The evaluation of nutrition educational programs and their results: Impact of the GYERE® – Children's Health Program, socioeconomic status, and social isolation on the nutritional status of 6–12-year-old children

PhD thesis

Kinga Orsolya Bartha

Health Sciences Division

Semmelweis University Doctoral School

Supervisor: Márta Bálint Veresné Ph.D.
Adrienn Lichthammer Ph.D.

Official reviewers: Zoltánné Horváth Ph.D.
Annamária Zsákai Ph.D.

Head of the Complex Examination Committee: Lajos Attila Réthy Ph.D.

Members of the Complex Examination Committee: Erika Greiner Ph.D
Sándor Hollós Ph.D

Budapest

2025

1. Introduction

The age period from six to twelve years is a transition period from early childhood into adolescence, with physical and psychological development that affects later life outcomes. Dietary behaviors in childhood are influenced by individual, parental, and community factors. 6-12-year-old children gain greater autonomy over their food choices and have to navigate food environment, their preferences and their views on how healthy or tasty foods are beginning to significantly influence their decisions. Nutritional knowledge, socioeconomic status of the parents, household food security, parenting practices, accessibility to recreation and sports facilities, the implementation of nutritional educational programs may have an impact on children's eating behavior and nutritional status.

In 2022, 190 million children aged 5 to 19 years were living with thinness, while over 390 million were overweight, including 160 million of being obese. In Hungary, 27% of children were living with overweight, from which 12% were obese. The prevalence of thinness was 15.3% among boys and 19.8% among girls. Several international and national organizations are committed to improve children's nutritional status, and a number of initiatives have been implemented to achieve this goal.

The GYERE®-Children's Health program is a community-based intervention that aims to prevent childhood overweight and obesity in Hungary. The three-year pilot program, using the EPODE methodology, was first launched in Dunaharaszti (2014), followed by Szerencs (2015) and Diósgyőr (2018). As a health education program, thematic lectures about healthy eating were held by dietitians in all schools and kindergartens within the town. Besides in-class lectures, drawing and recipe competitions, GYERE® menu in school catering, GYERE® day, articles (online and in the local press), and nutrition counseling were implemented to increase family involvement.

2. Objectives

The aim of my thesis was to explore the multiple factors contributing to the effectiveness of the GYERE® program, providing a comprehensive understanding of children's eating behavior and changes in their nutritional status. Thus, we set out the following hypotheses in my theses:

1. The GYERE® program succeeds in reducing childhood overweight and obesity
2. 2-years of nutrition education significantly improves children's knowledge.

3. Social isolation due to the COVID-19 pandemic has a negative impact on the body weight and lifestyle of children.
4. The socioeconomic status of parents and the family's food security influence children's consumption of vegetables, fruits, fruit juices, and soft drinks.

3. Methods

3.1. Data collection and sample

Data collection was carried out with the approval of the Scientific and Research Ethics Committee of the Health Science Council of the Ministry of Health (TUKEB permit number: 52769/3260/2015/EKU).

The children's height and weight were measured and recorded by local health visitors in the medical examination room of the educational institutions. Data collection was performed at the beginning (Dunaharaszti November-December 2014; Szerencs January-February 2016; Diósgyőr October-November 2018) and at the end of each program (Dunaharaszti 2017 February-March 2017; Szerencs February 2018; Diósgyőr October-November 2020). At baseline the sample size was n=3496, with a mean age of 8.93 (±1.923), and the proportion of boys was 50.3%. Follow-up sample size was n=3264, with a mean age of 8.88 (±1.941), and the proportion of boys was 48.6%.

Weight was measured in light clothing, without shoes, on an Omron BF 511 body composition monitor, with an accuracy of 0.1 kg, and height was documented by a Seca 206 instrument, with an accuracy of 0.1 cm. Based on body mass index international (IOTF and WHO) and national (ONV2) references were used to classify children into nutritional status categories.

Knowledge level was determined using a questionnaire of single and multiple choice questions about healthy eating. The questionnaire was distributed at the beginning (n=318) and the end (n=327) of the program in Szerencs (November 2016 and March 2018) and Diósgyőr (November 2018 and January 2021). Every correct answer meant 1 point, and wrong responses 0 points. The maximum score on the test filled out among children living in Szerencs was 19, and in Diósgyőr 17. To evaluate the two assessments altogether, I transformed scores into ratios and ran statistical analyses on them.

To assess the impact of social isolation due to the COVID-19 pandemic on children's lifestyles we used an online questionnaire, consisting of 20 closed questions offering single and multiple choices. Teachers sent the questionnaire to parents of primary school children. 387 parents responded, from which data from 87 parents were excluded because their children were

older than 12 years. Data collection was carried out between 16 and 26 June 2020.

The association of socioeconomic status, food security with children's fruits and vegetables, fruit juices, and soft drinks consumption was explored by a questionnaire consisting of closed questions, with Likert-type scale responses. It was completed electronically between 23 November 2020 and 19 January 2021 by 156 parents of children aged 6 to 9 years participating in the GYERE® Diósgyőr program.

Data from 16 parents were excluded due to missing information concerning employment status and/or educational level.

3.2. Statistical analysis

Data processing was performed in IBM SPSS (Statistical Package for the Social Sciences) Version 23.

Independent-samples t-test and one-way analysis of variance (ANOVA) were used to compare mean BMI between baseline and follow-up. Z-test was performed to check for differences in nutritional status, between baseline and follow-up results. Associations between body weight change and lifestyle habits during COVID-19 confinement were evaluated with the Fisher's exact test and the correlation between the factors with Spearman's correlations.

Mann-Whitney U test was used to assess differences in nutritional knowledge between baseline and follow-up, as well as between socioeconomic status/ food security and energy-balance-related behavior.

The results obtained were interpreted at a 95% confidence interval at a significance level of 0.05.

4. Results

4.1 Body mass index (BMI)

Children had significantly lower mean BMI at the end of the program (18.09±4.07) compared to the beginning of the program (18.30±3.92), $t(6682)=2.187$, $p=0.029$, which resulted in a moderate Cohen's d effect size ($d=0.53$).

Significant differences in mean BMI were found among 6-year-old girls (baseline BMI: 16.73±2.99; follow-up BMI: 16.09±2.78; $t(444)=2.360$, $p=0.019$), 8-year-old children (baseline BMI: 17.57±3.21; follow-up BMI: 17.00±3.41; $t(1087)=2.804$, $p=0.005$), and 8-year-old boys (baseline BMI: 17.65±3.15; follow-up BMI: 16.87±3.21; $t(544)=2.850$, $p=0.005$).

4.2. Nutritional status according to IOTF cut-offs

A significant association was found between nutritional status and survey time point (baseline vs follow-up) among 7-year-olds

($\chi(3)=16.332$, $p=0.001$), 8-year-olds ($\chi(3) = 33.280$, $p<0.001$), and in the total sample ($\chi(3) = 25.399$, $p<0.001$). The prevalence of thinness significantly increased in the total sample (from 9.2% to 13.0%), among 7-year-old girls (from 9.6% to 17.9%), 8-year-old boys (from 6.9% to 17.6%), 8-year-old girls (from 6.9% to 19.2%), 9-year-old boys (from 5.2% to 11.7%), as well as among boys (from 8.1% to 11.6%) and girls (from 10.3% to 14.3%) overall. The prevalence of thinness at follow-up is in concordance with Hungarian data, where national surveys documented that 13.0-15.2% of children were affected by thinness between 2018-2019.

The prevalence of overweight significantly decreased among 7-year-old girls (from 17.3% to 11.3%) and among 7-years-olds overall (from 17.0% to 11.4%). No significant change was observed in overweight (from 19.0% to 18.0%) or obesity (from 10.1% to 10.2%) rates in the total sample after follow-up.

4.3. Nutrition status according to WHO and Hungarian references

The prevalence of thinness and obesity among 6-12-year-old children was the highest according to the WHO classification. The prevalence of overweight was similar using different references. The Hungarian cut-offs show the lowest prevalences

of thinness and obesity. Significant differences ($p<0.001$) were detected among classifications.

4.4. Nutritional knowledge assessment

Follow-up test results in the whole sample had significantly greater score ratios than at baseline ($z=-4.96$, $p<0.001$). A significant difference between boys and girls was found in the second study ($z=-3.27$, $p=0.001$). Study performance was significantly higher at the end of the program among boys ($z=-2.30$, $p=0.021$) and girls ($z=-4.83$, $p<0.001$).

4.5. The impact of social isolation due to the COVID-19 pandemic on children's nutrition status

Body weight change was significantly associated with sleep time ($p=0.030$), physical activity ($p=0.006$), food intake ($p<0.001$), and emotional status ($p=0.015$). A positive correlation was found between body weight change and sleep time ($r=+0.126$, $p=0.029$) and food intake ($r=+0.397$, $p<0.001$). Body weight change inversely correlated with physical activity ($r=-0.152$, $p=0.008$).

4.6. The association of socioeconomic status and food security with children's fruit and vegetable consumption, and fruit juice/soft drink intake

The children of the high SES groups and from food-secure households consumed fruit ($p=0.003$ and $p=0.001$), salad/grated

(p=0.002 and p=0.001), and raw (p=0.021 and p=0.007) vegetables significantly more frequently than their counterparts from the low categories. Parental demand for fruit (p=0.007), home availability of vegetables served with dinner (p=0.001), and eating vegetables with the child (p=0.014) were significantly more frequent among high SES groups. Food security was associated with the price of food purchased for children (p=0.032), parental demand (p<0.001), allowance (p=0.004) and home availability (p=0.033) of fruits. Children from food-secure households were more frequently allowed to eat as much vegetables as they like (p=0.005), and home availability of vegetables served with dinner (or lunch) was more frequent (p=0.001) among them. Parents from food-secure households drank fruit juices together with their children less often than parents from food-insecure households (p=0.042).

No significant associations were detected between children's soft drink intake and food security or socioeconomic status of the parents.

5. Conclusions

After 2 year follow-up, the GYERE® program succeeded in reducing overall mean BMI by -0.21 kg/m² among children.

The prevalence of thinness increased and approached the national average. The prevalence of overweight decreased by 1%, and obesity rates remained stable, which is in contrast to the nationally and globally increasing rates of pediatric overweight and obesity. Community-based programs in the long term may be more effective, as children's dietary behaviors do not develop or change within a short-term period, and several other factors may interfere with their results.

Nutrition education programs should target all children and be implemented in school curricula to help them make informed food choices and sustain healthy dietary behavior. Two years of nutrition education in the GYERE® program significantly improved children's knowledge.

During social isolation due to COVID-19 pandemic, nearly half of the children (46.3%) gained weight, which was significantly associated with sleep time, physical activity, food intake, and emotional status of the pupils. Nutrition education programs require enhanced adaptability to meet diverse circumstances, therefore the online version of the GYERE® program was developed.

Besides community and environmental influences, parental factors play a significant role in shaping children's dietary habits. A significant association between socioeconomic status and

food security, children's fruit and vegetable intake, and parenting practices was confirmed in the study.

In conclusion, long-term, highly adaptable nutrition education programs are needed for school-aged children from different socioeconomic backgrounds to improve their dietary habits, nutritional status, and health outcomes.

6. Bibliography of the candidate's publications

Publications related to the thesis:

1. Bartha, K. O., Kubányi, J., Lichthammer, A., Veresné Bálint, M., Erdélyi, A., & Szűcs, Z. (2026). Associations of food security and maternal education with 6–9-year-old children's dietary habits. *Journal of Hunger & Environmental Nutrition*, 1–17. https://doi.org/10.1080/19320248.2025.2612585

2. Bartha, K. (2025). Középiskolások tápláltsági állapota és táplálkozási szokásainak felmérése. *Új Diéta*, 1*,* 17–22.

3. Bartha, K. (2024). Hat–tizennégy éves gyermekek tápláltsági állapotának határértékei a referenciák tükrében. *Új Diéta*, 4*,* 10–15.

4. Bartha, K. O., Csengeri, L., Lichthammer, A., et al. (2022). Impact of COVID-19 lockdown on children's lifestyle.

Acta Alimentaria, *51*(3), 382–389. https://doi.org/10.1556/066.2022.00056

5. Bartha, K. (2021). Effects of COVID-19 lockdown on children's lifestyle. *Obesitologia Hungarica, 19*(Suppl. 2), 42.

Publications not related to the thesis:

1. Sárga, D., Bartha, K., Csonka, V. Gy., Kubányi, J. (2025). Okos Snack gyermekedukációs program hosszútávú hatékonyságának vizsgálata [Evaluation of the long-term effectiveness of the Smart Snack child education program]. *Obesitologia Hungarica*, *23*(2), 19–25.

2. Erdélyi-Sipos, A., Bartha, K., Dobák, Z., & Szűcs, Zs. (2022). A dietetikai tevékenység értékelése a személyi minimumfeltételek teljesülése tükrében, mi változott hat év alatt. *Új Diéta, 4*, 2–5.

3. Bartha, K. (2020). A borsmentaolaj hatása az irritábilisbél-szindrómára: Összesített klinikai adatok meta-analízise. *Új Diéta, 2*, 2–3.

4. Bartha, K. (2018). Élelmiszerek, tápanyagok és a kardiometabolikus egészség. *Új Diéta, 4*, 11–13.

5. Erdélyi-Sipos, A., & Bartha, K. (2017). A dietetikai tevékenység értékelése fekvőbeteg-ellátó intézményekben a

személyi minimumfeltételek teljesülése tükrében. *Új Diéta, 4*, 2–5.

6. Bartha, K., & Pásztor, M. A. (2016). Táplálási nap az Ortopédiai Klinikán. *Új Diéta, 1*, 30–32.

7. Szűcs, Zs., & Bartha, K. (2015). Személyi minimumfeltételek megvalósulása a fekvő- és járóbeteg-szakellátásban. *Új Diéta, 5*, 5–7.