The effect of nutrition education on dietary knowledge, habits, nutritional status and fitness in schoolchildren

Abstract of PhD Thesis

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1. INTRODUCTION

Obesity, which was declared a stand-alone disease by the World Health Organization (WHO) in 1998, is one of the most common non-communicable diseases that develops on the basis of unhealthy eating and physical inactivity (Mendis 2014). Obesity is also spreading epidemically among children around the world, and it is considered one of the most serious public health challenges of the 21st century. Unfortunately, the unfavorable trend can also be observed in Hungary.

According to the World Obesity Federation Atlas of Childhood Obesity 2019, 23% of 5-9-year-old and 17% of 10-19-year-old children will be obese by 2030. The probability of reaching the WHO target, according to which obesity will not increase further by 2025, is estimated at 2%. Although a number of international organizations are publishing calls, evidence-based policies and strategies are emerging, a series of interventions at the national and local levels are aimed at improving the situation, breakthroughs have been achieved only sporadically. Recent evidence shows (Verjans-Janssen et al 2019) that school-based educational interventions have the potential to improve children's optimal weight status, knowledge and lifestyles if they run for a sufficient duration and manage to actively incorporate parents into the process. However, only limited information is available to understand whether these interventions can improve fitness of children and whether the improvements persist during the summer break.

2. OBJECTIVES OF THE STUDY

The main objective of my doctoral dissertation was to investigate how a whole academic year long school based nutritional intervention impacts nutrition knowledge and habits, nutritional status and fitness parameters of schoolchildren.

My other objective was to study whether the effects of the intervention persist after the summer break as well.

In the course of my research I was looking for answers to the following questions:

1. Does complex nutrition education affect dietary knowledge and habits?
2. Is there any difference in the nutrition knowledge and habits of the intervention and control groups after the intervention?
3. Does the nutritional status of children change after the intervention? Is there any difference in the nutritional status between the intervention and control groups?
4. Does children's fitness change?
5. Do the groups' fitness parameters differ after the intervention?
6. After the summer break, is there any change in nutrition knowledge, habits and in the nutritional status of children?
7. Is there any change in the children's fitness parameters after the summer break?
8. Could the post-intervention changes be sustained during the summer break?

3. MATERIALS AND METHODS

3.1. STUDY POPULATION

The study population was enrolled from two primary schools in Budaörs, a town near the capital city (approval number: 8776-1/2016/EKU). Four classes – two 6th grade and two 7th grade classes were selected from each of the two elementary schools (altogether 8 classes), which were randomized into intervention and control groups. In total there were 229 students involved in the study with the mean age of 12.6 +/-0,1 years. 112 students formed the control group (61 boys and 51 girls) and 117 students the intervention group (41 boys and 76 girls).

3.2. TIME OF THE MEASUREMENTS

The survey period took place in 2015/2016 and in 2016/2017 academic years. The measurements were performed three times, at the beginning of the 2015/2016 school year (measurement I.), after the one year long intervention at the end of the school year (measurement II.) and after the summer break, at the beginning of the 2016/2017 school year (measurement III.).

3.3. SURVEY METHODS

All studies were classroom-based. Dietary habits and knowledge were examined by questionnaire method, while nutritional status and fitness were evaluated with the necessary standard measuring instruments.

Scores were assigned to the results of the questions on nutritional knowledge in the questionnaires completed by the children. The maximum achievable score was 6.

Scoring was also performed for dietary habits, where the maximum achievable score was 10.

Physical fitness assessments followed the Hungarian National Student Fitness Test (NETFIT®) protocol (Kaj et al 2014). The test elements can be used to measure cardiovascular fitness (aerobic capacity), skeletal muscle

functional fitness (muscle strength, strength endurance, flexibility) and body composition (body fat percentage, body mass index). The NETFIT® protocol was supplemented with a waist circumference measurement, with Cooper test, with modified Borg scale for subjective assessment of fatigue and heart rate measurements by using polar watch.

3.4. THE INTERVENTION

From the beginning of the year, a complex intervention was implemented among the students of intervention classes aimed at developing healthy dietary habits. I personally held theoretical and practical lessons on a weekly basis with the purpose of eliminating the main risk factors in children's nutrition. The duration of the lessons was 25-45 minutes. Practical education was further expanded with afternoon club sessions with the involvement of parents/grandparents.

I used the online opportunities (social media, e-mail) to send reminders (on the importance of fluid consumption, breakfast, etc.) or recipes.

3.5. DATA ANALYSIS

Stata 11.0 software was used to evaluate the data. For continuous variables, results are expressed as mean ± standard error (SE) and significance level (p). Before testing the difference between the group means, the distribution of the given variable was checked with the Kolmogorov-Smirnov normality test and a logarithmic transformation was performed when found necessary. For categorical variables, frequency distributions along clustering factors were tested using Pearson's chi-square test. The change in the examined parameters during the fitness tests was characterized by the difference of the measured values at the two time points in the case of the continuous variables. Changes in the different groups were tested by two-sample t-test. The results were presented by gender (boy, girl), by groups (intervention, control) and nutritional status (lean, normal, overweight, obese). The significance threshold was set at $p = 0.05$.

4. EREDMÉNYEK

4.1. THE EFFECT OF COMPLEX NUTRITION EDUCATION ON DIETARY KNOWLEDGE AND HABITS

As a result of the one school year long intervention, the children's nutrition knowledge improved in several points in the intervention group. Their knowledge of healthy eating ($p < 0.05$), of the adequate amount of vegetables ($p < 0.001$) and of fluid intake ($p < 0.01$) increased. In these areas there was no change in the control group.

The nutrition habits of the intervention group changed favorably in several aspects. The number of meals per day increased ($p < 0.01$) and the consumption of sweets decreased ($p < 0.01$). The control group's consumption of sweets changed unfavorably, since it increased compared to the baseline ($p < 0.01$).

Based on the overall score, the nutritional knowledge ($3.8 \rightarrow 4.1$; $p < 0.05$) and habits ($4.3 \rightarrow 4.5$; $p < 0.05$) improved in the intervention group after the intervention. The dietary knowledge of the control group changed unfavorably, their dietary habits deteriorated ($4.1 \rightarrow 3.6$; $p < 0.05$).

Comparing the results of the measurements I. and III., it can be observed that after the summer break (measurement III) the knowledge of both groups deteriorated, and this was manifested in several aspects in the control group. It was less important for them to exercise because of their health ($p < 0.05$) and to talk about a healthy diet ($p < 0.05$). Knowledge about the importance of water consumption (intervention group $p < 0.01$; control group $p < 0.05$) and about the harmful effects of energy drinks (intervention group $p < 0.01$; control group $p < 0.01$) decreased in both groups. The control group was less aware of the detrimental effect of sugary drinks consumption compared to measurement I. ($p < 0.01$).

There were also some positive changes in the intervention group. Their knowledge of the frequency of dairy product consumption improved ($p < 0.05$) and compared to the first measurement, their knowledge that a healthy diet also requires the consumption of fats ($p < 0.01$) and carbohydrates ($p < 0.01$) also improved. The intervention group consumed sweets ($p < 0.01$) and sugary soft

drinks ($p < 0.05$) less frequently, while the frequency of sweets consumption in the control group increased ($p < 0.01$). After the summer break, based on the overall score the dietary knowledge of the intervention group fell back to the baseline value, and a similar trend was observed in their habits. Both the knowledge (3.9→3.3; $p<0.01$) and the habits (4.1→3.3; $p < 0.001$) of the control group deteriorated significantly, as compared to the baseline values.

4.2. CHANGES IN THE NUTRITIONAL STATUS OF CHILDREN

After the intervention (measurement II.) body height of both groups and body weight of the control group increased, but their body mass index, the percentage of body fat, and their waist circumference did not change. For measurement III. body height (intervention group $p < 0.01$; control group $p<0.01$) and body weight of both groups (intervention group $p < 0.01$; control group $p<0.01$) increased significantly compared to the first measurement. Waist circumference of the control group increased ($p < 0.01$).

The combined proportion of overweight and obese children, which was 22.7% at the beginning of the study, did not change in either group during the measurements, however, waist circumference of the control group increased significantly after the summer break as compared to the baseline value.

4.3. DEVELOPMENT OF FITNESS PARAMETERS IN THE INTERVENTION AND CONTROL GROUPS

After the intervention, the intervention group achieved better results in the Cooper test ($p < 0.01$) and in the shuttle run test ($p < 0.01$) than in the first measurement. There were also significant improvements in flexibility ($p < 0.01$) in paced curl-up test ($p < 0.01$), hand grip strength measurement ($p < 0.01$) and trunklift test ($p < 0.05$).

The control group achieved better results only in hand grip strength measurement ($p < 0.01$) and in the long jump test ($p < 0.01$) compared to measurement I. Comparing the fitness parameters of the two groups, at measurement II. the intervention group performed significantly better than the control group in

Cooper test ($p < 0.05$), flexibility test ($p < 0.01$),paced curl-up test ($p < 0.05$) and paced push-up test ($p < 0.01$). The control group has better result in long jump- and trunk lift tests ($p < 0.01$; $p < 0.05$).

After the summer break, the fitness parameters of the intervention group improved as compared to baseline in all tests except paced push-up test, while in the control group only hand grip strength increased ($p < 0.01$), other fitness parameters either did not change or deteriorated.

5. CONCLUSIONS

1. Complex nutrition education improved the dietary knowledge and habits of the intervention group. In the control group the nutritional knowledge changed unfavorably, their dietary habits deteriorated. Based on this, our intervention seems to have played a role in preventing these adverse changes.
2. After the intervention, there were significant differences between the groups in both dietary knowledge and habits. The scores of the intervention group were substantially better, than that of the control ones, which confirms the effectiveness of our intervention.
3. Body mass index, body fat percentage, waist circumference and the combined proportion of overweight and obesity did not change in either group after the intervention. The reason for this is presumably that at this age sexual maturation also has a significant role in the development of nutritional status. It can also be supposed, that longer duration of intervention is necessary.
4. The fitness of those children, who were involved in the intervention, ameliorated in a number of parameters. The improvement in the parameters of aerobic endurance, including Cooper test, shuttle run test and estimated relative aerobic capacity is remarkable. In the control group, there were improvements in only a few parameters of the fitness tests, the aerobic endurance measures did not change at all. Further studies are needed to confirm the potential role of our nutritional intervention.

5. After the intervention, there was a difference in fitness parameters between the two groups. The intervention group performed better than the control group in the Cooper test, the flexibility test, the paced push-up test and the paced curl-up test.
6. After the summer break, the dietary knowledge and habits of both groups deteriorated. The scores in the intervention group were practically equal to pre-intervention ones. In the control group both scores were even worse, than at baseline. The nutritional status based on BMI and body fat percentage did not change in either group, but the waist circumference of the control group increased substantially.
7. The aerobic endurance parameters of the intervention group did not change after the summer break, the results of the trunklift and handgrip tests improved as compared to the post-intervention values. In the fitness parameters of the control group no changes could be observed, they stagnated during the entire study period.
8. Positive changes in dietary habits and knowledge, as a result of the intervention, are not sustainable during the summer break.
9. It would be crucial to identify the factors most responsible for the deterioration in adolescents' dietary habits during the summer break and to focus on preventing their harmful effects.
10. Our results confirm that the introduction of everyday physical education classes itself is not enough for improving fitness and changing nutritional status.
11. Extracurricular physical activity should also be encouraged.

6. BIBLIOGRAPHY OF OWN PUBLICATIONS

6.1. PUBLICATIONS RELATED TO THE THESIS

1. **Takacs H,** Martos E, Kovacs VA. (2020) Effects of a practice-focused nutrition intervention in Hungarian adolescents. Ann Ist Super Sanita, 56:99-106.
2. Spinelli A, Buoncristiano M, Kovacs VA, Yngve A, Spiroski I, Obreja G, Starc G, Pérez N, Rito AI, Kunešová M, Sant'Angelo VF, Meisfjord J, Bergh IH, Kelleher C, Yardim N, Pudule I, Petrauskiene A, Duleva V, Sjöberg A, Gualtieri A, Hassapidou M, Hyska J, Burazeri G, Petrescu CH, Heinen M, **Takacs H,** Zamrazilová H, Bosi TB, Sacchini E, Pagkalos I, Cucu A, Nardone P, Gately P, Williams J, Breda J. (2019) Prevalence of Severe Obesity among Primary School Children in 21 European Countries. Obes Facts, 12:244-258.
3. **Takács H.** (2017) A gyermekkori elhízás megelőzése. Gyermekgyógyászat. 68:285.
4. **Takács H,** Martos É. (2017) Iskoláskorú gyermekek testösszetétele, táplálkozási szokása és fittsége-Célzott táplálkozási intervenciót megalapozó eredmények. Sportorvosi Szemle, 58:51-60.

6.2. PUBLICATIONS NOT RELATED TO THE THESIS

1. **Takács H,** Antal E. Orvosi háttér áttekintése. In: Szűcs V. (szerk.), Élelmiszeripari kézikönyv 2. Gluténmentes Élelmiszerek. Nemzeti Agrárgazdasági Kamara, Budapest, 2018: 5-12.