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Quality of Life and Nutritional Status of Primary School Pupils: Evidence From Croatia

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Annotation. The aim of this paper was to determine the quality of life of primary school pupils with regard to their nutritional status. A statistically significant difference was found in the self-assessment of quality of life between the pupils whose nutritional status is normal and those who are obese. Timely early interventions, which have a positive impact on general health status, could increase the level of children's quality of life.

Keywords: *health, KIDSCREEN-10, nutrition, obesity, pupils.*

Introduction

Quality of life has been a topic of research in various fields of science. Research on quality of life started at the beginning of the previous century. At that time, indicators of quality of life were diverse, starting with various indicators of material well-being, i.e., the living standard of citizens in a particular country. In the 1960s, there was a change in the approach to this phenomenon. Social indicators, which can be objective or subjective, were taken into account when determining the level of quality of life. The objective indicators include the conditions and facts relating to a certain social environment (unemployment rate, the number of working hours per week, etc.), while the subjective indicators are based on an individual's perception and assessment of the social circumstances (life satisfaction, job satisfaction, perception of justice achievement in society, etc.) (Noll, 1996, as cited by Lučev & Tadinac, 2008). Cummins (2000) claims that if quality of life should encompass

the whole activity of human life, then both objective and subjective dimensions should be incorporated in it. However, Cummins also believes that some scientists disagree with this view. They think that the difference between these dimensions is pointless since the objective dimensions are a result of our perceptions and are, consequently, subjective. Therefore, due to different interpretations, multidimensionality, and complexity of the construct itself, scientific literature contains various definitions of quality of life.

Literature Review

Quality of Life

Felce and Perry (1995) define quality of life as general well-being, which includes objective factors and subjective assessment of physical, material, social, and emotional well-being, with personal growth and purposeful activities, viewing all the mentioned components through an individual's personal system of values. The concept of quality of life describes emotional, social, and physical well-being of a person, as well as their ability to perform everyday activities efficiently (Jurko et al., 2015). Quality of life can be understood as a subjective perception of one's own life, which is determined by objective living conditions, personality traits which affect the way people perceive their environment and specific life experiences of a person (Krizmanić & Kolesarić, 1989). Having analysed numerous studies, Cummins (1996; 2000) pointed out that most of those focusing on the assessment of quality of life cover the following seven areas: health, emotional well-being, material well-being, close relationships with other people, productivity, belonging to a community, and safety.

Recently, researchers have focused more and more on the quality of life of children. Wallander and Koot (2016) believe that conceptualization, as well as measurement of the quality of life of children (and adults) could be classified through three different approaches: health-related quality of life (HRQOL), social indicators, and subjective well-being. The authors state that the majority of studies on the quality of life of children focuses on its relation to health. Health-related quality of life covers diverse kinds of health status, including subjective perceptions and thoughts, as well as an individual's functioning in everyday life and their ability to grow and develop in various domains of life. That is why it is most frequently used in quality of life assessment (Haraldstad et al., 2019).

Obesity in Children

One of the most serious health problems nowadays is obesity. All across Europe, the number of obese people has been on the rise (Gaio et al., 2018). The World Health Organization (WHO) has declared obesity reduction its priority in the 21st century (WHO, 2016). Overweight and obesity are defined as chronic diseases characterized by

abnormal or excessive accumulation of fat tissue which poses a risk to health (World Health Organization, 2021). In the last few years, the prevalence of obesity in infants, children, and adolescents has increased dramatically (Lunardi & Petroski, 2009). In 2020, 337 million children or adolescents were obese (World Obesity Federation, 2021). An increasing prevalence of obesity, especially in children, is considered a by-product of the COVID-19 pandemic, when diverse restrictions and lockdowns were introduced in almost all countries across the world. The damage of the pandemic in terms of an increase in the number of obese people will be difficult to repair (World Obesity Federation, World Obesity Atlas, 2023). Obesity in children might double by 2035, in comparison to its 2020 level. It is estimated that obesity rate will double in boys and reach 208 million (100% increase), and more than double in girls and reach 185 million (125% increase) (World Obesity Federation, 2023).

In Croatia, in the school year 2018/2019, a total of 35% of children aged between 8 and 8.9 years were overweight or obese, out of which 37% were boys and 33.1% were girls (Musić Milanović et al., 2021). Results of a research carried out in the Republic of Croatia on pupils aged 11 years indicate that 31.2% of boys and 20.6% of girls are either overweight or obese (Pavić Šimetin et al., 2020).

Negative Impact of Obesity on Cildren's Healthy Growth and Development

Overweight endangers children's well-being and has a range of negative impacts on their growth and development. According to the results of research carried out in Spain on a sample of 684 children aged between 6 and 17.9 years, overweight and obesity are negatively related to life satisfaction, the quality of family relationships, and academic success of children (Padilla-Moledo et al., 2012). Obese children have a lower level of self-esteem (Madowitz et al., 2012) and they have a higher risk of anxiety, depression, attention deficit, hyperactivity, and sleep disorders (Erhart et al., 2012). Due to being overweight, social problems emerge as well, as children are very often isolated from society (Pakpour et al., 2019) and are often bullied by peers (Erhart et al., 2012). There is evidence that overweight and obesity are related to an increased risk to various health conditions (Fontaine et al., 2003) and that they shorten life expectancy, especially in younger adults (Fontaine et al., 2003; Malecka-Tendera & Mazur, 2006). Children who are overweight or obese rank their quality of life lower, as they experience negative influences and come across various obstacles (Houben-van Herten et al., 2015; Jalali-Farahani et al., 2013). According to research results, the quality of life has been significantly reduced in children and young people who are obese, which is mostly manifested in health assessment, physical appearance, normal fnctioning, and social relationships (Griffiths et al., 2010).

Data obtained by research on the quality of life of children and adolescents in a particular population help assess the impact of interventions on public health (de Matos et al., 2012). The results of such research in certain population can be taken as useful indicators of health results (Kamp-Becker et al., 2010), serve as a basis for assessment

of interventions in public health (de Matos et al., 2012), and provide insight needed to develop and advance the methods for improving quality of life. The modern approach describes obesity through a biological, social, and ecological framework which takes into account biological predispositions, socio-economic characteristics and environmental factors (Jebeile et al., 2022). Nga et al. (2019) point out that various stakeholders, such as the community, scientists, policy creators, and parents, should invest more effort in order to solve the problem of obesity and overweight, with participation of school education.

The aim and Research Problems

The aim of this paper is to determine the difference in quality of life among primary school pupils according to their nutritional status. Based on the aim formulated in this way, the following research problems were formed:

1. To determine the morphological characteristics of fourth-grade pupils, their nutritional status, and their self-assessment of the quality of life.
2. To examine if there are differences in the quality of life in terms of nutritional status among fourth-grade pupils.

Methods

Participants

This research included 651 fourth-grade pupils from 16 primary schools in the Republic of Croatia (M_{age} = 10.38±0.50 years (instead of godina)). Out of the total number of participants, 316 (48.54%) were girls, and 335 (51.46%) were boys. The research was conducted in May and June 2022, and it included those pupils who were healthy and present at school when the measurement was conducted and when the questionnaire was being filled out. The research was conducted in line with ethical principles prescribed by the Code of Ethics of the University of Zagreb and the Code of Ethics in Research Involving Children (Ajduković and Keresteš, 2020). The pupils were given an informative text, which, along with the parental consent form was sent to their parents/legal guardians to read and sign. Only those pupils who had provided a signed parental consent were included in the research.

Procedure and Measurement Instruments

All measurements were conducted in line with the International Biological Programme (IBP). Body height was measured to the closest value of 0.1cm using a portable stadiometer, while body mass, the body mass index – BMI, fat tissue (%), level of obesity (%) and muscle mass (kg) were measured using a dual-frequency body composition analyzer (TANITA DC-360P). Waist circumference and hip circumference were measured using

a measuring tape, while the WHR index (*Waist to Hip Ratio*) was calculated based on the ratio between waist circumference and hip circumference. The classification of the respondents according to the fat tissue percentage was carried out according to the procedure described by McCarthy et al. (2006), with the defined centile curves characteristic of children in terms of gender and age, and division into normal body mass (normal body mass – 2–85 centiles), overweight (overweight body mass – 85–95 centiles) and obesity (obese – over 95 centiles).

Within the KIDSCREEN project conducted by the European Commission, a questionnaire was designed for determining health and well-being of children and adolescents aged 8–18 years, which can be found in three different self-report versions with 52, 27, and 10 items (Müller & Haenni Hoti, 2020). In this research, a shortened Croatian version of the KIDSCREEN-10 Index Questionnaire was used to assess quality of life. It consists of 10 items relating to one's own health and well-being. The respondents assess how they felt during the previous week, by marking their level of agreement with the listed items on a Likert-type scale. The levels of agreement range from 1 (never) to 5 (always). Two items are related to each of the following dimensions: physical well-being (*Have you felt physically fit and well?; Have you felt full of energy?*), moods and emotions (*Have you felt sad?; Have you felt lonely?),* autonomy (*Have you had enough time for yourself?; Have you been able to do the things that you want to do in your free time?*), family and friends (*Have your parent(s) treated you fairly?; Have you had fun with your friends?*) and school environment (*Have you got on well at school?; Have you been able to pay attention?*) (Müller & Haenni Hoti, 2020; The KIDSCREEN Group Europe, 2006). The KIDSCREEN-10 provides a single score of health-related quality of life (HRQOL). The Cronbach's alpha value was 0.82, and the test-retest coefficient was 0.70, which indicates a satisfactory internal consistency of the questionnaire (Ravens-Sieberer et al., 2010). The Croatian version of the questionnaire also has satisfactory metric characteristics and it enables the researchers to make a reliable assessment of quality of life in all age groups (Lorger, 2011). In data processing of the results obtained by the applied morphological measurements and questionnaire, descriptive statistics was used in order to obtain the basic statistical indicators.

The normality of the distribution of the variables was tested by the Kolmogorov-Smirnov test. Levene's test was used to test the homogeneity of variance and a statistically significant difference was found between the variances. In further processing, to determine the differences between the formed sub-samples according to nutritional status (normal body mass, overweight, obesity) and quality of life of primary school pupils, Welch's analysis of variance was used – ANOVA, which does not require the precondition of variance homogeneity. With variables for which Welch's Test showed a statistically significant F value, the Mann-Whitney U test was used to determine the differences between the arithmetic means of the groups. Data processing was carried out using the software STATISTICA version 14.0.0.15., TIBCO Software Inc. The statistical significance of the differences was tested at the significance level $p < 0.05$.

Results and Discussion

Determining the Existence of Differences in the Quality of Life According to the Level of Nutritional Status of Fourth-Grade Pupils

Table 1 shows descriptive statistics of the measured morphological characteristics.

Table 1

Descriptive Indicators of Morphological Characteristics of Fourth-Grade Pupils (N = 651)

Variables	M±SD	MIN	MAX	Skewness	Kurtosis	K-S
Body height (cm)	147.92 ± 7.23	124.60	174.00	0.24	0.17	p > .20
Body mass (kg)	41.03 ± 9.93	21.90	82.60	0.89	0.77	p < .01
Body fat (percentage %)	19.21 ± 7.57	4.50	44.40	0.55	-0.29	p < .01
Body fat mass (kg)	8.49 ± 5.33	1.20	33.00	1.35	2.03	p < .01
Muscle mass (kg)	30.82 ± 5.11	18.60	50.00	0.56	0.23	p < .10
Total body water (percentage %)	59.04 ± 5.58	37.40	69.90	-0.59	-0.07	p < .01
Body Mass Index (kg/m²)	18.57 ± 3.45	12.70	31.40	0.95	0.68	p < .01
Waist circumference (cm)	63.50 ± 8.88	45.00	101.00	1.22	1.72	p < .01
Hip circumference (cm)	80.34 ± 8.58	63.00	110.00	0.58	0.07	p < .01
Hip to Waist Ratio	0.79 ± 0.05	0.51	0.99	0.37	1.73	p < .05

M = arithmetic mean; SD = standard deviation; MIN = minimum result; MAX = maximum result; Skewness = asymmetrical distribution; Kurtosis = tailedness of distribution; K-S = The Kolmogorov-Smirnov normality test

The results presented in Table 1 show descriptive parameters on the total research sample consisting of pupils in the fourth grade of primary school. According to the obtained results, it is evident that the pupils who participated in the research have normal body mass (*M* = 41.03; *SD* = 9.93) and that they are developing according to the principles of growth and development. The results of similar research do not show the same results. In some studies, higher values for body mass were obtained (Álvarez et al., 2020); somewhat lower values were obtained in the studies conducted by Skreda et al. (2018), while in the study conducted by Füssenich et al. (2016), the same body mass values were obtained, as in our research.

Numerous factors can have an impact on the health-related quality of life of children and young people. However, the most significant ones are fat percentage and Body Mass Index (BMI), as the main anthropometric parameters. It should be pointed out that the

result of fat percentage in the body (*M* = 19.21; *SD* = 7.57) and the Body Mass Index value (*M* = 18.57; *SD* = 3.45) indicate that the pupils who participated in the research had, on average, a normal nutritional status, according to the normative values (Jureša et al., 2018; McCarthy et al., 2006). Some studies carried out so far point to a significantly higher percentage of body fat (Batista et al., 2020; Álvarez et al., 2020), while other show a significantly lower body fat percentage in comparison with this research (Greier and Drenowatz, 2018; Skrede et al., 2018). In the study carried out by Caamaño-Navarrete et al. (2021), the Body Mass Index values were similar to those obtained in this research. Somewhat lower Body Mass Index values were found in other studies as well (López-Gil et al., 2020).

The results of the Kolmogorov-Smirnov normality test show deviations from the normal distribution in almost all of the examined variables, except in body height and muscle mass. Due to the type of the test applied to larger samples, skewness and kurtosis of the distributions were checked. The values were within the -2 and 2 value ranges, and the criterion was therefore met (Tabachnick et al., 2013) to include the examined variables in the analysis.

Table 2 shows the descriptive values of fourth-grade pupils' assessment of the KIDSCREEN-10 questionnaire dimensions.

Table 2

Descriptive Indicators of Quality-of-Life Assessment Provided by Fourth-Grade Pupils (N = 651)

Variables	M±SD	MIN	MAX	Skewness	Kurtosis	K-S
Health assessment	4.30 ± 0.74	2.00	5.00	-0.80	0.08	p < .01
Physical fitness	4.26 ± 0.84	1.00	5.00	-1.16	1.31	p < .01
Feeling energetic	4.38 ± 0.75	1.00	5.00	-1.22	1.61	p < .01
Sadness	1.88 ± 0.92	1.00	5.00	1.26	1.63	p < .01
Loneliness	1.47 ± 0.89	1.00	5.00	2.25	4.80	p < .01
Personal time	4.15 ± 0.98	1.00	5.00	-1.14	0.76	p < .01
Leisure time	4.22 ± 0.94	1.00	5.00	-1.12	0.52	p < .01
Relationship with parents	4.68 ± 0.65	2.00	5.00	-2.13	4.24	p < .01
Entertainment with friends	4.53 ± 0.79	1.00	5.00	-1.88	3.36	p < .01
School success	4.12 ± 0.85	1.00	5.00	-0.66	-0.14	p < .01
Attentiveness in school	4.41 ± 0.86	1.00	5.00	-1.59	2.34	p < .01
Total assessment of quality of life	4.33 ± 0.48	2.20	5.00	-1.17	1.62	p < .01

M = arithmetic mean; SD = standard deviation; MIN = minimum result; MAX = maximum result; Skewness = asymmetrical distribution; Kurtosis = tailedness of distribution; K-S = The Kolmogorov-Smirnov normality test

In the further statistical data analysis, the variables *Sadness* and *Loneliness* were recoded, as they did not have the same path as other variables. The variables with highest assessment were *Relationship with parents* ($M = 4.68$; $SD = 0.65$) and *Entertainment with friends* ($M = 4.53$; $SD = 0.79$). Such results were expected, as at the age of 10, both parents and peers have a very important role. Meeus and Deković (1995) point out that those children who have developed a quality relationship with their parents also have quality relationships with their peers. Furthermore, the individuals who build and maintain secure attachments to parents and peers will probably behave in a socially acceptable way (Carlo et al., 2012). Apart from that, *Loneliness* ($M = 1.47$; $SD = 0.89$) was also among the highly assessed variables, which could be taken as a potentially concerning piece of data. Loneliness, although it does not necessarily have to be negative, is usually considered an undesirable state (Heinrich & Gullone, 2006), and is often associated with feelings of rejection, unacceptance, lower self-esteem, and depression. Children who gave a high assessment of loneliness might be at risk, especially during the period of transition from childhood into adolescence, when they have higher expectations of joint activities, beliefs, wishes, values and confident relationships with friends (Parker et al., 1999; Parkhurst & Hopmeyer, 1999). The lowest values were found for the variables *School success* ($M = 4.12$; $SD = 0.85$) and *Leisure time* ($M = 4.22$; $SD = 0.94$). The final variable, *Total assessment of quality of life*, is a separate composite variable used for assessing the total quality of life of the pupils who participated in the research, and pupils perceive it as quite important ($M = 4.33$; $SD = 0.48$).

Table 3

Classification of Pupils According to Nutritional Status/Body Fat Percentage

Classification of respondents according to body fat percentage	N	Percentage %
Normal nutritional status	515	79.11
Overweight	82	12.60
Obese	54	8.29

As can be seen, pupils were divided into three groups according to the body fat percentage: those with normal nutritional status, those who are overweight and those who are obese (Table 3). The largest number of pupils have a normal nutritional status ($n = 515$), while the number of those whose health status is at risk in terms of body fat percentage, i.e., those who are obese, is the lowest ($n = 54$).

Examining the Existence of Differences in the Quality of Life According to the Level of Nutritional Status of Fourth-Grade Pupils

Table 4 shows the results of Levene's test for testing the equality of variance values when determining the difference in quality of life in terms of the nutritional status of primary school pupils. It is evident that the test shows that variances are not homogenous,

so in the further analysis, Welch's variance analysis (ANOVA) was used, as it does not require a precondition of variance homogeneity.

Table 4

Levene's Test Results for Assessment of Variance Homogeneity to Determine the Difference of Quality of Life in Terms of Nutritional Status

	F-value	p-level
Quality of life	4.69	0.00

F = variance analysis coefficient; p = statistical analysis level

The results presented in Table 5 show the values of Welch's variance analysis (ANOVA), which make it clear that there is a statistically significant difference between the groups classified according to nutritional status. The pupils classified into three groups, according to their nutritional status, differ statistically significantly in the variable for assessing quality of life ($p = 0.01$) at the significance level of $p < 0.05$.

Table 5

The Results of Variance Analysis/ Welch's F test for Determining the Differences in Quality of Life in Terms of Primary School Pupils' Nutritional Status

	df between groups	df within a group	F	p
Quality of life	2	101	5.55	0.01*

*df between groups – degrees of freedom between groups; df within a group = degrees of freedom within a group; F – Welch's F value; p = Welch's value; *at an error level p < 0.05*

Table 6 shows that there is no statistically significant difference in quality-of-life self-assessment between the pupils with normal nutritional status and those who are overweight ($p = 0.06$). In addition, the comparison between overweight and obese pupils did not reveal any statistically significant differences in quality-of-life self-assessment ($p = 0.17$). However, it is evident that pupils with normal nutritional status have significantly higher quality of life self-assessment than obese pupils ($p = 0.00$).

Table 6

The Results of the Mann-Whitney U Test for Determining the Differences in Quality of Life According to Nutritional Status of Primary School Pupils

	Quality of life AS±SD	U	z	p
Normal-overweight	4.36 ± 0.46 – 4.28 ± 0.48	18348.00	1.91	0.06
Normal-obese	4.36 ± 0.46 – 4.12 ± 0.57	10412.00	3.04	0.00*
Overweight-obese	4.28 ± 0.48 – 4.12 ± 0.57	1903.50	1.38	0.17

*AS = arithmetic mean; SD = standard deviation; U = The Mann–Whitney U test; z = standardized value; p = significance; *at error level p < 0.05*

Statistically significant difference was found in other studies as well (Gu et al., 2016; Delgado Floody et al., 2019). Meixner et al. (2020) state that in Germany, a statistically significant difference was found in the quality of life of children aged 11–17 years when comparing those with normal nutritional status with those who are overweight and obese. The same author claims that boys exhibited a significant correlation between nutritional status and physical and psychological well-being, while in girls, the correlation was found only in the physical well-being domain. On a sample comprising primary school pupils in England, a statistically significant correlation was also found between the physical and psychological well-being domains and the Body Mass Index (Basterfield et al., 2021). Khodaverdi et al. (2011) pointed out that social, physical, and school functioning were significantly reduced in obese children, in comparison with children who have normal weight (age 9–11). The correlation between nutritional status and the physical well-being domain, mood and self-realization domain was found in girls in Italy. Girls with lower body mass had higher results for quality of life in comparison with those who were overweight and obese (Mastorci et al., 2021). In boys with normal nutritional status, the correlation was found only between the physical well-being domain and emotional functioning, in comparison with the group of obese boys (Mastorci et al., 2021). It should be pointed out that in some studies, no correlation was found between nutritional status and quality of life (e.g., Pastor et al., 2022; Jalali-Farahani et al., 2016).

In recent decades, the prevalence of obesity in children has increased dramatically and childhood overweight is recognized as one of the most serious, complex, and pressing health challenges (Di Cesare et al., 2019). Childhood overweight has a substantial negative impact on daily functioning and well-being (van de Pas et al., 2023). Rankin et al. (2016) pointed out that childhood obesity stigma, teasing, and bullying are pervasive and can have serious consequences for emotional and physical health and performance. A possible explanation why obese pupils in our study have a lower assessment of quality of life could be found in a feeling of being rejected by their peers and loneliness. These children are often teased, ridiculed, insulted, or isolated and neglected. Obese children probably find it more difficult to make friends due to the negative experiences. Their peers rarely include them in joint activities, especially sports activities, which results in physical inactivity and more negative health status indicators. That, in turn, can lead to even greater obesity.

Conclusion

This research contributes to a better understanding of the quality of life of children attending primary school. The difference in the assessment of quality of life between children with normal nutritional status and those who are obese is evident in a larger number of studies, as well as in this one. The potential negative impact of obesity

on children's physical and psychological health, well-being, mood, emotions, and self-realization is not to be disregarded.

A change in lifestyle and habits can significantly improve the current state, as timely interventions at an early age which affect health positively can have a positive effect on the quantitative and qualitative indicators. Programs designed to introduce healthy eating habits in children and raise the level of total physical activity in the entire vertical organization of the education system in the Republic of Croatia could help raise children's quality of life.

Although this research was not carried out on a representative sample, its results might be used as an indicator of the direction of future research on the quality of life and morphological status of children and young people. It is necessary, through various programs, to motivate children to accept the lifelong concept of a healthy lifestyle.

Acknowledgements

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Pradinių klasių mokinių gyvenimo kokybė ir mityba: Kroatijos duomenys

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Santrauka

Šio tyrimo tikslas – nustatyti pradinių klasių mokinių gyvenimo kokybę atsižvelgiant į jų mitybos būklę. Šiame tyrime dalyvavo Kroatijos Respublikos 16-os pradinių mokyklų 651 ketvirtų klasių mokinys ($M_{amžius}$ = 10,38 ± 0,50 metų). Šiame tyrime gyvenimo kokybei įvertinti buvo naudojama sutrumpinta KIDSCREEN-10 indekso klausimyno kroatų versija. Kūno

ūgis buvo matuojamas naudojant nešiojamąjį stadiometrą, o kūno sudėtis matuojama naudojant dviejų dažnių kūno sudėties analizatorių (TANITA DC-360P). Aukščiausiai vertinami gyvenimo kokybės kintamieji buvo šie: santykiai su tėvais, pramogos su draugais ir vienatvė. Žemiausios vertės kintamieji buvo sėkmė mokykloje ir laisvalaikis. Pagal kūno riebalų procentą nustatyta, kad 79,11 proc. mokinių laikosi normalios mitybos, 12,60 proc. turi antsvorio ir 8,29 proc. yra nutukę. Nustatytas statistiškai reikšmingas gyvenimo kokybės įsivertinimo skirtumas tarp mokinių, kurių mitybos būklė normali, ir tų, kurie yra nutukę. Gyvenimo būdo ir įpročių pakeitimas gali žymiai pagerinti esamą būklę, nes savalaikės intervencijos ankstyvajame amžiuje, kurios teigiamai veikia sveikatą, gali turėti teigiamą įtaką kiekybiniams ir kokybiniams rodikliams. Programos, skirtos sveikos vaikų mitybos įpročiams diegti ir fizinio aktyvumo lygiui visoje švietimo sistemoje didinti, galėtų padėti kelti vaikų gyvenimo kokybę.