richest group compared to the poorest group showed a significant RRR of becoming overweight or obese than having a normal BMI. Compared to previous research, studies conducted in other LICs suggested a stronger effect of family SES on children's nutritional status such that the richest groups in India, Vietnam, and Peru had the higher odds of being overweight or obese (Carrillo-Larco et al., 2016; Verma et al., 2021). Similarly, the highest prevalence of being overweight and obese was found among Mexican children and adolescents at the highest socioeconomic level. However, longitudinally, the increase in overweight and obese individuals was more profound among those children in the lowest socioeconomic level in these LICs (Hernández-Cordero et al., 2017). Although prevalence rates of children with overweight and obesity problems were still higher among the wealthy compared to poor families, the increase in obesity prevalence rate was much larger in poor children than rich children (Aizawa and Helble, 2017).

Our study measured family economic level based on the highest reported level from either parent. In Indonesia, since fathers generally have a higher economic level than mothers (Tadjoeddin, 2020), our results are more likely to represent the economic level influence of fathers on children's weight status than mothers. However, since children are influenced by the lifestyle patterns shared among family members (Iguacel et al., 2021), using the highest reported economic level from either parent may indicate a general economic contextual influence on the weight status of children. Families belonging to higher socioeconomic level tend to possess greater motivation and resources to sustain a healthy way of living (Wang and Geng, 2019).

According to our stratified analyses by sex, we detected a higher risk of being overweight or obese in the richest group only in boys. The association remained significant after controlling for BMI and age in IFLS 2. A similar finding was reported in South Korea of a positive relationship between income and obesity found in men but not women (Chung et al., 2017). A study in China reported that the BMI of males was more likely to be affected by family income than that of females, and the differential relationship between gender has been increasing over the years (Asiseh and Yao, 2016). This can partly be attributed to differences in healthy behavior and diets, with women being more likely to focus on healthy eating and activities aiming for a thinner body image (Brytek-Matera et al., 2015; Gaylis et al., 2020).

Cultural factors may in part contribute for the differences in nutrition status between boys and girls in our study. This finding is consistent with prior research findings in other Asian countries (Rachmi et al., 2017). Gender discrimination and inequitable intrahousehold food allocation practices can lead to higher rates of undernutrition in girls, and are more likely to occur in food insecure or poor households (Madjdian et al., 2018). Since Indonesia has been known to have diverse cultural and ethnic groups in different regions, the geographical and cultural differences may be the determinants of children's nutritional status (Beal et al., 2018).

Although the main strength of this study is using a longitudinal design and GBTM to examine trajectory patterns over 17 years, our findings should be viewed in the context of some limitations. First, while the study used a nationwide sample, the sample did not cover the eastern part of Indonesia (Mulyaningsih et al., 2021). Second, the IFLS asked participants to report a subjective relative income level, rather than actual family income. Although prior studies suggested that subjective evaluations of family income are a more-valid measure than asking about family income directly because of difficulties in asking about family income in a survey context (Rubin et al., 2014), future studies should examine the potential effects of combining subjective reports of relative income standing and actual family assets in order to provide a more-comprehensive picture of the influence of the SES (Torres et al., 2018). Third, the number of missing data over time is still a concern for the generalizability of our study results. Compared to the original sample in IFLS 2, the missing data mostly came from children that were slightly older, male, and resided in rural areas, but the differences were not statistically significant.

5. Conclusions

Our study identified three distinct trajectories of family economic levels. The study results indicated that being in the increasing richest trajectory compared to the stable poorest trajectory may lead boys to becoming overweight/obese rather than being categorized as having a normal BMI in their late adolescent phase. Present results highlight the importance of early interventions to minimize the potential adverse impacts of excessive BMI later in adulthood.

CRediT authorship contribution statement

Yoseph Leonardo Samodra: Conceptualization, Methodology. **Hui-Chuan Hsu:** Writing – review & editing. **Kun-Yang Chuang:** Writing – review & editing. **Ying-Chih Chuang:** Conceptualization, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Acknowledgement

The authors are thankful for RAND which provided access to IFLS data at http://www.rand.org/labor/FLS/IFLS/download.html.

References

Aizawa, T., Helble, M., 2017. Socioeconomic inequality in excessive body weight in Indonesia. Econ. Hum. Biol. 27, 315–327. https://doi.org/10.1016/j.ehb.2017.09.005.

Asiseh, F., Yao, J., 2016. Family income and body mass index – what have we learned from China. Health Econ. Rev. 6, 1–10. https://doi.org/10.1186/s13561-016-0129-z.

Beal, T., Tumilowicz, A., Sutrisna, A., Izwardy, D., Neufeld, L.M., 2018. A review of child stunting determinants in Indonesia. Matern. Child Nutr. 14, 1–10. https://doi.org/10.1111/mcn.12617.

Bella, A., Dartanto, T., Nurshadrina, D.S., Kusnadi, G., Moeis, F.R., Nurhasana, R., Satrya, A., Thabrany, H., 2022. Do parental Smoking Behaviors Affect Children's Thinness, Stunting, and Overweight Status in Indonesia? Evidence from a Large-Scale Longitudinal Survey. J. Fam. Econ. Issues 1–13. https://doi.org/10.1007/s10834-022-09864-x.

Betcherman, G., Marschke, M., 2016. Coastal livelihoods in transition: How are Vietnamese households responding to changes in the fisheries and in the economy? J. Rural Stud. 45, 24–33. https://doi.org/10.1016/j.jrurstud.2016.02.012.

Bhargava, M., Bhargava, A., Ghate, S.D., Rao, S.P., R.,, 2020. Nutritional status of Indian adolescents (15–19 years) from National Family Health Surveys 3 and 4: Revised estimates using WHO 2007 Growth reference. PLoS One 15, 1–24. https://doi.org/10.1371/journal.pone.0234570.

Bonaccio, M., Di Castelnuovo, A., Costanzo, S., De Curtis, A., Persichillo, M., Cerletti, C., Donati, M.B., de Gaetano, G., Iacoviello, L., on behalf of the Moli-sani Study Investigators, 2021. Life-Course Socioeconomic Status and Risk of Hospitalization for Heart Failure or Atrial Fibrillation in the Moli-sani Study Cohort. Am. J. Epidemiol. 190 (8), 1561–1571.

Bridger Staatz, C., Kelly, Y., Lacey, R.E., Blodgett, J.M., George, A., Arnot, M., Walker, E., Hardy, R., 2021. Socioeconomic position and body composition in childhood in high- and middle-income countries: a systematic review and narrative synthesis. Int. J. Obes. 45, 2316–2334. https://doi.org/10.1038/s41366-021-00899-y.

Brytek-Matera, A., Donini, L.M., Krupa, M., Poggiogalle, E., Hay, P., 2015. Orthorexia nervosa and self-attitudinal aspects of body image in female and male university students. J. Eat. Disord. 3, 1–8. https://doi.org/10.1186/s40337-015-0038-2.

Buoncristiano, Marta, Williams, Julianne, Simmonds, Philippa, Nurk, Eha, Ahrens, Wolfgang, Nardone, Paola, Rito, Ana Isabel, Rutter, Harry, Bergh, Ingunn Holden, Starc, Gregor, Jonsson, Kenisha Russell, Spinelli, Angela, Vandevijvere, Stefanie, Mäki, Päivi, Milanović, Sanja Musić, Salanave, Benoît, Yardim, Mahmut S., Hejgaard, Tatjana, Fijałkowska, Anna, Abdrakhmanova, Shynar, Abdurrahmonova, Zulfiya, Duleva, Vesselka, Farrugia Sant'Angelo, Victoria, García-Solano, Marta, Gualtieri, Andrea, Gutiérrez-González, Enrique, Huidumac-Petrescu, Constanta, Hyska, Jolanda, Kelleher, Cecily C., Kujundžić, Enisa, Peterkova, Valentina, Petrauskiene, Ausra, Pudule, Iveta, Sacchini, Elena, Shengelia, Lela, Tanrygulyyeva, Maya, Taxová Braunerová, Radka, Usupova, Zhamilya, Maruszczak, Katharina, Ostojic, Sergej M., Spiroski, Igor, Stojisavljević, Dragana, Wickramasinghe, Kremlin, Breda, João, 2021. Socioeconomic inequalities in overweight and obesity among 6- to 9-year-old children in 24 countries from the World Health Organization European region. Obes. Rev. 22 (S6) https://doi.org/10.1111/obr.13213.

Carrillo-Larco, R.M., Miranda, J.J., Bernabé-Ortiz, A., 2016. Wealth index and risk of childhood overweight and obesity: evidence from four prospective cohorts in Peru and Vietnam. Int. J. Public Health 61, 475–485. https://doi.org/10.1007/s00038-015-0767-7.

Chung, W., Lim, S.J., Lee, S., Kim, R., Kim, J., 2017. Gender-specific interactions between education and income in relation to obesity: A cross-sectional analysis of the Fifth Korea National Health and Nutrition Examination Survey (KNHANES V). BMJ Open 7, 1–14. https://doi.org/10.1136/bmjopen-2016-014276.

Coronado-Ferrer, Silvia, Ferrer-Sapena, Antonia, Aleixandre-Benavent, Rafael, Valderrama Zurián, Juan Carlos, Cogollos, Lourdes Castelló, 2022. Global Trends in Scientific Research on Pediatric Obesity. Int. J. Environ. Res. Public Health 19 (3), 1251.

de Onis, M., Onyango, A.W., Borghi, E., Siyam, A., Nishida, C., Siekmann, J., 2007. Development of a WHO growth reference for school-aged children and adolescents. Bull. World Health Organ. 85, 660–667. https://doi.org/10.2471/BLT.07.043497.

Demment, M.M., Haas, J.D., Olson, C.M., 2014. Changes in family income status and the development of overweight and obesity from 2 to 15 years: A longitudinal study. BMC Public Health 14, 1–9. https://doi.org/10.1186/1471-2458-14-417.

Di Cesare, M., Sorić, M., Bovet, P., Miranda, J.J., Bhutta, Z., Stevens, G.A., Laxmaiah, A., Kengne, A.P., Bentham, J., 2019. The epidemiological burden of obesity in childhood: A worldwide epidemic requiring urgent action. BMC Med. 17, 1–20. https://doi.org/10.1186/s12916-019-1449-8.

Donat-Vargas, C., Guerrero-Zotano, Á., Casas, A., Baena-Cañada, J.M., Lope, V., Antolín, S., Garcia-Saénz, J.Á., Bermejo, B., Muñoz, M., Ramos, M., de Juan, A., Jara Sánchez, C., Sánchez-Rovira, P., Antón, A., Brunet, J., Gavilá, J., Salvador, J., Arriola Arellano, E., Bezares, S., Fernández de Larrea-Baz, N., Pérez-Gómez, B., Martín, M., Pollán, M., 2021. Trajectories of alcohol consumption during life and the risk of developing breast cancer. Br. J. Cancer 125, 1168–1176. https://doi.org/10.1038/s41416-021-01492-w.

Ferrer, F.S., Castell, E.C., Marco, F.C., Ruiz, M.J., Rico, J.A.Q., Roca, A.P.N., 2021. Influence of weight status on bone mineral content measured by DXA in children. BMC Pediatr. 21, 1–8. https://doi.org/10.1186/s12887-021-02665-5.

Fidyani, A.Y., Wisana, I.D.G.K., 2021. The Impact of Mother's Bargaining Power on the Nutritional Status of Children in Indonesia. Econ. Financ. Indones. 67, 115. https://doi.org/10.47291/efi.v67i1.797.

Frankenberg, E., Thomas, D., 2000. The Indonesia Family Life Survey (IFLS): Study Design and Results from Waves 1 and 2 (No. DRU-2238/1-NIA/NICHD).

Gaylis, J.B., Levy, S.S., Hong, M.Y., 2020. Relationships between body weight perception, body mass index, physical activity, and food choices in Southern California male and female adolescents. Int. J. Adolesc. Youth 25, 264–275. https://doi.org/10.1080/02673843.2019.1614465.

Greene, N.D., Riley, T., Mastroianni, R., Billimoria, Z.C., Enquobahrie, D.A., Baker, C., Gray, M.M., Umoren, R.A., 2022. Neonatal Vital Sign Trajectories and Risk Factors During Transport Within a Regional Care Network. Air Med. J. 1, 1–7. https://doi.org/10.1016/j.amj.2022.08.002.

Hadi, H., Nurwanti, E., Gittelsohn, J., Arundhana, A.I., Astiti, D., West, K.P., Dibley, M.J., 2020. Improved understanding of interactions between risk factors for child obesity may lead to better designed prevention policies and programs in indonesia. Nutrients 12, 1–12. https://doi.org/10.3390/nu12010175.

Hernández-Cordero, S., Cuevas-Nasu, L., Morán-Ruán, M.C., Méndez-Gómez Humarán, I., Ávila-Arcos, M.A., Rivera-Dommarco, J.A., 2017. Overweight and obesity in Mexican children and adolescents during the last 25 years. e249 Nutr. Diabetes 7, e247. https://doi.org/10.1038/nutd.2016.52.

Iguacel, I., Gasch-Gallén, Á., Ayala-Marín, A.M., De Miguel-Etayo, P., Moreno, L.A., 2021. Social vulnerabilities as risk factor of childhood obesity development and their role in prevention programs. Int. J. Obes. 45, 1–11. https://doi.org/10.1038/s41366-020-00697-y.

Isasi, Carmen R., Jung, Molly, Parrinello, Christina M., Kaplan, Robert C., Kim, Ryung, Crespo, Noe C., Gonzalez, Patricia, Gouskova, Natalia A., Penedo, Frank J., Perreira, Krista M., Perrino, Tatiana, Sotres-Alvarez, Daniela, Van Horn, Linda, Gallo, Linda C., Ali, Raghib Ietheqad, 2016. Association of childhood economic hardship with adult height and adult adiposity among hispanics/latinos. The HCHS/SOL socio-cultural ancillary study. PLoS One 11 (2), e0149923.

Jansen, Pauline W., Mensah, Fiona K., Nicholson, Jan M., Wake, Melissa, Gravenor, Mike B., 2013. Family and Neighbourhood Socioeconomic Inequalities in Childhood Trajectories of BMI and Overweight: Longitudinal Study of Australian Children. PLoS One 8 (7), e69676.

Jones, B., Nagin, D.S., 2012. A Stata Plugin for Estimating Group-Based Trajectory Models (No. National Science Foundation Grants SES-102459 and SES-0647576).

Jones, Bobby L., Nagin, Daniel S., 2007. Advances in Group-Based Trajectory Modeling and an SAS Procedure for Estimating Them. Sociol. Methods Res. 35 (4), 542–571.

Kendzor, D.E., Caughy, M.O., Owen, M.T., 2012. Family income trajectory during childhood is associated with adiposity in adolescence: A latent class growth analysis. BMC Public Health 12, 1–9. https://doi.org/10.1186/1471-2458-12-611.

Kurniawan, R., Managi, S., 2018. Economic Growth and Sustainable Development in Indonesia: An Assessment *. Bull. Indones. Econ. Stud. 54, 339–361. https://doi.org/10.1080/00074918.2018.1450962.

Madjdian, Dónya S., Azupogo, Fusta, Osendarp, Saskia J.M., Bras, Hilde, Brouwer, Inge D., 2018. Socio-cultural and economic determinants and consequences of adolescent undernutrition and micronutrient deficiencies in LLMICs: a systematic narrative review. Ann. N. Y. Acad. Sci. 1416 (1), 117–139.

Mohammad, K.U., Muhammad, A., Muhammad, K.U., 2021. Post-Crisis Behavior of Banks in Asia: A Case of Chronic Over-Capitalization. J. Asian Financ. Econ. Bus. 8, 517–525. https://doi.org/10.13106/jafeb.2021.vol8.no3.0517.

Mulyaningsih, Tri, Mohanty, Itismita, Widyaningsih, Vitri, Gebremedhin, Tesfaye Alemayehu, Miranti, Riyana, Wiyono, Vincent Hadi, Metwally, Ammal Mokhtar, 2021. Beyond personal factors: Multilevel determinants of childhood stunting in Indonesia. PLoS One 16 (11), e0260265.

Narciso, Janine, Silva, António José, Rodrigues, Vitor, Monteiro, Maria João, Almeida, António, Saavedra, Raquel, Costa, Aldo Matos, Carraça, Eliana, 2019. Behavioral, contextual and biological factors associated with obesity during adolescence: A systematic review. PLoS One 14 (4), e0214941.

Nguena Nguefack, H.L., Pagé, M.G., Katz, J., Choinière, M., Vanasse, A., Dorais, M., Samb, O.M., Lacasse, A., 2020. Trajectory modelling techniques useful to epidemiological research: A comparative narrative review of approaches. Clin. Epidemiol. 12, 1205–1222. https://doi.org/10.2147/CLEP.S265287.

Noh, J.W., Kim, Y.E., Park, J., Oh, I.H., Kwon, Y.D., 2014. Impact of parental socioeconomic status on childhood and adolescent overweight and underweight in Korea. J. Epidemiol. 24, 221–229. https://doi.org/10.2188/jea.JE20130056.

Oshiro, C.E., Hillier, T.A., Edmonds, G., Peterson, M., Hill, P.L., Hampson, S., 2021. Vitamin D deficiency and insufficiency in Hawaii: Levels and sources of serum vitamin D in older adults. Am. J. Hum. Biol. 34, 1–10. https://doi.org/10.1002/ajhb.23636.

Pape, K., Cowell, W., Sejbaek, C.S., Andersson, N.W., Svanes, C., Kolstad, H.A., Liu, X., Hougaard, K.S., Wright, R.J., Schlünssen, V., 2021. Adverse childhood experiences and asthma: Trajectories in a national cohort. Thorax 76, 547–553. https://doi.org/10.1136/thoraxjnl-2020-214528.

Prihartono, N.A., Fitria, L., Ramdhan, D.H., Fitriyani, F., Fauzia, S., Woskie, S., 2022. Determinants of Hypertension amongst Rice Farmers in West Java, Indonesia. Int. J. Environ. Res. Public Health 19, 1–13. https://doi.org/10.3390/ijerph19031152.

Rachmi, C.N., Li, M., Baur, L.A., 2017. Overweight and obesity in Indonesia: prevalence and risk factors-a literature review. Public Health 7, 20–29. https://doi.org/10.1016/j.puhe.2017.02.002.

Ricardo, L.I.C., Gatica-Domínguez, G., Crochemore-Silva, I., Neves, P.A.R., dos Santos Vaz, J., Barros, A.J.D., Victora, C.G., 2021. Age patterns in overweight and wasting prevalence of under 5-year-old children from low- and middle-income countries. Int. J. Obes. 45, 2419–2424. https://doi.org/10.1038/s41366-021-00911-5.

Rubin, M., Denson, N., Kilpatrick, S., Matthews, K.E., Stehlik, T., Zyngier, D., 2014. "I am working-class": Subjective self-definition as a missing measure of social class and socioeconomic status in higher education research. Educ. Res. 43, 196–200. https://doi.org/10.3102/0013189X14528373.

Scharoun-Lee, M., Kaufman, J.S., Popkin, B.M., Gordon-Larsen, P., 2009. Obesity, race/ethnicity and life course socioeconomic status across the transition from adolescence to adulthood. J. Epidemiol. Community Health 63, 133–139. https://doi.org/10.1136/jech.2008.075721.

Schuch, H.S., Peres, K.G., Demarco, F.F., Horta, B.L., Gigante, D.P., Peres, M.A., Do, L.G., 2018. Effect of life-course family income trajectories on periodontitis: Birth cohort study. J. Clin. Periodontol. 45, 394–403. https://doi.org/10.1111/jcpe.12845.

Shackleton, N., Derraik, J.G.B., Audas, R., Taylor, R.W., Glover, M., Morton, S.M.B., Tautolo, E., Kokaua, J., Taylor, B., Cut, W.S., Milne, B.J., 2019. Decomposing ethnic differences in body mass index and obesity rates among New Zealand pre-schoolers. Int. J. Obes. 43, 1951–1960. https://doi.org/10.1038/s41366-019-0390-4.

Sparrow, R., Agustina, R., Bras, H., Sheila, G., Rieger, M., Yumna, A., Feskens, E., Melse-Boonstra, A., 2021. Adolescent Nutrition—Developing a Research Agenda for the Second Window of Opportunity in Indonesia. Food Nutr. Bull. 42, S9–S20. https://doi.org/10.1177/0379572120983668.

Strauss, J., Beegle, K., Sikoki, B., Dwiyanto, A., Herwati, Y., Witoelar, F., 2004. The Third Wave of the Indonesia Family Life Survey (IFLS3): Overview and Field Report No. WR-144/1-NIA/NCHID.

Strauss, J., Witoelar, F., Sikoki, B., 2016. The 5th Wave of the Indonesia Family Life Survey (IFLS): Overview and Field Report (No. WR-1143/1-NIA/NICHD).

Strauss, J., Witoelar, F., Sikoki, B., Wattie, A.M., 2009. The Fourth Wave of the Indonesia Family Life Survey: Overview and Field Report No. WR-675/1-NIA/NICHD.

Susanto, T., Yunanto, R.A., Rasny, H., Susumaningrum, L.A., Nur, K.R.M., 2019. Promoting Children Growth and Development: A community-based cluster randomized controlled trial in rural areas of Indonesia. Public Health Nurs. 36, 514–524. https://doi.org/10.1111/phn.12620.

Tadjoeddin, Mohammad Zulfan, 2020. Inequality and exclusion in Indonesia: Political economic developments in the post-soeharto era. J. Southeast Asian Econ. 36 (3), 284–303.

Torres, J.M., Rizzo, S., Wong, R., 2018. Lifetime Socioeconomic Status and Late-life Health Trajectories: Longitudinal Results from the Mexican Health and Aging Study. Journals Gerontol. - Ser. B Psychol. Sci. Soc. Sci. 73, 349–360. https://doi.org/10.1093/geronb/gbw048.

Verma, Madhur, Das, Milan, Sharma, Priyanka, Kapoor, Nitin, Kalra, Sanjay, 2021. Epidemiology of overweight and obesity in Indian adults - A secondary data analysis of the National Family Health Surveys. Diabetes Metab. Syndr. 15 (4), 102166.

Vieira, Luna Strieder, Bierhals, Isabel Oliveira, Vaz, Juliana dos Santos, Meller, Fernanda de Oliveira, Wehrmeister, Fernando César, Assunção, Maria Cecília Formoso, 2019. Socioeconomic status throughout life and body mass index: a systematic review and meta-analysis. Cad. Saude Publica 35 (10), e00125518. https://doi.org/10.1590/0102-311X00125518.

Wang, J., Geng, L., 2019. Effects of socioeconomic status on physical and psychological health: Lifestyle as a mediator. Int. J. Environ. Res. Public Health 16, 1–9. https://doi.org/10.3390/ijerph16020281.

Weihrauch-Bluher, S., Wiegand, S., 2018. Risk Factors and Implications of Childhood Obesity. Curr. Obes. Rep. 7, 254–259. https://doi.org/10.1007/s13679-018-0320-0.

WHO Expert Consultation, 2004. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet 363, 157–163. https://doi.org/10.2307/2136890.