SOCIOECONOMIC DISPARITIES AS PREDICTORS OF NUTRITION INEQUALITIES AMONG CHILDREN UNDER FIVE IN HUNGARY AND INDONESIA

Ph.D. thesis

Arie Dwi Alristina

Semmelweis University Doctoral College
Health Sciences Division

Supervisor: Helga Judit Feith, Ph.D
Official reviewers: Julianna Boros, Ph.D
Edina Molnár, Ph.D

Head of the Complex Examination Committee:
László Szabó, MD, Ph.D
Members of the Final Examination Committee:
Zsófia Mészner, MD, Ph.D
Zsanett Bodor, Ph.D
Éva Nagy, Ph.D

Budapest, 2026

1. Introduction

All countries should act immediately to implement these 17 Sustainable Development Goals (SDGs) as outlined in the United Nations 2030 Agenda. Five objectives behind these goals from the United Nations are no poverty, no hunger, good health and well-being for all, and quality education for everyone. It aims to reduce health and social inequities (education) as well as encourage sustainable economic growth. At the heart of this agenda is nutrition equity, or equitable and fair access to healthy food that can improve people's health, thereby promoting better health and productivity outcomes, and reducing disparities in health and nutrition outcomes among children. But the inequalities in malnutrition continue to be one of the major public health concerns as it heavily burdens certain marginalised populations, especially in low and middle-income countries (LMICs). Equitable nutrition cannot be achieved without socioeconomic development; in fact, improved nutrition itself helps prevent many adverse outcomes for children, including impaired physical growth, cognitive deficits, and reduced productivity potential in adulthood.

Chronic undernutrition has resulted in stunting among more than 148 million children under five, while acute undernutrition leads to wasting affecting about 45 million. In LMICs, health reports from 2023 show that 22.0% of children under five are stunted (wasting: 6.8%; overweight: a rising indicator of nutritional transition with high economic growth, reaching 5.6%). The social determinants of this double burden of malnutrition can be identified as the combination of economic inequalities, low educational attainment, and inequitable distribution of healthcare services. The food supply system has already been established in high-income countries, and thus, healthy food is more accessible. Yet some low-income neighbourhoods have food deserts, where residents have limited access to affordable, nutritious foods such as whole grains. vegetables, and fruits. In LMICs, poverty pushes families into a perpetual dynamic of food insecurity. Their short-term decision, feeling satiated versus hungry, traps them in a vicious cycle because their stomachs feel full. Still, they avoid the more complex dietary necessity of dietary diversity (enough granularity by trusting calories rather than a complete diet).

In sub-Saharan Africa and South Asia, more than 30% of low-SES groups are undernourished; higher levels of undernutrition (10–30%) also occur in transitional economies of Eastern Europe and Southeast Asia, where socioeconomic differences between the richest and poorest are beginning to be observed following rapid socioeconomic transitions. The child mortality rates also remain reflective of socioeconomic disparities: malnutrition-induced deaths are still at unsustainable levels globally (according to the UNICEF), 12 deaths per 1,000 live births is considered a high threshold), where this number exceeds that in various countries with SES vulnerabilities. This is also a 'window of opportunity' for nutrition interventions, as those under five years are particularly vulnerable. Malnutrition in early life harms not only children; it also impacts future generations, thereby perpetuating a cycle of poverty. Understanding these patterns requires context-specific analyses of the various direct and indirect pathways through which socioeconomic conditions influence child nutrition.

Recently, several nutrition programmes have been in place. But prioritising only based on the burden of malnutrition, without appropriate analysis, lacks sufficient justification and presents significant methodological limitations, as it makes it difficult to adapt the same programmes across diverse socioeconomic environments. Interventions offered should depend upon direct and indirect etiologies of alterations in nutritional status. Socioeconomic determinants remain a subject of debate as key drivers of child health, while previous studies have also detailed their associations with child nutritional status.

This study adapted a modified UNICEF framework and PLS-SEM with Multi-Group Analysis (MGA) to compare the causes of child malnutrition in Hungary and Indonesia. The framework suggests a flow of causation that starts from basic factors such as socioeconomic status and household environment, moves to underlying determinants such as food insecurity, maternal knowledge, and child factors, and finally reaches immediate causes such as eating behaviours and feeding practices. This study will create a model through pathways that will be more predictive of malnutrition in the Indonesian sample than in the Hungarian sample.

2. Objectives

This study aims to explore both the structural and behavioural pathways linking SES and child nutrition inequalities in two urban settings: Budapest (Hungary) and Surabaya (Indonesia). To meet this main objective, this study presents the specific aims to:

1. Examine the mediation pathways between SES and child malnutrition.
2. Examine the mediating role of health coverage between SES and child nutrition outcomes in the Indonesian sample, where universal health coverage for children fully insured is a structural constant at the national level rather than a variable predictor of disparities in the Hungarian sample.
3. Investigate the translation of maternal nutrition knowledge into behavioural factors.
4. Assess the influence of early childhood biological risks on malnutrition.
5. Identify the contextual predictors of child feeding practices.
6. Determine whether behavioural factors (feeding practices and child eating behaviour) drive as the key predictor of malnutrition in Hungary, in contrast to Indonesia, where structural factors (SES and household food insecurity) largely dictate the influence of behavioural factors on malnutrition.
7. Investigate the direct and indirect effects that determine socioeconomic and nutrition inequalities within the metropolitan areas of Budapest (Hungary) and Surabaya (Indonesia) using Path Analysis.

2.1 Hypotheses:

The following hypotheses describe the focus of this study:

H1a: In the Hungarian sample, the negative association between SES and child malnutrition is significantly mediated by maternal nutritional knowledge, household food insecurity, child feeding practices, and child eating behaviour.

H1b: SES significantly exerts a direct effect on child malnutrition in the Indonesian sample instead of being entirely mediated through intermediate factors.

H2a: Health coverage does not significantly mediate the SES and child malnutrition relationship in the Hungarian sample.

H2b: Health coverage significantly mediates the relationship between SES and child malnutrition in the Indonesian sample.

H3: The relationship between maternal nutrition knowledge and child malnutrition is significantly mediated by child feeding practices in the Hungarian sample, while this mediating effect does not exist or is non-significant in the Indonesian sample

H4a: Behavioural variables (feeding practices, maternal nutrition knowledge) significantly mediate the effect of early child biological risks (low birth weight, prematurity) on malnutrition in the Hungarian sample.

H4b: Early child biological risks have a direct effect on malnutrition in the Indonesian sample, with no mediation by behavioural factors.

H5a: Maternal knowledge and child eating behaviour are positively associated with child feeding practices in the Hungarian sample.

H5b: The resource availability variables (SES and household food insecurity) are strong positive predictors of child feeding practices in the Indonesian sample.

H6a: Behavioural factors (feeding practices and child eating behaviour) have a significant direct effect on malnutrition in the Hungarian sample.

H6b: The structural factors (SES and household food insecurity) have a direct effect on malnutrition in the Indonesian sample.

H7: The overall variables in the structural modelling exhibit greater predictive relevance (Q2) on child malnutrition in the Indonesian sample compared to the Hungarian sample.

3. Methods

This study employs a case study of two cities: Budapest, Hungary, and Surabaya, Indonesia. Budapest, the capital of Hungary, is a high-income country. Budapest is split into Buda and Pest. This study worked with five kindergartens, two based in Pest and three based in Buda. Surabaya is a major industrial and capital city in the province of East Java, Indonesia. Surabaya consists of five regions (East, South, Central, West, and North). This study worked in 10 subdistricts, which served as the basic units or lowest administrative divisions, and public health centres (known as Posyandu).

3.1. Study design and sampling

This study used a cross-sectional design informed by health community survey guidance and examined the prevalence and predictors of undernutrition and SES in households with children aged 36-59 months. The mothers/primary caregivers of children aged 36 to 59 months who visited Public Health Centres (Posyandu) in Surabaya and the survey population in Budapest were from kindergartens. In both locations, mothers or caregivers from 10 districts in Surabaya and 5 districts in Budapest participated. Purposive sampling was conducted to select the survey location. All respondents were selected using simple random sampling, as described later in this section. A total of 657 households in Surabaya were purposively selected with children under five, and 535 households were identified based on children aged 36 to 59 months. While in Budapest, 132 households were purposively selected that had at least one child aged 36 to 59 months, but only 128 completed the questionnaire.

3.2 Data quality assurance

The instruments were designed to fit in a survey for data collection among children aged 36 to 59 months. Only the biological mother could be an eligible respondent as the primary caregiver. Written informed consent was obtained from literate participants before the start of the study, and for illiterate participants, it was documented with a thumbprint witnessed by an independent observer. The subjects remained anonymous throughout the research. Also, the study excluded children with chronic illness (diagnosed) or disabled and/or had to have a severe acute illness. The same condition applied to any child with a physical deformity involving the lower limbs or spine. In households with multiple eligible children, only one was chosen for analysis.

3.3 Data measurement

SPSS was used to conduct analyses confidentially; missing data were accounted for (listwise deletion or multiple imputation when possible (i.e., <5% threshold on listwise). The variables were all extracted from primary survey data, including structured interviews, schedules, and anthropometric measurements. Further details of each of these variables are provided below.

- Socioeconomic Status (SES)
  SES was a combined measure that reflects economic and social family resources. It was built as a quintile-based measure to account for relative deprivation or advantage in each study area. It consisted of four indicators: household income, employment status, subjective wealth status, assets, and parental level of education. The total scores were expressed in tertiles and categorised as low SES (≤33.33%), middle SES (33.34–66.67%), and high SES (>66.67%)
- Subjective wealth status
  Subjective wealth status was assessed with a Likert-scale question with scores: 1 = rather better off; 2 = average; 3 = rather better off.
- Household Food Insecurity
  Household food insecurity was also considered when evaluating access to sufficient, safe, and nutritious food. Responses were dichotomously scored (1 = yes to the experience of insecurity; 0 = no), and raw scores ranged from 0 to 8. The latter scale was grouped into two categories: food-secure (score 0) and food-insecure (score 1–8).
- Maternal nutrition knowledge
  It was assessed using the GNKQ-R, a validated questionnaire that evaluated knowledge in the areas of dietary recommendations, nutrient sources, and principles of healthy eating, which was categorised as low (score ≤ 17), moderate (score 18 – 34), and high (score ≥ 35).
- Child Feeding Practices
  Child feeding practices have been used as a point to assess how closely optimal early nutrition behaviours were followed, based on the WHO and UNICEF Infant and Young Child Feeding guidance.
- Child Eating Behaviour
  The child eating behaviour questionnaire was a 35-item parent-report scale with a five-point Likert scale.
- Malnutrition
  The malnutrition assessment used the WHO Child Growth Standards and was computed with the WHO ANTHRO 3.2.2 software.

3.5 Data analysis

The analyses were conducted using SmartPLS4 software. It is used to analyse sophisticated models that include measured and unmeasured latent variables, including endogenous, exogenous, and mediating variables. A multi-group analysis in the SEM was used to determine the linkage of different groups on the structural model and to explore possible differences in the relationships among the variables across these ensembles. In this study, the group analysis includes Hungary and Indonesia.

4. Results

4.1 Prevalence of Malnutrition and SES

In Budapest, Hungary, among 128 children examined, most (88.3%) were not stunted, wasted, or underweight. The rest of the cases were either wasting (9.4%) or stunting (2.3%), and there were no cases of being underweight or of having two or three indicators of undernutrition at the same time. In Surabaya, Indonesia, however, only 50.2% of the 535 children were not undernourished. This shows how serious the problem of undernutrition is in Indonesia. The remaining single-indicator prevalence was: stunting 15.4%, underweight 12.0%, and wasting 9.3%. The combined symptoms were more common, with stunted and underweight 6.2%, wasted and underweight 3.2%, and 1.1% of children having a combination of stunting, wasting, and underweight, as shown in Figure 1.

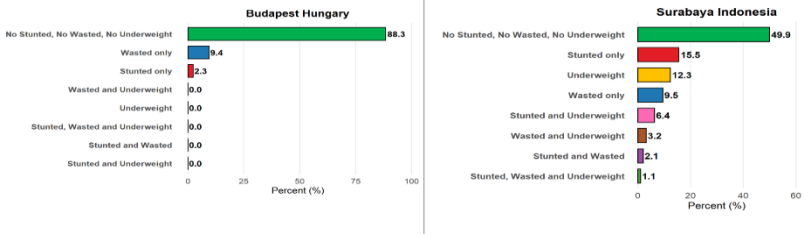


Figure 1. Prevalence of Wasting, Stunting, and Underweight in Hungary and Indonesia included in the study *(n=128, Hungary; n=535, Indonesia), (Source: Primary Data Survey)*

SES shows how well off a household is based on its income, job status, education, and subjective wealth. Figure 2 shows that most Hungarians who answered the survey have high SES (85.9%), with

none having low SES and 14.1% having middle SES. On the other hand, the majority of Indonesian respondents have a middle SES (89.5%). Only a few households have low SES (5.5%) and high SES (5.0%).

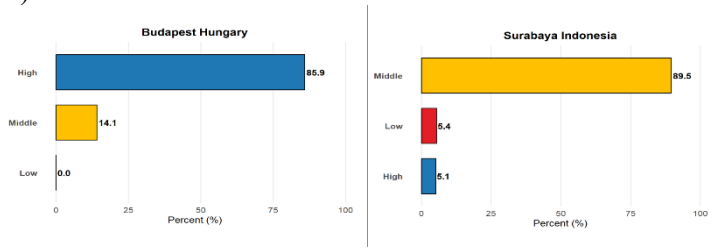


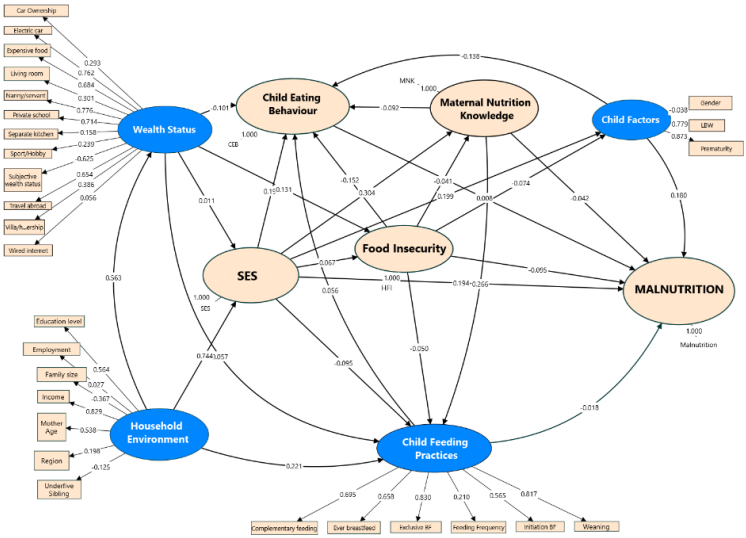
Figure 2 Percentage of SES in Hungary and Indonesia included in the study (n=128, Hungary; n=535, Indonesia) (Source: Primary Data Survey)

4.2 Measurement Model of PLS-SEM Analysis

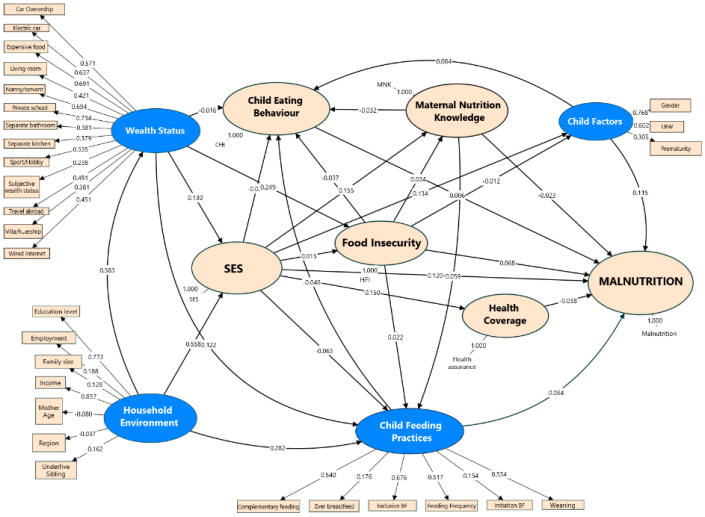
4.2.1 Outer Model

Factor loadings are the primary measures used to determine convergent validity. The outer weights in the model estimation indicate how closely the observed indicator scores are related to their underlying constructs or factors. If an indicator's loading is more than 0.70, it is considered valid. However, in exploratory research, outer loadings higher than 0.50 may be acceptable. To improve the model, indicators that do not meet the above limits should be removed. The first test of the convergent validity's results is shown in Figure 3.

The threshold for outer loading > 0.50 is supported by data, as outlined in Figure 3, which demonstrates the reliability and validity of the constructs and indicates that the measurement model adequately represented the data. Additionally, this test recommended removing the following variables from the path.



a)



b)

Figure 3. Path diagrams of socioeconomic factors on malnutrition, a) Hungarian Model (n=128); b) Indonesian Model (n=537); (Source: Primary Data Survey, PLS-SEM Test)

4.2.2 Model Fit of Inner Model

R-squared in PLS-SEM defines the extent to which the independent latent variables of a model explain variance in the dependent latent variable. R^2 values (ranging from 0 to 1, with higher values indicating a better model) are reported as an overall measure of the model's predictive power, based on the variance explained. Tables 1 and 2 further interrogate inner model fit in Hungarian and Indonesian Modelling. SES, with $R^2 > 0.50$ (moderate predictive power); other variables have weak predictive power.

Table 1. Inner model fit using R^2 in Hungary (*n=128, Hungary; Source: Primary Data Survey, PLS-SEM Test)*

Variable	R-square	R-square adjusted	Decision
Child Eating Behaviour	0.073	0.050	Weak
Child Factors	0.040	0.032	Weak
Child Feeding Practices	0.126	0.109	Weak
Food Insecurity	0.057	0.050	Weak
Malnutrition	0.084	0.062	Weak
Maternal Nutrition Knowledge	0.091	0.084	Weak
SES	0.579	0.576	Moderate
Wealth Status	0.141	0.138	Weak

$R^2<0.25$ weak; $0.25<R^2<0.50$, moderate; $R^2>0.75$, strong

Table 2. Inner model fit using R^2 in Indonesia (*n=535, Indonesia; Source: Primary Data Survey, PLS-SEM Test)*

Variable	R^2	R^2 adjusted	Decision
Child Eating Behaviour	0.016	0.005	Weak
Child Factors	0.020	0.016	Weak
Child Feeding Practices	0.043	0.034	Weak
Food Insecurity	0.054	0.050	Weak

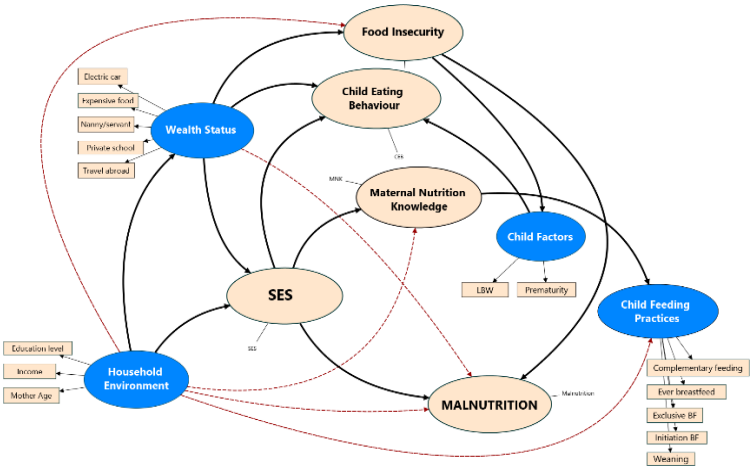
Health Coverage	0.022	0.021	Weak
Malnutrition	0.037	0.024	Weak
Maternal Nutrition Knowledge	0.026	0.022	Weak
SES	0.418	0.416	Moderate
Wealth Status	0.292	0.290	Moderate

R^2<0.25 weak; 0.25<R^2<0.50, moderate; R^2>0.75, strong

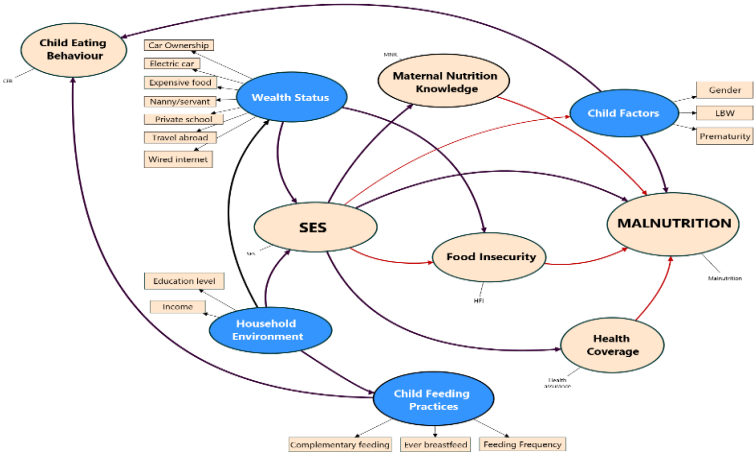
The final model is suitable for analysing the relationship between latent variables, providing confidence that we can consider this model a sufficient representation of our data and that it is expected to yield estimates valid for prediction. SRMR for both Hungary 0.090 and Indonesia 0.078 were within the acceptable validity limits according to global model fit (SRMR≤0.01). Thus, these results statistically confirm the structural model and provide a basis for further hypothesis tests in both contexts. Predictive relevance (Q^2>0.15) indicated overall acceptability in Indonesia (>0.15), except for some key constructs, which are >0.15, and weaker in Hungary (0.35).

4.2.3 Direct and Indirect Effects of the Structural Model

Figure 4(a) shows the model path diagram that explains how SES and other latent variables relate to malnutrition in the Hungarian model. Direct, total, and indirect effects were illustrated. In the PLS-SEM diagram, circles represent latent exogenous and endogenous variables, and rectangles indicate observed or measured exogenous and endogenous variables. Arrows linking circles and rectangles inherit their path from their coefficients. Black arrows indicate direct effects, and red arrows indicate indirect/mediating effects. While in Indonesia, as shown in Figure 4(b), SES has a mediating effect on child malnutrition through child factors and on the household environment through both SES and child factors. It indicates only two mediating factors to malnutrition. The strong direct effect on malnutrition is SES and child factors.



a)



b)

Figure 4. Model path diagram of socioeconomic disparities on nutrition inequalities, a) in Hungary; and b) in Indonesia (Hungary, n=128; Indonesia, n=535; Source: Primary Data Survey, PLS-SEM test)

4.4 MICOM (Measurement Invariance of Composite Models) and Multi-Group Analysis (MGA)

The MICOM procedure outlines a three-step approach to assess measurement invariance before conducting multigroup

analyses in PLS-SEM. For all constructs with significant p-values ($p < 0.05$), the observed differences in means were outside the 95% confidence intervals: child eating behaviour, food insecurity, malnutrition, and maternal nutrition knowledge, as well as SES. Thus, it indicates significant differences in mean across groups. Results for variances were mixed: Child eating behaviours, food insecurity and malnutrition p-values were significant ($p < 0.05$), meaning unequal variance across groups. While no significant group differences were found in maternal nutrition knowledge and SES, the applicability (normality) of equal variances was supported across groups. As a result, because configural invariance (Step 1) was confirmed and compositional invariance (Step 2) was demonstrated, but not all means and variances (Step 3) were resolved, the findings support partial measurement invariance. MICOM Step 3 Results indicated that the two countries had different means for malnutrition, food insecurity, and child eating behaviour ($p < 0.05$). Therefore, measurement invariance was not established. However, Partial Measurement Invariance was confirmed (Step 2: Compositional Invariance), which enables MGA to investigate the path coefficients and hypotheses. This indicates that partial measurement invariance enables a significant comparison of structural paths between Hungarians and Indonesians. Therefore, MGA can be conducted to compare path coefficients between Hungary and Indonesia, as shown in Table 3.

Table 3. Results of Multi-Group Analysis between Hungary and Indonesia *(n=128, Hungary; n=535, Indonesia; Source: Primary Data Survey, PLS-SEM test)*

Path	**Difference (Hungary-Indonesia)**	**p-value (Hungary - Indonesia)**	**Decision**
Child Eating Behaviour -> Malnutrition	-0.029	0.768	Not significant difference
Food Insecurity -> Child Eating Behaviour	-0.052	0.324	Not significant difference

Food Insecurity -> Malnutrition	-0.178	0.120	Not significant difference
Maternal Nutrition Knowledge -> Child Eating Behaviour	-0.044	0.394	Not significant difference
Maternal Nutrition Knowledge -> Food Insecurity	-0.068	0.582	Not significant difference
Maternal Nutrition Knowledge -> Malnutrition	-0.040	0.778	Not significant difference
SES -> Child Eating Behaviour	0.131	0.677	Not significant difference
SES -> Food Insecurity	**0.012**	**0.001**	**Significant difference**
SES -> Malnutrition	**0.100**	**0.001**	**Significant difference**
SES -> Maternal Nutrition Knowledge	**0.141**	**0.000**	**Significant difference**

p-value < 0.05: significant

Cross-country analyses for the two samples, with respect to SES, food insecurity, malnutrition, and maternal nutrition knowledge, are based on scores derived from the MGA test. This study examines the research model theoretically (PLS-SEM) and its significance. Although we cannot infer causation, the associations are strong and have been cross-validated with MICOM and MGA, thus providing solid ground for policy recommendations across two highly distinct socioeconomic environments.

5. Discussion

This study applied a modified UNICEF framework to compare the basic, underlying, and immediate causes of child undernutrition between urban Hungary (a high-income country) and Indonesia (an upper-middle-income country). The findings indicate that while the underlying theory can hold in general for applied settings, it is expressed differently depending on a country's economic state and social welfare system. The model showed more nuanced,

indirect socioeconomic effects in Hungary. In contrast, SES was one of the factors influencing food security and health outcomes in Indonesia. These findings underscore that the ways to malnutrition are both very diverse and closely connected to local institutions.

The SEM analysis supported the hypothesis that the model fit was poorer for the Hungarian sample than for the Indonesian sample. In wealthy Hungary, powerful social protection and institutional guarantees have largely shielded household incomes from significant growth challenges. Extreme deprivation is uncommon in a country like Hungary, where the Global Hunger Index score is below five. Traditional markers of malnourishment, therefore, become less salient because of the protective nature of universal health care/child welfare, which decreases the linkage between household income and child nutritional status.

In contrast, the Indonesian model demonstrated high predictive relevance consistent with its status as a rapidly urbanising LMIC. Socioeconomic differences remain the key drivers of nutritional inequality here. In Indonesia, on the other hand, you have no such strong social protection nets as those in Europe, so a household's income and wealth are directly linked to its ability to consume high-quality food and health services. These findings challenge the assumption of a single solution to global health and highlight that, within transition economies, the structural model is highly responsive to economic and material deprivation.

Examining the 'basic causes' in Hungary, it is obvious that whilst SES and wealth status are still important, they operate within a limited range of deprivation. In countries like Hungary, stable infrastructure and housing allow even lower-SES households to avoid the prospect of serious growth retardation. In most European countries, the association between household income and undernutrition decreases as the health system develops. Therefore, in Hungary, wealth is more of a lifestyle indicator than a measure of survival or minimum physical growth.

There is an exception in Indonesia about the basic causes. In this case, SES was an unambiguous predictor of poor nutrition. Housing quality and asset ownership indicators were directly associated with the risk of stunting and underweight status. This is consistent with broader LMIC research, where economic shocks and

informal employment markets increase vulnerability among children. The comparison also demonstrates that, although welfare states in general are able to dampen the effects of poverty on child growth in ways that are less identity- and involvement-driven, heavier transitional economies still face a strong interrelation between family assets and child growth.

Household food insecurity showed large variation as a possible "underlying cause" between the two countries. In Hungary, food insecurity was more indicative of perceived psychological stress or dissatisfaction with food diversity than real caloric shortages. Also, it is well known that, among high-SES families, the level of reported food insecurity was not associated with clinical undernutrition in Hungary. This indicates that in developed contexts, "food insecurity" might reflect hedonic deprivation or economic difficulties stemming from elevated food prices rather than an actual lack of access to essential vitamins and minerals.

Malnutrition, however, is mainly caused by food insecurity in Indonesia. That links low SES to poor nutritional outcomes, where lack of money and access produce real health deficits. However, in this study, even Indonesian mothers with the highest level of nutritional knowledge usually had limited possibilities to provide healthy meals. If the goal is to initiate educational interventions in Indonesia, economic assistance is also required; knowledge and understanding alone cannot solve the problem of limited access to healthy food.

The household environment was also very different. However, in Hungary, where basic living standards are largely equalised, there was a weak correlation between parental education or housing conditions and malnutrition. In Hungary, undernutrition is less likely to be due to direct environmental deprivation, but is often related to more complex health or mental health problems. In Indonesia, on the other hand, the environment, which encompasses factors such as sanitation, overcrowding, and neighbourhood conditions, is key to how children fare in terms of health and growth.

Using the "immediate causes" approach, the Hungarian study concluded that biological factors, such as prematurity or low birth weight, are only weakly associated with long-term undernourishment. This is probably because of the country's universal healthcare scheme,

which provides follow-up care and nutrition advice for high-risk infants. Long-term growth troubles usually associated with difficult births are significantly reduced when healthcare is available and free at the point of use.

Biological factors were significantly stronger predictors for malnutrition in Indonesia. This more tenuous health climate makes it more difficult to recover from a combination of slow growth while still in the womb and additional infections early in life. Children in Indonesia born with health vulnerabilities face an increased risk of stunting and wasting, heightened by household poverty, but not uniform across levels of deprivation if families have access to ongoing quality postnatal support.

Aspects of feeding practices and eating behaviours also differed significantly between the two countries. These behaviours did not distinguish between malnourished and well-nourished children in Hungary, partly because calorie-dense foods were available regardless of reported feeding practices. In contrast, the feeding practices in Indonesia were associated with specific material conditions. In practice, parental choice about what to feed children was constrained by parental means, making SES the primary driver.

The study also used MGA, which helped differentiate between SES as a form of human capital and material wealth. For example, SES influenced nutrition through knowledge and access to healthcare in Hungary, but functioned primarily as a critical structuring factor for all components of the wider determinant system, from food security to health resilience in Indonesia. These results imply that Hungary needs integrated clinical and psychosocial assistance, whereas Indonesia requires large-scale economic measures and social protection reforms to address the drivers of nutritional disadvantage.

5. Conclusions

The study examined the associations between SES, maternal nutritional knowledge, household food insecurity, child feeding practices, child eating behaviours and child malnutrition in urban settings of Hungary and Indonesia. SES is an important factor in child malnutrition. Children in higher-SES families with higher education and stable jobs may be more likely to meet essential food and health needs. The study reported important differences in socioeconomic factors, policies, and health systems between the two countries, especially in health coverage. Low financial resources and a lack of formal education among mothers emerged as major barriers to maternal nutrition knowledge. While child feeding practices did not significantly affect malnutrition directly or indirectly, they are strongly shaped by maternal nutrition knowledge in Hungary and by the household economic situation in Indonesia. Low birth weight is a known risk factor for malnutrition, and early health interventions for mothers could be crucial. The consequences of both structural and biological factors on malnutrition were similar in Hungary and Indonesia. However, path analysis indicated that the Hungarian model was less predictive than the Indonesian model. Overall, the results suggest that child nutrition programs and interventions appropriate to the current national context will be needed to improve child health outcomes and to tackle structural SES factors.

6. Bibliography of the candidate's publications

Publications related to the thesis (∑IF: 19.8)

- **Alristina, A.D**.; Mahrouseh, N.; Irawan, A.S.; Laili, R.D.; Zimonyi-Bakó, A.V.; Feith, H.J. Prematurity and Low Birth Weight Among Food-Secure and Food-Insecure Households: A Comparative Study in Surabaya, Indonesia. Nutrients 2025, 17, 2479. https://doi.org/10.3390/nu17152479
- **Alristina, A.D**.; Laili, R.D.; Nagy, É.; Feith, H.J. The Importance of Socioeconomic Factors Associated with Maternal Nutrition Knowledge and Undernutrition Among Children Under Five. Nutrients 2025, 17, 3355. https://doi.org/10.3390/nu17213355
- **Alristina, A.D.**; Kovács, É.; Arini, D.; Feith, H.J. Structural Equation Modelling of Socioeconomic Status on Malnutrition Among Urban Preschoolers: Multi-Group Analysis of Hungary and Indonesia. *Int. J. Environ. Res. Public Health* 2026, *23*, 858. https://doi.org/10.3390/ijerph23070858

Publications not related to the thesis (∑IF: 3.8)

- S. Juwita, N. B. Argaheni, and A. D. Alristina, "SCOPING REVIEW: APPLICATION OF TACTILE/KINESTHETIC STIMULATION IN PRETERM INFANTS," Placentum: Jurnal Ilmiah Kesehatan dan Aplikasinya, vol. 11, no. 1, pp. 65–74, Feb. 2023, doi: 10.20961/PLACENTUM.V11I1.66530.
- S. Irawan, A. D. Alristina, et al., "Beyond the interface: benchmarking pediatric mobile health applications for monitoring child growth using the Mobile App Rating Scale," Front Digit Health, vol. 7, p. 1621293, Jun. 2025, doi: 10.3389/FDGTH.2025.1621293/BIBTEX.