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**Original Article**

# SPORT PARTICIPATION IN RELATION TO MENTAL AND PHYSICAL PROBLEMS IN AN ITALIAN PRIMARY SCHOOL

## PARTICIPAÇÃO ESPORTIVA EM RELAÇÃO A PROBLEMAS MENTAIS E FÍSICOS EM UMA ESCOLA PRIMÁRIA ITALIANA

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**RESUMO**

A pandemia de covid-19 tem causado problemas fisiológicos como tosse e dores de cabeça, ou ligados à diminuição da actividade física e alterações na alimentação, problemas psicológicos como formas de depressão, medo, stress ou ansiedade e problemas sócio-relacionais em todo o mundo, mas teve um impacto ainda maior nas crianças, como evidenciado por numerosos artigos na literatura científica. O objetivo do presente estudo foi estimar a correlação entre a atividade esportiva e alguns problemas fisiológicos ou psicológicos. A pesquisa foi realizada em uma escola primária italiana usando questionários (PHQ-9 e um questionário ad-hoc)**.** O estudo envolveu 146 crianças com idades entre 6 e 11 anos, com uma idade média de 8,6 anos e um desvio padrão de 1,5 anos (8,6 ± 1,5 anos). Após a realização da avaliação postural, análise cinesiológica e questionários, foram calculados os valores associados à atividade esportiva, depressão, problemas posturais e hipermobilidade articular. Resultados: os resultados mostraram um aumento excessivo do IMC em crianças do primeiro ao quinto ano com um alto percentual de obesidade. Os dados mostraram que o aumento excessivo do peso corporal estava associado a problemas posturais que afetavam especialmente os pés (pés planos). Além disso, o valor sobre a perceção de depressão (PHQ-9) indicou um aumento durante o crescimento, mesmo que os valores não fossem altos e também fossem resultado de uma maior autoconsciência durante o crescimento. Os resultados das correlações estão de acordo com os encontrados na literatura científica referenciada. Foram encontradas correlações positivas entre o IMC e o pé plano, e entre o pé plano e os problemas posturais.Finalmente, as correlações estatisticamente significativas entre os resultados do PHQ-9 e o IMC e as horas de atividade esportiva realizadas mostraram mais uma vez como o esporte é importante como ferramenta para combater tanto o aumento da massa gorda (ou seja, a educação para um estilo de vida ativo correto) quanto o fenômeno depressivo. Em conclusão, os resultados do presente estudo, realizado em uma escola primária, embora limitados quanto ao tamanho da amostra, podem ser úteis para a reflexão e conscientização sobre o crescimento das novas gerações e sobre a importância do aspeto educacional da educação física (currículo) e atividades desportivas (atividades extracurriculares) destina-se a ensinar às crianças hábitos de vida ativos e saudáveis.

**Palavras-chave**: Educação física; Escola primária, Itália; Esporte; Doenças.

**ABSTRACT**

The covid-19 pandemic has caused physiological problems such as cough and headache, or linked to a decrease in physical activity and changes in diet, psychological problems such as forms of depression, fear, stress or anxiety and socio-relational problems in around the world, but it has had an even greater impact on children as evidenced by numerous articles in the scientific literature. The aim of the present study was to evaluate the correlation between sports activity and certain physiological or psychological problems. Research was carried out in an Italian primary school using questionnaires (PHQ-9 and an ad-hoc questionnaire). The research involved 146 pupils aged between 6 and 11 years (age 8.6 ± 1.5). After conducting postural assessment, kinesiological analysis and questionnaires, values associated with sporting activity, depression, postural problems, and joint hypermobility were calculated. The results showed an excessive increase in BMI in children ranging from first grade to fifth grade with a high percentage of obesity. The data showed that the excessive increase in body weight was associated with postural problems especially affecting the feet (flat feet). Also, the value on the perception of depression (PHQ-9) indicated an increase during growth, even if the values were not high and were also a result of a greater self-awareness during growth. The results of the correlations are in line with those found in the referenced scientific literature. Positive correlations have been found between BMI and flatfoot, and between flatfoot and postural problems. Finally, the statistically significant correlations between the PHQ-9 results and the BMI and the hours of sporting activity carried out showed once again how important sport is as a tool to counter with both the increase of fat mass (i.e. education in correct active lifestyle) and depressive phenomenon. In conclusion, the results of present study, conducted in a primary school, albeit limited in terms of the sample size, can be useful for reflection and awareness of the growth of new generations and on how important the educational aspect of physical education (curriculum) and sports activities (extra-curricular activities) is in order to teach children correct and healthy active lifestyles.

**Keywords**: Physical Education; Primary School; Italy; Sport; Diseases.

## Introduction

In all age groups, starting from the developmental one, the improvement of health and quality of life contributes to the maintenance of well-being and self-sufficiency in old age, and it also represents a tool for increasing productivity in working age. Furthermore, it can help to stem situations of social exclusion[1].

Statistical data issued by the World Health Organization (WHO) reveal that, in recent years, in Europe 86% of deaths and 77% of the loss of years of life in good health were caused by chronic non-communicable diseases (NCDs), such as cardiovascular disease, cancer, diabetes mellitus, chronic respiratory disease, mental health problems and musculoskeletal disorders, all of which share modifiable risk factors.

In modern society, the increase in comfort and in the level of living standards has led to a situation of physical disengagement so abnormal as to alarm most governments of the most technologically advanced countries. This phenomenon has been generating serious problems regarding physical and social maladjustment in a large part of the population, recognizable by evident and widespread paramorphism and dysmorphisms, especially among adolescents, as well as by chronic conditions that can lead to pathophysiological alterations. The most common ones are a stooped back, tired appearance, obesity, flat feet, scoliotic attitudes, and circulatory system and respiratory diseases. In the following work, to measure this aspect, variables relating to the presence of flat feet, postural problems and body mass index (i.e. obesity) were used.

All the effects of covid-19 have had an even greater impact on children, decreasing the hours of physical or sporting activity[2,3] carried out and radically changing their lives from both a physiological and psychological point of view[4,5,6].

The cause for these conditions and problems is, above all, seen in the lack of movement and correct nutrition. To these factors, it is often added a scarce or non-existent awareness of the regression process, due to the characteristics of the environment and the social, economic, and cultural context[7]. In this regard, as reported in the 2020-2025 National Prevention Plan, the main causes of death worldwide remain Non-Communicable Chronic Diseases (NCDs), such as cardiovascular diseases, tumors, chronic respiratory diseases, diabetes, mental health problems and musculoskeletal disorders. With reference to psychological problems, in the following work we focused on depression, which as highlighted in the scientific literature[8], was one of the most characterizing aspects of the pandemic period in children and teenagers. Physical inactivity and a sedentary lifestyle, together with incorrect nutrition and lifestyles, contribute to the onset of chronic diseases that significantly affect the processes of aging and premature death[1]. In order to deal with these problems, it is crucial to introduce even more effective preventive actions. Since physical-sports activity is very important for the well-being and prevention especially of developing children and young people, in the following work one of the variables analyzed measured the weekly hours of physical or sports activity carried out by children. In the current historical moment, the World Health Organization (WHO) is increasingly supporting prevention and health promotion, seeking economic support and funding to implement them, and is paying particular attention to health and lifestyle changes.

The extraordinary scientific development in last two centuries in the medical and biological fields, has had the merit of revolutionizing the knowledge not only of a disease and of its diagnosis and its treatment, but also of its prevention, of determining causes, of environmental and behavioral causes and of the concept of risk related to these causes. In industrially advanced countries, this development has led to an evolution of health services in a way never experienced by humanity, involving populations, as well as professionals, in the cultural participation born of scientific discoveries in medicine[9]. The concept of disease prevention is strongly correlated with that of medicine and has always accompanied human beings; the preventive role of medicine, in fact, can be found in all civilizations, even in the

most primitive ones, but despite the attention to prevention being ancient, only in the 20th century was this theme tackled systematically, first for the infectious-contagious diseases, then for non-infectious ones.

The old prevention's definition has broadened: prevention today does not mean simply activity implemented to prevent the onset of a disease, but also the set of all the procedures necessary to delay its aggravation or recurrence, as reported in the World Health Organization (WHO) glossary, namely that disease prevention "does not only include measures aimed at preventing the onset of disease, such as the reduction of risk factors, but it also concerns measures aimed at halting the evolution of a disease that has already arisen and reducing its consequences"[10,11]. Through structured physical activity protocols and physical education in schools, these become exceptional tools that allow children, from an early age to acquire a correct active lifestyle and prevent childhood obesity. In fact, it represents one of the most serious and relevant problems of our times. Likewise, postural disorders in children and adolescents are one of the most widespread, but underestimated health problems. According to literature an obese child is more likely to incur postural problems, such as lower limb disorders[12], and psychological discomfort, as well as obesity in adulthood with associated diseases. Therefore, the importance of prevention programs in childhood should be emphasized aiming to combat obesity, hypokinesia, involution of motor skills, early abandonment of sporting practice and poor eating and postural habits, by promoting thus essential principles linked to psychophysical well-being, correct diet and body care. Correct nutrition is one of the key aspects to combat obesity and avoid numerous other problems. A recent work[13] has highlighted how the use of fizzy drinks is related to problems not only of a physiological but also psychological nature; in fact, in the following work, a variable was included that measures the number of fizzy drinks consumed by children. The objective of present study work is to be able to document the state of health in the developmental age, implementing a prevention path in primary school environment.

## Methods

*Participants and procedures*

A convenience sample of 147 children, 71 girls and 77 boys aged 6 – 11 years (mean age: 8.6 years, standard deviation=1.55) participated in the study, each of which has been assigned a numerical identification code for privacy reasons. Characteristics of participants are shown in Table 1. Children were recruited from an Italian primary school. Children with a history of psychological or physical problems were excluded from the study. Informed consent was obtained from all parents of children included in the study.

As for the data collection, it was carried out by two kinesiologists with the same years of experience in the field of assessment. In the first phase, all children underwent an anamnestic and postural assessment, while in the second phase, each of them autonomously completed two questionnaires, one for eating habits and one for mental health monitoring. The children were examined individually by undergoing a kinesiological evaluation, and the data obtained for each child were subsequently reported in a Microsoft Excel spreadsheet.

**Table 1.** Characteristic of the sample.

| Class | N | female | male | mean age (years old) SD | mean weight (Kg) SD | mean height (m) SD | BMI SD |
|---|---|---|---|---|---|---|---|
| 1 | 23 | 10 | 13 | 6,09 | 24,70 | 1,23 | 16,21 |
| | | | | 0,42 | 5,90 | 0,07 | 2,35 |
| 2 | 22 | 11 | 11 | 7,41 | 27,06 | 1,28 | 16,63 |
| | | | | 0,5 | 2,94 | 0,04 | 2,12 |
| 3 | 26 | 13 | 13 | 8,27 | 36,02 | 1,36 | 19,42 |
| | | | | 0,45 | 7,02 | 0,07 | 2,33 |
| 4 | 37 | 16 | 21 | 9,35 | 39,42 | 1,39 | 20,25 |
| | | | | 0,48 | 10,81 | 0,07 | 4,29 |
| 5 | 38 | 21 | 17 | 10,32 | 45,98 | 1,46 | 21,41 |
| | | | | 0,47 | 11,77 | 0,06 | 4,69 |

**Source:** authors.

*Measures and instruments*

The anamnestic questionnaire including information on health of the children and their family was given to the parents. Furthermore, they were asked to quantify weekly hours that their children spent on physical activities or sports. As regards the acquisition of anthropometric data (height and weight), an analog bathroom scale was used for weight, a measuring chart for height and a tailor's measuring tape together with a skin caliper for circumferences. A podoscope was used for postural assessment.

Subsequently, a series of photographs of the reflected footprint was taken (with the podoscope) and to the whole subject was recorded in an upright position in two of three planes of the body: first in the posterior frontal plane, then in the anterior frontal plane, both with open and closed eyes, and lastly in the sagittal plane, from both right and left side.

We have considered on the three planes respectively: 1) on frontal, anterior and posterior planes, any sublevels of some parameters, considering the subject even with eyes closed, for example bipupillary line, wrist line, interpopliteal line, bimalleolar line, and possible asymmetry of the triangles of the cut. 2) on the right and left sagittal plane, the presence or absence of anteposed head, dorsal hyperkyphosis, as well as of lumbar hyperlordosis were noticed. 3) on the transversal level, which can be evaluated indirectly, the positioning of the shoulders observed in the sagittal plane, normally positioned or in anteposition with relative shoulder rotation, and the presence of a hump, evident with the subject in forward flexion of the trunk. As regards the lower limbs, various knee deformities (valgus or varus), as well as feet deformities (flat or cavus) were noticed. As far as flat feet are concerned, the next section dedicated exclusively to a flat foot, has allowed, based on the observation of the footprint and breech support, to identify the degree.

Furthermore, for the last section, the Beighton Score test was performed to assess joint hypermobility by the use of the orthopedic goniometer for the measurement of range of motions of joints, indicating thus any positivity within the range table together with the resulting score. The questionnaire administered to investigate eating habits referred to the 6-11 age group and it was extrapolated from a report by the Italian Society of Human Nutrition, and it is a questionnaire containing three introductory questions regarding the food pyramid and 27 questions related to daily meals, various types of food (i.e. cereals, meat, fish, vegetables, legumes, eggs, fruit, sweets, yoghurt, drinks), frequency and the consumption quantities in

portions or in liters; except for the last question, related to existence of physical activity, the type and frequency on a weekly basis of physical activity if carried out. For the assessment of psychological and emotional well-being, the Patient Health Questionnaire PHQ-9 was applied. This is a short scale specific to Medicine General[14] and it is used for diagnosis, monitoring and determining the severity of depression. The PHQ-9 score ranges from 0 to 27. Scores between 5 and 9 indicate the presence of subthreshold depression. The score of 10 is the cut-off optimal for highlighting clinically relevant depressions[15] with three different levels of severity depending on the score[16].

The PHQ-9 was translated and adapted graphically for the age groups in question, in which the empty boxes for the answers on which to put the cross with emoticons, increasingly respecting their value, were going from the smiliest smiley referring to "not at all" to the saddest smiley referring to "almost every day", to make the understanding more immediate.

*Statistical Analysis*

Data were preliminarily checked for accuracy, missing values, outliers, and normal distribution (by the use of skewness and kurtosis analysis, and the Kolmogorov-Smirnov test), and then statistical analyzes were performed in two stages. First analysis was made by observing the means of each variable. Then the ANOVA test was applied to identify whether there were statistically significant differences between different classes in analyzed variables. Regarding variables with identified significant difference obtained from the ANOVA test, the Bonferroni post-hoc test was applied and graphs were created in order to have statistically significant differences. Finally, the correlations between the variables examined were measured. The statistical analysis was conducted by the use of SPSS v. 21.0 (SPSS Inc. Chicago, IL, USA). The level of significance was set to $p \leq 0.05$.

## Results

The Table 2 below shows the ANOVA test data.

**Table 2.** ANOVA results.

| | ***df*** | **F** | **sig.** |
|---|---|---|---|
| BMI | 4,14 | 11,15 | 0,000 |
| PostureProblems | 4,14 | 1,72 | 0,148 |
| Flatfoot | 4,14 | 0,6 | 0,661 |
| BeightonScore | 4,14 | 1,39 | 0,242 |
| Sport(hour*week) | 4,14 | 2,06 | 0,089 |
| FizzyDrinks(n*week) | 4,14 | 0,54 | 0,707 |
| PHQ-9 | 4,14 | 7,68 | 0,000 |

**Source**: authors.

From this test it is possible to observe how a statistically significant difference was identified between the classes in two variables: BMI and PHQ-9. To investigate in which class this difference occurred, the post-hoc test was carried out, and the results are shown in Table 3.

**Table 3.** Bonferroni post-hoc test results.

| | (I) Class | (J) Class | M Difference (I-J) | Std. Error | *Sig.* |
|---|---|---|---|---|---|
| BMI | 1° | 2° | -0,419 | 1,073 | 1,000 |
| | | 3° | -3,191 | 1,030 | 0,024 |
| | | 4° | -4,050 | 0,956 | 0,000 |
| | | 5° | -5,195 | 0,951 | 0,000 |
| | 2° | 3° | -2,772 | 1,043 | 0,088 |
| | | 4° | -3,630 | 0,921 | 0,003 |
| | | 5° | -4,776 | 0,965 | 0,000 |
| PHQ-9 | 1° | 2° | -2,593 | 1,180 | 0,296 |
| | | 3° | -5,457 | 1,132 | 0,000 |
| | | 4° | -4,929 | 1,050 | 0,000 |
| | | 5° | -3,983 | 1,045 | 0,002 |

**Source:** authors

The differences found refer to the BMI, which, as it can be seen from Figure 1, grows in various classes (this is quite in line with normal growth of children, even though the average BMI in fifth graders is higher than normal). The other differences refer to the depression index. Also, in this case we are witnessing a growth from first class to third class. In this case, even if there is a statistically significant difference, the PHQ-9 reference values indicate a subthreshold level of depression.

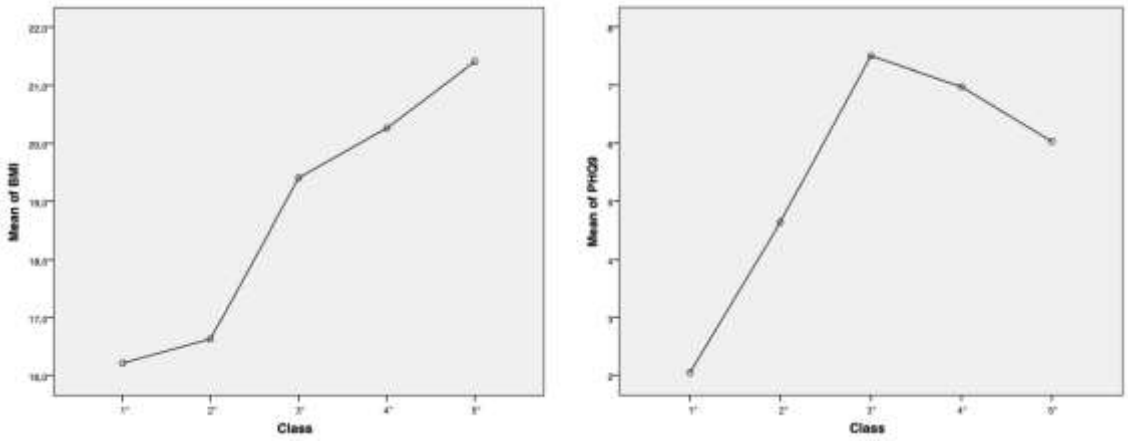


**Figure 1.** Differences in the five classes for the BMI and PHQ-9 results.

From an initial analysis of variable averages, it is possible to conclude that 70% of the sample manifests postural problems associated with a high BMI. In fact, with reference to the BMI, 30% of the sample is obese, 23% overweight, 45% normal weight and 2% underweight. Furthermore, the results obtained from the evaluation of flatfoot show 64% of the sample having a flat foot (37% of third degree, 44% of second degree, 19% of first degree). On the other hand, 30% of the sample has a cavus foot and only 6% does not have either a flat foot or cavus foot. The PHQ-9 results show depression absent in 40% of the sample, subthreshold in 43%, mild in 14%, 2% moderate, and 1% severe.
Results obtained using the Pearson correlation index can be seen in the table below (Table 4).

**Table 4.** Correlation between variables.

| | | BMI | Posture Problems | Flatfoot | Beighton Score | Sport (hour*week) | FizzyDrinks(n*week) | PHQ-9 |
|---|---|---|---|---|---|---|---|---|
| **BMI** | r | 1 | .068 | .190 | -.152 | -.027 | -.043 | .303 |
| | sig. | - | .412 | .021* | .067 | .743 | .605 | .000** |
| **Posture Problems** | r | | 1 | .496 | -.077 | -.089 | .121 | .113 |
| | sig. | | - | .000** | .357 | .283 | .146 | .175 |
| **Flatfoot** | r | | | 1 | -.077 | -.089 | -.019 | .105 |
| | sig. | | | - | .357 | .287 | .820 | .208 |
| **Beighton Score** | r | | | | 1 | 0.43 | -.150 | -.140 |
| | sig. | | | | - | .605 | .071 | .091 |
| **Sport (hour*week)** | r | | | | | 1 | .016 | -.251 |
| | sig. | | | | | - | .848 | .002** |
| **FizzyDrinks (n*week)** | r | | | | | | 1 | .156 |
| | sig. | | | | | | - | .060 |
| **PHQ-9** | r | | | | | | | 1 |
| | sig. | | | | | | | - |

**Source:** authors.

The above presented results show a correlation between flatfoot and BMI, and between flatfoot and postural problems, while other correlations refer to the perception of one's depression associated with a higher BMI and insufficient time spent on physical activity.

## Discussion

Regarding BMI, the prevalence of postural disorders in obese subjects was significantly greater than that in subjects with normal body mass ($p<0.05$). Specifically, out of 30 obese individuals, 28 also had postural problems. It is therefore very probable that an obese subject is also inclined to have postural defects. These results are in line with the literature and highlighted in different researches[12,17,18].

Regarding breech support, the prevalence of postural anomalies in subjects affected by flatfoot has been remarkably higher than in those with normal breech support ($p<0.000$).
In the case of first-graders, second-graders and third-graders, the p-value was well below the significance threshold. Therefore, there is a very strong correlation between flat foot and posture disorders as also reported by Carr and colleagues[19].

Finally, it has been noticed that there was no connection between the subject's depression and the occurrence of a posture defect. In fact, the prevalence of postural problems in subjects presenting a depressive state did not provide a significant finding compared to those

with subthreshold or absent depression, which is in congruence with results obtained in a recent study[20].

Obesity, which is broadly defined as excess body weight compared to a given height, remains an ongoing global health problem, as it is associated with an elevated risk of several chronic diseases including type 2 diabetes, hypertension and cardiovascular disease. A recent analysis of data from 195 countries revealed that, in more than 70 states, the prevalence of obesity doubled from 1980 to 2015, in which over 600 million adults were obese, with a high BMI causing 4 million deaths globally. The pathogenesis of obesity is complex, with environmental, sociocultural, physiological, medical, behavioral, genetic, epigenetic and numerous other factors that contribute to causality and persistence[21,22].

Another study collected and analyzed 2,416 different studies on populations with measurements of height and weight, including 128.9 million participants over the age of 5, with 31.5 million subjects aged between 5 and 19. Using Bayesian hierarchical modeling, trends from 1975 to 2016 were estimated in 200 countries for average BMI and the prevalence of BMI in the indicated categories, including children and adolescents aged 5 to 19: more than 2 SD below the median of the WHO growth reference for children and adolescents (moderately and severely underweight), from 2 SD to more than 1 SD below the median (slightly underweight), from 1 SD below the median to 1 SD above the median (healthy weight), more than 1 SD to 2 SD above the median (overweight but not obese), and more than 2 SD above the median (obese). In 2016, 75 million girls and 117 million children worldwide were moderately or severely underweight. In the same year, 50 million girls and 74 million children worldwide were obese[,23].

Spinelli and colleagues[,24] conducted a study involving cross-sectional data from 21 European countries that are members of the WHO. Schoolchildren in these countries were measured using standardized tools and methods. The children were categorized as severely obese according to definitions provided by the WHO and the International Obesity Task Force (IOTF). The analysis included a subset of subjects categorized by age, and the mother's education level, and was further divided by residential areas. A total of 636,933 children (323,648 boys and 313,285 girls) were included in the study. The prevalence of severe obesity varied significantly between countries, with higher rates observed in Southern Europe. According to WHO criteria, severe obesity ranged from 1.0% among children in Sweden and Moldova (95% CI 0.7–1.3 and 0.7–1.5, respectively) to 5.5% (95% CI 4.9–6.1) among Maltese children. Generally, boys exhibited higher prevalence rates than girls. The IOTF criteria produced lower prevalence estimates but still highlighted differences between countries, with similar patterns observed for both genders. In many of the countries studied, about one in four obese children was classified as severely obese. Estimations based on the WHO criteria indicated that approximately 398,000 children aged 6 to 9 years in these 21 European countries were severely obese. Between 2007 and 2013, the trend did not show a clear pattern, and severe obesity was more prevalent among children whose mothers had lower educational attainment.

A recent study by Bel-Serrat and colleagues[25] investigated a possibly different cluster of behaviors related to energy balance, and whether the identified groups were associated with weight status. The participants were children aged 6 to 9 years (n =63.215, 49.9% girls) from 19 countries who participated in the fourth round (2015/2017) of the WHO European Childhood Obesity Surveillance Initiative. The behaviors related to the energetic budget were reported by parents. The weight and height were measured objectively. The cluster analysis was performed separately for a group of countries (North Europe, Eastern Europe, Southern Europe / Mediterranean countries and Western Central Asia). Seven clusters were identified in each group. Health clusters were common for each group. The distribution model of healthy and unhealthy behaviors within each cluster was group specific. The associations between the grouping of behaviors related to energy balance and weight status varied depending on the

group. A few or no associations were found respectively in the Northern Europe and Western Central Asia. These results support the hypothesis that one's unfavorable weight status, in some countries, is associated with a particular combination of models of behavior related to energy balance.

Another study[26], conducted in 2004 on 4287 girls and 3505 boys aged 9 to 16 years, evaluated time spent in front of a screen reported in relation to a simultaneous change of BMI. Specific gender models were previously adjusted for BMI, age, race/ethnicity, growth/development, months between the questionnaires and physical activity. The television, which has always been the most frequent source of food advertising, was rather associated with the increase in BMI. In girls, electronic games and DVDs/videos were also related to the increase of the BMI, probably due to influences of product placements and diet advergames and/or distracted eating. Teenagers, especially overweight teenagers, can benefit from spending less time using different types of media. In a prospective study conducted by Brzęk[27] et al., a cohort of 155 schoolchildren aged 7 to 9 years was observed. The study involved administering two different tests at two points in time: once at the start of the school year and again after 10 to 11 months. The tests assessed various factors including age, gender, BMI, the weight of the schoolbag, and the length of the schoolbag straps. Additionally, body posture was evaluated using Adam's test. Initially, the average weight of the schoolbags was 6.3 ± 0.8 kg, ranging from 4.7 to 9 kg. Boys were found to carry slightly heavier schoolbags compared to girls (6.7 kg vs. 5.9 kg, $p = 0.00001$). The weight of the schoolbags increased linearly with age ($R = 0.68$, $p < 0.001$). In 3.2% of the children, the weight of their schoolbag exceeded the recommended norms. Abnormal shoulder rotation was noted in 35.3% of girls (average increase of 2.7 ± 1.2) and 60.9% of boys (average increase of 2.3 ± 1.3). Additionally, increased kyphotic angles were observed in 48.5% of girls and 36.8% of boys. Brzeziński and colleagues[17] conducted a cross-sectional study to explore the relationship between lower-extremity defects and body mass in Polish children. This study included 6,992 children (3,476 boys and 3,516 girls) from Gdansk, Northern Poland. Various standard screening tests were used to assess lower limb defects, including measurements of intermalleolar and intercondylar distances, knee alignment, valgus heel using a linear vertical compass, and foot analysis through a computer-based podoscope or classical imprint. [28,29,30]The body mass of the children was categorized using percentile graphs and IOTF cutoffs. The prevalence of postural disorders was analyzed using Pearson's chi-square test and Fisher's exact test, while logistic regression was employed to estimate the probability of lower limb defects, with results expressed as odds ratios (OR) and 95% confidence intervals. The study revealed a cumulative prevalence of lower limb defects at 31.5%, which was lower compared to many other studies. The most common defects included heel valgus (21.8%) and knee valgus (14.5%). Boys exhibited a higher frequency of lower limb issues, including knee varus and valgus heel ($p < 0.001$). Limb defects were present in 90.2% of obese children, compared to 25.7% of those with normal weight and 15.1% of underweight children. A 2017[12] study highlighted that common postural deviations observed in children and adolescents with obesity include valgus knees and flat feet. Children and adolescents who are overweight or obese are more likely to experience certain postural issues and thus require targeted prevention programs to address these health concerns. The incidence of overweight and obesity in children tends to increase with age. Observations showed a decrease in intermalleolar distance and an increase in the longitudinal arch of the foot, both of which are typical developmental changes. Valgus knee alignment was particularly prevalent among overweight children. Additionally, significant correlations were found between body mass index, intermalleolar distance, and Clarke's angle ($P < 0.05$). [18]

Another study conducted in the same year examined the prevalence of foot-related conditions. The findings indicated that boys exhibited a higher rate of flat feet compared to girls, though this difference was not statistically significant ($p > 0.05$). Specifically, flat feet

were observed in 17.5% of boys and 14.5% of girls. The study also found that 10.3% of children were classified as overweight or obese. When comparing different weight categories, significant variations were noted in the prevalence of flat feet: underweight children had a prevalence of 13.9%, those with normal weight had 16.1%, overweight children had 26.9%, and obese children had 30.8%.[31]

A high rate of flatfeet and flatfeet-associated pathologies in children was already documented in the past[32,33,34]. Even though there is a correlation between PHQ-9 results and hours spent doing sports, the results are consistent with the 2020 research that found a significant relationship between depression and the level of physical activity[20].

The results of the present study, regarding the Beighton score, are in line with results obtained in the 2011 study in which 551 children, attending various Dutch elementary schools, participated in the study, 47% of boys (258) and 53% of girls (293), aged from 6 to 12 years. The evaluation of the children's joints and movements was conducted by qualified physiotherapists using the Beighton score, along with a protractor to assess 16 ranges of passive joint motion on both sides of the body. Over 35% of the children achieved a score greater than 5 out of 9 on the Beighton scale. Additionally, those who scored higher on the Beighton scale demonstrated increased flexibility in other measured joints. Plus 12.3% of children had symptoms of joint pain and 9.1% complained about pain after exercise or a sport. It is important to point out that this percentage was independent from the Beighton score[35].

## Conclusion

In conclusion, the results of present study conducted in a primary school can be useful for reflection and awareness on the growth of new generations and on how important the educational aspect of physical education (curriculum) and sports activities (extra-curricular activities) is in order to teach children correct and healthy active lifestyles. Furthermore, it can be useful for reflection on the importance of prevention and maintaining a correct, healthy and active lifestyle. The following work has limitations such as the limited size of the sample which does not allow the results to be generalized and the absence of an evaluation prior to the period taken into consideration. Future research could expand the sample and broaden the results by, for example, adding a follow-up of the same sample after a couple of years.

## Statements and Declarations

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