

ORIGINAL RESEARCH PAPER

## ASPECTS REGARDING THE EFFECTS OF THE COVID-19 PANDEMIC ON THE 10 – 11-YEAR-OLD CHILDREN'S ACTIVE MOTOR, DIETARY, AND PSYCHOLOGICAL BEHAVIOR

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**Abstract:** Child obesity has become a phenomenon that is increasingly difficult to counteract because of their lifestyle and diet. The extra weight leads to, besides physical disorders, such as high cholesterol and diabetes, a series of psychological disorders represented by the lack of self-confidence and depression. Physical activity was strongly affected during the COVID-19 pandemic because of the imposed restrictions. The children had to study online classes a large portion of their time, which has contributed to a significant increase in the hours they have spent in front of a computer. The objective of this study was to emphasize the effects of the Coronavirus pandemic on the relation between the active motor behavior, the dietary behavior, and the psychological behavior in 10-11-year-old children of Bacau, Romania. This research is an observational study conducted by identifying, assessing, and establishing certain correlations between the aforementioned factors, based on questionnaires filled by the children's mothers. Of the main statistical markers, the following were used: the Cronbach's alpha fidelity index, and the correlation coefficients, in order to establish the validity of the questionnaires, and the significance level of the correlations between the studied aspects.

**Keywords:** *modifications behavior, nutrition children, pandemic*

## INTRODUCTION

A healthy diet is essential for all children to have healthy growth and development, both mentally and physically. To meet nutritional requirements, children need regular, nutrient-dense meals. Also, effective hydration is a key strategy for safe and optimal performance. Although water is what provides the optimal intake of electrolytes for the body, children often consume sugar-rich, carbonated or non-carbonated juices.

Obesity is the result of malnutrition, where a child receives far more calories than his body needs, and often from nutrient-poor sources. This can lead to a multitude of negative effects on the cardiovascular system, hormonal balance, and the symptoms and side effects will vary with other nutritional deficiencies and toxicities related to the child's specific diet [1].

The nutrients needed by the human body, child or adult, can be grouped into 7 major groups. Although they perform different and unique functions in the body, they are all essential because they work together and contribute to the health of the body.

Carbohydrates are a major source of energy for the body and come mainly from grains, but also from fruits, root vegetables, dry beans and dairy products. Proteins are contained in meat, fish, seafood, eggs, dairy products, dry beans, contributing to building, repairing and maintaining healthy body tissues. Fats serve as a source of energy and can be found in foods such as meat, fish, seafood, dairy products, nuts, seeds and oils. They are responsible for transporting fat-soluble vitamins such as vitamin A, D, E and K. Vitamins participate in various body metabolisms, such as maintaining healthy skin and hair, building bones, and releasing and using energy from food. Vitamins can be classified into water-soluble and fat-soluble vitamins.

Minerals such as Ca, Mg, P, Fe are a group of essential nutrients that regulate many body functions such as fluid balance, muscle contraction and nerve impulse transmission. They also contribute to body structure and build strong, healthy bones. Dietary fiber helps stabilize blood sugar, promotes gastrointestinal health and prevents constipation. Water is the most abundant substance in the human body and is also an essential nutrient for maintaining our health. Major functions of water include regulating body temperature, producing body fluids, transporting nutrients, and eliminating waste [2].

Children need different amounts of specific nutrients at different ages, activity level and other characteristics.

According to many Dietary Guidelines, foods with no or limited sugar, no saturated fat or added salt are considered nutrient-dense and eating them helps children get the nutrients they need while limiting total calories.

According to Order no. 1563/2008 for the approval of the List of foods not recommended for preschoolers and schoolchildren and the principles underlying a healthy diet for children and adolescents from Romania [3], the daily required calories, nutrients and minerals for children are: boys 10 - 11 years – calories 2400 - 3100 kcal, proteins

84 - 105 g, carbohydrates 351 - 416 g, lipides 77 - 83 g; girls 10 - 11 years calories 2400 - 2600 kcal, proteins 84 - 89 g, carbohydrates 330 - 349 g, lipides 65 - 70 g; minerals – Ca 1200 mg, P 800 mg, Mg 270 mg, Fe 12 mg, Zn 12 mg, I 0.12 mg.

Eating healthy as a child reduces a child's chance of developing health problems as they get older. A healthy, balanced diet includes foods from all 5 food groups: fruits,

vegetables, grains, protein, and dairy. Also, it means that children are less likely to develop chronic diseases such as heart disease, type 2 diabetes, obesity and some cancers. It will also mean they feel better and enjoy life more. To stay healthy and maintain a healthy weight, children need to be physically active and eat the right amount of nutrients to balance the energy they use.

Some foods (sweet biscuits, cakes and desserts, processed meat and sausages, confectionery and chocolate, burgers, pizza, chips and other fatty and/or salty snacks) are not essential in children's diets. These are those high in saturated fat, added sugars or added salt. That is why they should be limited in the child's daily diet, as the consumption of large amounts of such foods can lead to overweight children or the development of diseases later in life [4].

The coronavirus pandemic has affected the entire global population, including children, adults, and the elderly, in various aspects. On February 26, 2020, the first case of coronavirus was recorded in Romania, and two weeks later, on March 15, 2020, the President of Romania signed a decree declaring a state of emergency in the country for 30 days. Schools were closed on March 11, 2020, initially for 10 days with the possibility of extension. The closure was extended until the end of the school year, and students were unable to return to schools, leading the whole world to resort to modern methods to continue with students' education. Numerous applications were created to support online classes, such as Microsoft Teams, Google Classroom, Zoom, which tried to maintain students' education in motion. The 2020 - 2021 school year was conducted with alternating periods of online and in-person activities, depending on the number of infections in a class or school. On-site teaching activities resumed entirely in September 2021. The closure of schools has led to a fundamental reorganization of the entire family's lifestyle and, consequently, that of the students. Numerous studies have been conducted in most countries, focusing on observing the behavior of different categories of the student population during the pandemic in terms of nutrition, emotions, and physical aspects. It is known that intellectual, emotional, volitional processes, as well as various personality characteristics, are formed and developed during different age periods [5]. Furthermore, the world of sports is always connected to a triadic tension between nature, culture, and individuality [6]. Sports are some of the most dynamic social activities aimed to perfect the human being [7].

Studies conducted by Scarmozzino and Visioli [8], and Ammar *et al.* [9] have focused on identifying changes in eating habits, resulting in under or overeating, depending on the severity of the stressor.

Another study conducted by Liboredo *et al.* [10], targeted eating habits under stressful conditions and associated factors in a group from Brazil. However, information about the impact of the COVID-19 pandemic on motor behavior, eating behavior, and perceived stress is still limited. Silva *et al.* [11] showed that a significant number of children had an extended sleep period, going to bed later and waking up later, which led to a decrease in physical activity.

The issue of nutrition in children has become extremely important because creating correct eating habits is practically the most effective method of maintaining good long-term health. Lesser and Nienhuis [12] concluded that physical activity was modified during the COVID-19 pandemic, with 40.5 % of the investigated individuals becoming much more inactive. In a study conducted by Moore *et al.* [13], canadian children did

not achieve the goals for physical activity (76.2 %), but they met the recommendations for sleep time (69.9 %). This is particularly important because negative exposure to these behaviors is associated with increased body weight, impaired social and motor development, and decreased cardiorespiratory fitness in children.

The results of the study conducted by Teixeira *et al.* [14] show that inactivity, sedentary behavior, and lack of a consistent exercise program can be both causes and effects of overweight. On the other hand, the eating behavior of the family greatly influences the culinary preferences of children. Nevertheless, this family behavior is also determined by social, economic, and cultural factors. The issue of nutrition and its correlation with physical exercise during the pandemic was also addressed in the study conducted by Ababei *et al.* [15] published in 2020 but authors referred to adults.

Health can be negatively affected by several psychological factors and a lack of physical activity, therefore, a diet, combined with moderate physical activity, can improve it considerably. Motor training induces an adaptive biochemical response that could lead to an increase in micronutrient intake and absorption, maintaining good nutritional status [15].

Another case study [16] highlighted the importance of dietary intake based on the environment and the physical effort exerted.

In terms of eating habits, social distancing can affect eating patterns [17], increasing consumption of sweets and high-calorie foods as found in studies conducted during quarantine in different countries [17 – 20]. In an Italian study [21] conducted during the COVID-19 pandemic, almost half of the respondents felt concerned about their eating habits, increased food consumption to feel better, in response to negative emotional stimuli.

A child's daily diet should be rich in vegetables, fruits, legumes, low-fat or unprocessed grains, potatoes, nuts, and foods of animal origin, i.e., meat, dairy products, fish, or eggs, in amounts adapted to the child's nutritional needs. Children should consume unsaturated fats, i.e., those contained in fish, avocados, nuts and olive oil. Their daily diet should not include saturated fat, i.e., lard, coconut oil or fatty meat. The diet should include dairy products in the recommended amounts, which provide vitamins D, A and B2, as well as beneficial fatty acids. The child should eat a variety of lean meat and fish instead of processed meat that contains a lot of salt and fat. Highly processed foods are contraindicated in the child's diet, i.e., fast food, various ready-to-eat snacks, pizza and frozen cakes and pastries, due to their content of trans fatty acids.

Based on these premises, the study aimed to evaluate the motor, psychological, and eating behaviors of 10-11-year-old children in Bacău, Romania, during the social isolation imposed by the COVID-19 pandemic.

## MATERIALS AND METHODS

The present study is a cross-sectional, municipality-level study with a qualitative approach conducted based on an anonymous opinion survey, which included 30 questions organized into 3 sections: socioeconomic data (child's/mother's age, mother's educational level, housing type, number of family members), questions related to the motor and psychological behavior of children during the pandemic (preference for physical exercise, frequency of physical exercise, time allocated to physical activities,

mode of physical exercise, changes in psychological behavior - restlessness, anxiety, or nervousness), and questions related to the eating behavior of 10 - 11-year-old children (4th-grade pupils), including favorite foods from the animal protein group and their frequency of consumption, favorite vegetables and their frequency of consumption, favorite foods from the eggs and milk group and their frequency of consumption, favorite foods from the sweets group and their frequency of consumption. The responses consisted of choosing only one answer option.

The completion of the questionnaire was carried out exclusively by the mothers of the children. They were asked to complete a single questionnaire for only one child, even if they had 2 or more children aged 10 - 11 years (e.g., twins or born within a 1-year interval).

The questionnaires were printed and physically administered in March 2022, after all activities resumed on-site. We chose this distribution method because not all participating mothers had computer literacy skills. To ensure a proper understanding of the questionnaire items, two training sessions were organized for the mothers who voluntarily participated in this research. During these meetings, the informed consent form regarding the conditions of the research was signed. The mothers were informed that the questionnaire was anonymous, that they had the possibility to withdraw at any time by not completing it, that no personal data was required, and that the completion time would not exceed 15 minutes. The questionnaire was developed by specialists and pre-tested on a sample of 30 individuals (mothers who did not participate in the research).

After verification, some responses were adjusted as follows: Variable Q10 was recoded into nominal form with 3 response options: 1- Age 30 - 39, 2 - Age 40 - 49, 3 - Age 50 - 59. Variables B1, B3, B4, B6, B8 were recoded into ordinal format, using a Likert scale with 4 levels (Strongly agree, agree, disagree, strongly disagree). A total of 230 questionnaires were distributed, and 204 were received. After entering the responses into the database, 191 questionnaires were validated. The non-validated questionnaires had missing or incorrect information (e.g., age of 9-year-old children). The data were processed using SPSS 26 software, conducting simple frequency analyses, correlations, and cross-tabulations.

The analysis of simple frequencies shows that out of the total of 191 children, 113 are 10 years old (59.2 %) and 78 (40.8 %) are 11 years old at the time of the study. Regarding the gender of the children, boys account for a higher percentage with 60.2 % compared to girls at 39.8 %. As for the number of family members, out of the 191 children, 115 live in families of 4 members (60.2 %), followed by those with 3 and 5 members equally, at 16.2 %. The smallest percentages are recorded for children living in families of 2 members (5.8 %) and 6 members (1.6 %).

Regarding the type of dwelling, 74 of the children (38.7 %) live in 3-room apartments, 58 of them (30.4 %) in 2-room apartments, 53 (27.7 %) live in houses, 4 (2.1 %) live in 4-room apartments, and 2 (1 %) in 1-room apartments.

The mothers of the participating children have the following characteristics: 92 of them (47.6 %) fall into the age group of 40 - 49 years, 91 (47.6 %) between 30 - 39 years, and only 8 (4.2 %) between 50 - 59 years. Furthermore, 44.5 % of them have university education, 17.8 % have completed postgraduate studies, 29.3 % have completed high school, and 8.4 % have completed middle school.

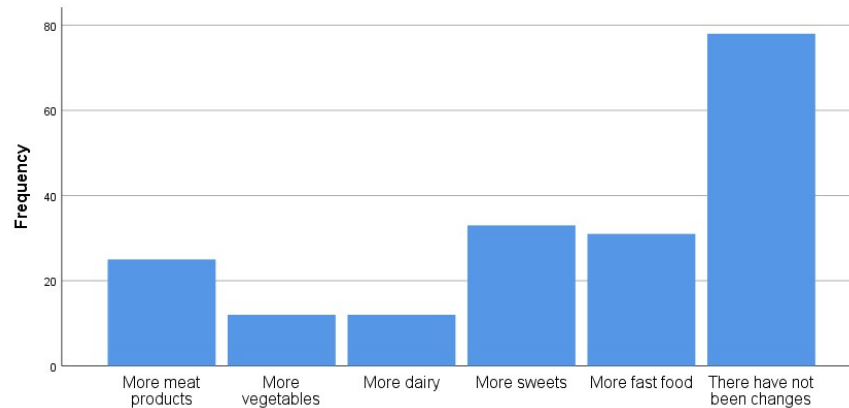
The studies involving human participants were reviewed and approved by University Ethics Committee from the “Vasile Alecsandri” University of Bacău, Romania.

## RESULTS AND DISCUSSION

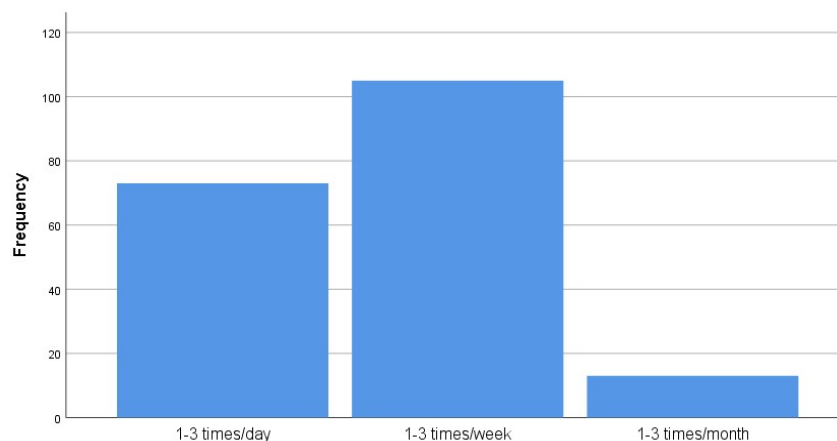
A healthy diet must be combined with physical activities depending on the abilities of each child. During the pandemic, outdoor movement and play was somehow restricted, children having to adapt to the existing conditions.

A food frequency questionnaire was used, with the following groups: meat (boiled, fried, oven baked meat, poultry, pork, fish), vegetables (potatoes, beans/green beans, broccoli, carrots, bell pepper, cauliflower), eggs, milk and dairy products (yogurt, salted cheese, melted cheese, hard cheese, sour cream), sweets (chocolate, cookies, pies, candy, soda), and fast-food (hamburgers, pizza, chips, fries). The frequency of consumption of the food groups and the differences between them were calculated.

Regarding the change in food preferences during the pandemic, over 33 % from the 191 respondents said that children consumed more sweets and fast food than before (Figure 1), the highest frequency of consumption of favorite foods (55 %) being 1 - 3 times / week (Figure 2).



**Figure 1.** Frequency of changes in the food preferences during pandemic vs before



**Figure 2.** Frequency of consumption of favorite food during pandemic

During the pandemic, depending on the age and gender of the children, the statistical analysis showed that there is a correlation between them and food preferences. Table 1 shows that the premises of applying the chi-square test are not met, but the Fisher test reveals a correlation between the age of the participants and the type of preferred food ( $F = 37.27$ ,  $p < 0.001$ ).

**Table 1.** Which aliment group is preferred by your child?

		Age		Total		
		10	11			
Meat and meat products	Count	26	20	46		
	Expected Count	27.2	18.8	46.0		
Eggs	Count	1	0	1		
	Expected Count	.6	.4	1.0		
Vegetables	Count	1	6	7		
	Expected Count	4.1	2.9	7.0		
Fruits	Count	2	0	2		
	Expected Count	1.2	.8	2.0		
Dairy	Count	2	7	9		
	Expected Count	5.3	3.7	9.0		
Sweets (including soda)	Count	8	0	8		
	Expected Count	4.7	3.3	8.0		
Fast food aliments (hamburgers, chips, pizza, fries)	Count	10	23	33		
	Expected Count	19.5	13.5	33.0		
All of them in equal measure	Count	63	22	85		
	Expected Count	50.3	34.7	85.0		
Total	Count	113	78	191		
	Expected Count	113.0	78.0	191.0		
Chi-Square Tests						
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	37.888 <sup>a</sup>	7	.000	.000		
Likelihood Ratio	42.376	7	.000	.000		
Fisher's Exact Test	37.278			.000		
Linear-by-Linear Association	2.551 <sup>b</sup>	1	.110	.116	.059	.006
N of Valid Cases	191					

The Fisher test also reveals a correlation between children's age and changes in food preferences due to the pandemic ( $F = 19.29$ ,  $p < 0.001$ ) (Table 2).



**Table 2.** Have there been changes in the food preferences during the pandemic?

		Age		Total		
		10	11			
More meat products	Count	7	18	25		
	Expected Count	14.8	10.2	25.0		
More vegetables	Count	4	8	12		
	Expected Count	7.1	4.9	12.0		
More dairy	Count	7	5	12		
	Expected Count	7.1	4.9	12.0		
More sweets	Count	18	15	33		
	Expected Count	19.5	13.5	33.0		
More fast food	Count	22	9	31		
	Expected Count	18.3	12.7	31.0		
There have not been changes	Count	55	23	78		
	Expected Count	46.1	31.9	78.0		
Total	Count	113	78	191		
	Expected Count	113.0	78.0	191.0		
Chi-Square Tests						
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	19.604 <sup>a</sup>	5	.001	.001		
Likelihood Ratio	19.674	5	.001	.002		
Fisher's Exact Test	19.292			.001		
Linear-by-Linear Association	17.941 <sup>b</sup>	1	.000	.000	.000	.000
N of Valid Cases	191					

**Table 3.** Which aliment group is preferred by your child?

		Gender		Total
		Male	Female	
Meat and meat products	Count	39	7	46
	Expected Count	27.7	18.3	46.0
Eggs	Count	1	0	1
	Expected Count	.6	.4	1.0
Vegetables	Count	0	7	7
	Expected Count	4.2	2.8	7.0
Fruits	Count	1	1	2
	Expected Count	1.2	.8	2.0
Dairy	Count	7	2	9
	Expected Count	5.4	3.6	9.0
Sweets (including soda)	Count	1	7	8
	Expected Count	4.8	3.2	8.0
Fast food aliments (hamburgers, chips, pizza, fries)	Count	20	13	33
	Expected Count	19.9	13.1	33.0
All of them in equal measure	Count	46	39	85
	Expected Count	51.2	33.8	85.0
Total	Count	115	76	191
	Expected Count	115.0	76.0	191.0



**Table 3.** Which aliment group is preferred by your child? (continuation)

Chi-Square Tests						
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2- sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	33.013 <sup>a</sup>	7	.000	.000		
Likelihood Ratio	37.683	7	.000	.000		
Fisher's Exact Test	33.803			.000		
Linear-by-Linear Association	8.408 <sup>b</sup>	1	.004	.004	.002	.000
N of Valid Cases	191					

Table 3 shows that, the Fisher test reveals a correlation between gender of the participants and the type of preferred food ( $F = 33.80$ ,  $p < 0.001$ ). Girls and boys have different preferences regarding their favorite food.

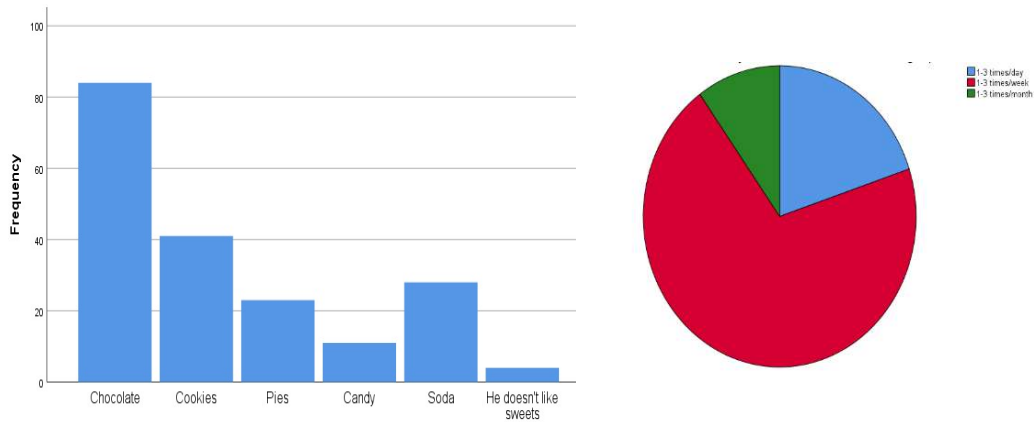
Also, from the recorded data, a statistically significant correlation can be observed between the gender of the children and the changes in food preferences. The pandemic affected girls differently compared to boys ( $F = 17.62$ ,  $p < 0.001$ ) (Table 4).

**Table 4.** Have there been changes in the food preferences during the pandemic?

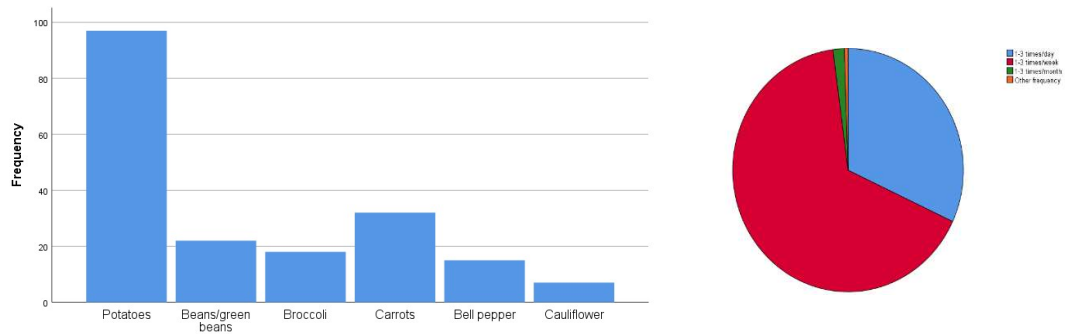
			Gender		Total	
			Male	Female		
	More meat products	Count	23	2	25	
		Expected Count	15.1	9.9	25.0	
	More vegetables	Count	9	3	12	
		Expected Count	7.2	4.8	12.0	
	More dairy	Count	8	4	12	
		Expected Count	7.2	4.8	12.0	
	More sweets	Count	17	16	33	
		Expected Count	19.9	13.1	33.0	
	More fast food	Count	19	12	31	
		Expected Count	18.7	12.3	31.0	
	There have not been changes	Count	39	39	78	
		Expected Count	47.0	31.0	78.0	
Total		Count	115	76	191	
		Expected Count	115.0	76.0	191.0	
Chi-Square Tests						
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	16.301 <sup>a</sup>	5	.006	.005		
Likelihood Ratio	18.823	5	.002	.003		
Fisher's Exact Test	17.624			.003		
Linear-by-Linear Association	13.301 <sup>b</sup>	1	.000	.000	.000	.000
N of Valid Cases	191					

The percentages of sweets consumption 1 - 3 times/day and 1 - 3 times/week were 19.9 and 70 % respectively, children preferring chocolate in proportion of 44 % (Figure 3),

while the percentages of vegetables consumption were 31.9 and 66 % respectively, with potatoes being preferred in proportion of 51 % (Figure 4).

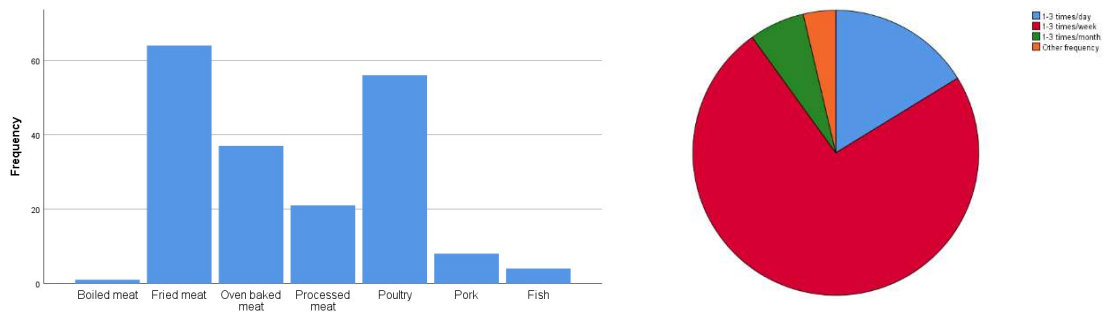


**Figure 3.** Children's preference for sweets

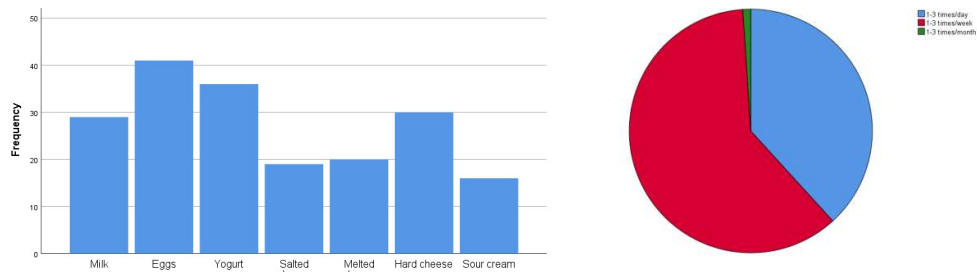


**Figure 4.** Children's preference for vegetables

33 % of children preferred fried meat on 1 - 3 times/week (74 %), 21.5 % eggs and 19 % yogurt (61 %) (Figures 5 and 6).



**Figure 5.** Children's preference for meat



**Figure 6.** Children's preference for dairy products and eggs

From the cross-analysis of data regarding the age of the children and their preference for physical exercise, no statistically significant correlation is observed. In this case,  $\chi^2 = 6.099$ , and  $p > 0.05$ . The fact that the ages of 10 - 11 years belong to the same stage of development, coupled with the somewhat similar leisure activities for these age groups, the results are not surprising. Similarly, no statistically significant correlation is observed between the gender/sex of the children and their preference for physical exercise. Here  $\chi^2 = 6.296$ , and  $p > 0.05$ . As with the age variable, in the case of the gender/sex variable of the children, correlated with their preference for physical exercise, the results do not show significant differences, which is in line with the referential behavioral specificity. Both girls and boys (at the age of normative conformity of social groups, namely peer groups) experience equal involvement in certain physical activities, as well as refusal or reluctance to engage in them.

Also, a lack of correlation was encountered between the age of the mother and the physical exercise practiced by the children, where  $\chi^2 = 8.895$ , and  $p > 0.05$ . According to the data presented in point 2, all the mothers included in the research sample have the age specific to the stage of psychological maturity. Psychological maturity, correlated with parenthood, translates into specific behaviors, such as *stimulating collaborative behaviors* with the child, where the parent creates a synchronized dyadic relationship both verbally and behaviorally; the parent's ability to repair the relationship when they encounter an impasse, an intrapersonal or interpersonal conflictual situation (certainly, the manifestation of this behavior during the pandemic situation represented an important variable in understanding the situation and the action of seeking and identifying healthy strategies to maintain a balanced life through the practice of a healthy, balanced lifestyle, where sports, emotional communication, and rational nutrition were daily, healthy routines); *emotional communication* with the child is a type of behavior in which the child's experiences, joys, and frustrations are monitored by the parent (the parent who understands the child's needs communicates empathically with them, helping the child take ownership of them, understand them, and use them positively in their own experience) [22]. Therefore, even though mothers can be classified into certain ranges of chronological age quantification, the existence of parental maturity certifies why there is no significant difference between the mother's age variable and the stimulation of physical exercise by the children.

It should be noted that the same lack of correlation was observed between the mother's level of education and the preference for physical exercise by the children ( $\chi^2 = 12.620$ ,  $p > 0.05$ ). Although the mothers included in the research sample have different levels of educational preparation (ranging from middle school to postgraduate studies), the need

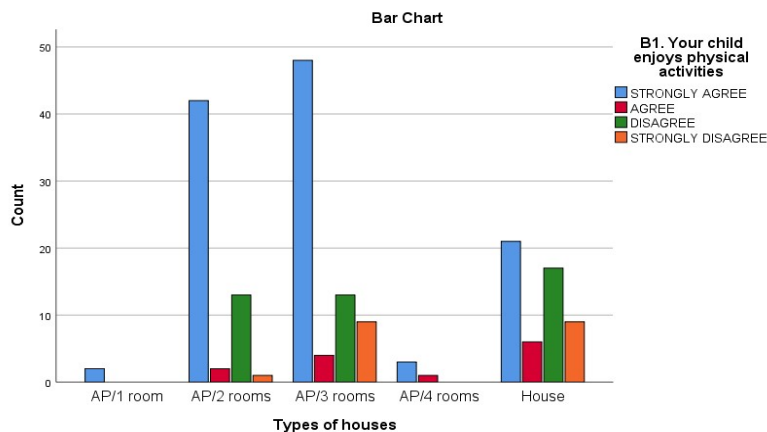
for stimulating physical activity is self-evident. Wallon [23] places two key concepts of interest for this research at the center of development: the concept of emotion and the *concept of movement*. Movement is seen by the author in two senses: as *physical movement* that ensures the child's physical growth and development, but also as *psychological, internal movement*. Movement sets in motion all the components of the human body, which determines the transformation of physical and psychological potentialities into manifest, full, and healthy behaviors.

Another analysis of the data suggests the impossibility of using the  $\chi^2$  test. The Fisher test for the independence of variables does not reject the null hypothesis ( $F = 16.46$ ,  $p > 0.05$ ), so we can conclude that there is no correlation between the number of family members and the preference for physical exercise by the children.

Recent studies [24 – 26] identify the harmful effects of social isolation, lack of physical activity, and the onset of depressive and anxiety disorders among children, adolescents, and adults.

However, analyzing the type of housing and preference for physical exercise, the chi-square test reveals a weak correlation between them, as it is invalidated by the violation of the application premises. The Fisher test for independence rejects the null hypothesis ( $F = 23.068$ ,  $p < 0.05$ ), allowing us to conclude that there is a correlation between the type of housing and the preference for physical exercise.

From the analysis of Figure 7, a correlation can be observed between the preference for physical exercise among children living in apartments with 2 or 3 rooms compared to other types of housing.

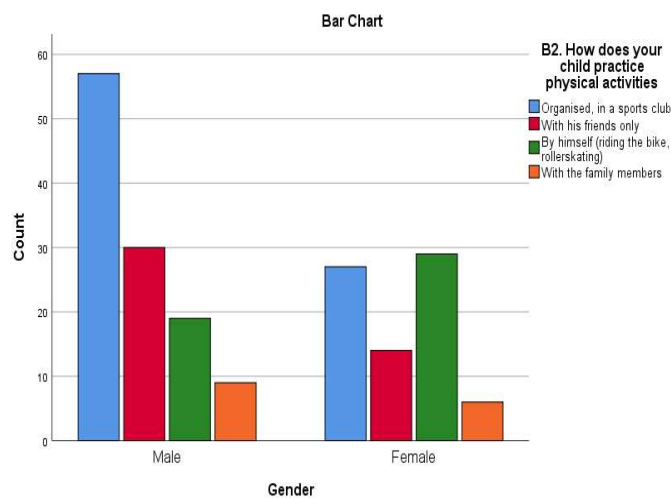


**Figure 7.** Children's preference for physical exercise depending on the type of housing

The reported preference for engaging in physical exercises in a pandemic context, according to the type of housing, can have several possible explanations. For children coming from families living in small spaces, such as a one-room apartment, staying together in a confined and limited space represented a normality even before the pandemic. Additionally, one can correlate this aspect with the economic level of these families: the lower the economic resources, the less availability there is to invest in health, including the stimulation of non-formal activities related to sports. Furthermore,

another possible cause could be the lack of an adult parent who can supervise the activities carried out by children while staying at home in real-time.

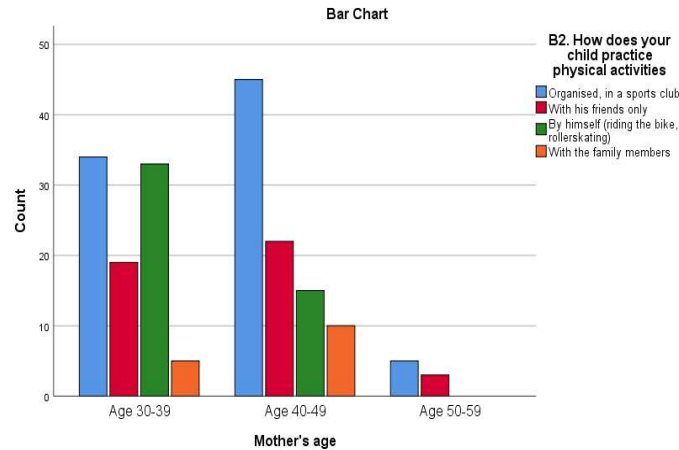
A statistical correlation is also observed between gender and the mode of practicing physical exercise ( $\chi^2 = 11.742$ ,  $p < 0.05$ ). Girls and boys have different ways of practicing physical exercise (Figure 8).



**Figure 8.** Correlation between gender and mode of physical exercise

The analysis of gender differences in the practice of certain sports activities, in relation to the social dimension of psychological life, allows us to highlight some specific psychological aspects of the 10 - 11-year-old age group. According to the psychosocial theory of development [27], children at the ages of 10 and 11 are at the end of the stage characterized by *hard work, competence versus inferiority*. As a result, social evaluation tends to be very important for children. Additionally, there are gender differences in preference for the social environment. Girls tend to focus more on themselves (considering the onset of puberty), while boys are much more active in the social environment. From this perspective, age and gender characteristics have influenced the preferences expressed by children regarding the environment for practicing certain sports activities during the COVID-19 pandemic period. While boys clearly tend to prefer practicing sports activities in a specialized club or in the company of friends, girls show a preference for types of sports activities practiced alone, followed by clubs or sports facilities. For both genders, there is a low attractiveness in practicing sports activities with family members. Regarding the tendency for behavioral changes based on the gender variable, no significant differences were recorded. However, there is a slight tendency for boys to experience more passivity and negative emotions in the realm of anger and frustration compared to girls. This slight tendency present in the daily behavior of boys can be explained through various psychological variables, such as the level of psychological resilience (which is lower in males compared to females in situations perceived as stressful) and the lack of control over specific experiential situations, in this case, the submission to the restrictions associated with the onset of the COVID-19 pandemic (males exhibit a higher behavioral index in the need for control).

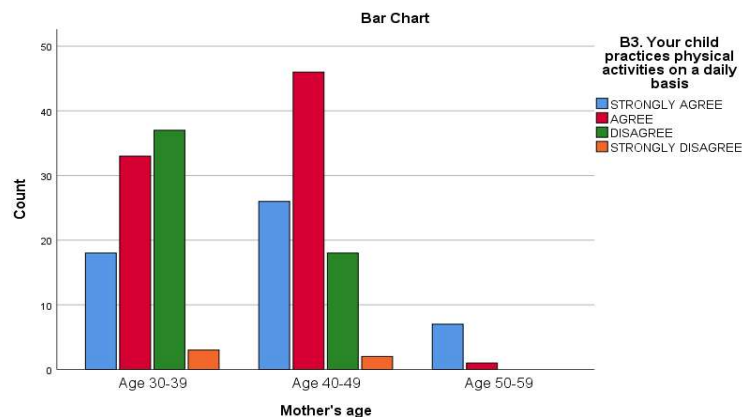
Both the chi-square test and the Fisher test reveal a statistically significant correlation between the mother's age group and the mode of physical exercise practiced by children ( $F = 13.828$ ,  $p < 0.05$ ) (Figure 9).



**Figure 9.** Correlation between the age segment of the mother and the way of practicing physical exercise

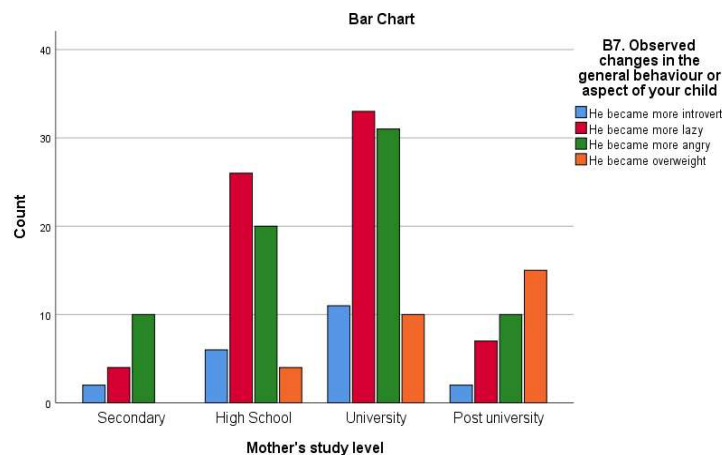
When considering the mother's age group and the mode of daily activities, a preference for practicing them in a club or sports facility is observed compared to other possible variables. In the age group of 30 - 39 years, there is a statistically similar preference between practicing sports in a club and doing it alone. However, in the age group of 40 - 49 years, there are significant differences, with the clearest option being to practice sports in a gym or club. It is presumed that this preference shown by children with mothers in the 40 - 49 age group is due to the emotional and material support provided by parents, more than other children. Alternatively, since sports facilities were prohibited during the pandemic period, this preference could be related to a tendency to test the restrictive limits imposed. Mothers in the 40 - 49 age group tend to be more balanced, communicative, and emotionally mature than younger or older mothers. The obtained results can also be explained by the presence of better communication between parents and children both before and during the pandemic.

The Fisher test reveals a statistically significant correlation between the mother's age group and the daily practice of physical exercise by children ( $F = 22.508$ ,  $p < 0.05$ ). In this case, the chi-square test cannot be applied (Figure 10). The chronological and psychological maturity of the mother, in the age intervals of 40 - 49, 30 - 39, and 50 - 59 (listed according to significance level), contributes to a better grounding of children in the idea of daily athletic activities.



**Figure 10.** Correlation between the age segment of the mother and the daily practice of physical exercise by the children

There is a statistically significant correlation between the mother's education level and changes in children's behavior during the pandemic period ( $\chi^2 = 33.265$ ,  $p < 0.05$ ) (Figure 11).



**Figure 11.** Correlation between mother's education level and children's behavioral changes

Analyzing age and behavior changes statistically, the chi-square test reveals a significant correlation between them ( $\chi^2 = 9.045$ ,  $p < 0.05$ ). In other words, 10-year-old children experienced different behavior changes compared to 11-year-olds.

Regarding age and the new situation experienced by children - the COVID-19 pandemic, the central issue correlates with the ability to understand what is happening. According to the psychogenetic theory of thinking development [28], children up to the age of

10 - 11 are in the stage of concrete operations. Therefore, they are very interested in the concrete, in what is tangible through the senses, in what is proximate and immediate. The one-year difference between the two groups of children mentioned in the



questionnaire applied to mothers was significant, in the sense that in general, 10-year-old children were more vulnerable to the onset of the pandemic situation in all four parameters considered (introversion-extroversion, activism-passivity, negative emotions, and body index).

## CONCLUSIONS

The COVID-19 pandemic has affected children's eating behavior and lifestyle. The pandemic has also had a significant impact on reduced levels of physical activity and increased screen time. Reducing time spent on physical activities as well as many other factors affected children's nutrition. The survey showed a decrease in daily vegetable consumption at the expense of sweets and fast food. More time spent at home allowed many families to prepare home-cooked meals together, but more parents admitted that their children maintained unhealthy eating habits during the pandemic.

Regarding motor behavior, the study highlights the fact that a significant factor in the intention to engage in sports activities during the pandemic depends on the specific lifestyle prior to the pandemic. The chance of being open to the idea of practicing sports activities is higher for those children (boys and girls) who were already involved in these activities, valued, and felt valued for engaging in them. Also, in stimulating the preference for engaging in physical activities during the pandemic context, an important role is played by how children, together with their parents, managed to psychologically cope with this new complex reality - the pandemic. Parents' awareness of the importance of psycho-motor activism is an important lever in activating motivation for movement in prepubescent children, regardless of gender variable.

From a social perspective, our study shows that those living in two or three-bedroom apartments were better socially integrated, had a much more active extracurricular life, had parents who were more flexible in dealing with the new situation, and as a result, had more access to age-specific activities that also involved physical exercise.

Children aged 10 - 11 are at the end of the stage characterized by industry versus inferiority, a stage in which the child learns the skills necessary for survival, economic and technical skills, integrates into school and the group of students, where they try to adapt to a cultural model. All these factors contribute to the development of competence and industriousness. Otherwise, they may experience feelings of failure and inferiority, leading to social isolation.

## AUTHOR CONTRIBUTIONS

Every author had an equal contribution in this study.

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