

Effects of the vacation period on the health-related physical fitness of schoolchildren

<https://doi.org/10.11606/issn.1981-4690.2022e36182831>

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Abstract

The aim of the study was to verify the effects of the summer vacation period on the health-related physical fitness (HRPF) of students in the 7th and 8th grades of elementary school. The study design is characterized as observational, considered short-term longitudinal. Physical evaluations were carried out before and after the summer school vacation period. The components of physical fitness analyzed were: Cardiorespiratory fitness - 6-minute running or walking test, body composition-measures of body mass index, waist circumference and waist-to-height ratio, muscle strength/endurance - abdominal endurance test (sit -up) and flexibility - test of sitting and reaching. As a statistical analysis, the paired t-test was used, adopting $p \leq 0.05$. A significant increase was observed in the body mass index, waist circumference, waist-to-height ratio and flexibility after the vacation period. However, there were no significant changes in cardiorespiratory fitness and muscle strength/endurance. Furthermore, analyzing boys and girls separately, no differences were found for waist-to-height ratio and only girls showed improvements in muscle strength/endurance. It was concluded that the vacation exposure factor improved the levels of flexibility and increased the variables of body composition, not generating significant changes in cardiorespiratory fitness, while muscle strength/endurance improved only in girls.

KEYWORDS: Physical evaluation; Health promotion; Prevention; Adolescents.

Introduction

The physical fitness is composed of biological and psychosocial aspects, which generate a good state of health and well-being¹. The health-related physical fitness (HRPF) is basically constituted by the physical capacities of cardiorespiratory fitness, muscular strength/endurance, body composition and flexibility². Currently, most adolescents do not reach recommendations of good levels of HRPF³. Never theless, many of the health-related problems are highly associated to low levels of HRPF, in which the majority of them already begin during childhood and adolescence, a representation that needs to be reversed⁴.

A risk factor highly associated with low levels of HRPF and Chronic Noncommunicable Diseases

(NCDs) is the physical inactivity. Epidemiological studies show this association with the increase in the relative occurrence of acute myocardial infarction (60%), osteoporosis (59%), type 2 diabetes (50%), coronary artery disease (45%), colon cancer (41%), breast cancer (31%) and arterial hypertension (30%)⁵, also contributing for the excessive accumulation of body fat⁶.

In a study conducted in Aracaju (SE, Brazil) the number of students classified as sedentary was 78.6%, in which 64.9% were children and 83.1% adolescents. In addition, the time spent in front of television was of 5.61 hours a day, thus favoring the increase of body fat and excess weight^{7,8}.

In this regard to achieve good levels of HRPF is essential, especially because HRPF is a protective factor against mortality, as MYERS et al.⁹ show, when emphasizing that some epidemiological studies have demonstrated reductions of at least 50% in the levels of mortality among individuals with high scores of HRPF compared to those less physically fit. However, HRPF attribute scores are more related to metabolic risks than usual levels of physical activity in schoolchildren, therefore it is essential to apply physical tests frequently to schoolchildren¹⁰.

Considering that the aging process itself leads to physiological losses that imply a decrease in HRPF, effective interventions during childhood and adolescence are increasingly necessary, especially in

Physical Education classes, aiming at maintenance and improvement, thus avoiding future diseases and cardiovascular complications^{11,12}.

Although several studies are concerned with factors that influence HRPF¹³⁻¹⁵, to our knowledge, only two were concerned with analyzing the vacation exposure factor and the relation with HRPF components^{16,17}.

Therefore, considering the scarcity in the literature and the relevance of this subject, the aim of this study was to investigate the influence of the summer vacation period on the HRPF levels of schoolchildren in the 7th and 8th grades of elementary school and secondarily to verify possible different effects among boys and girls.

Methods

This is an observational study, with a short-term longitudinal character, performed out between December 2018 and March 2019, that is, the end and beginning of the school year.

Schoolchildren aged between 12 to 17 years old of both sexes who met the following inclusion criteria participated in the research: to be regularly enrolled and participating in Physical Education classes; to be present in data collections at the pre and post school vacation; not having osteomioarticular limitations and the parents or guardians authorized and have signed the Free and Informed Consent Term. This study was approved by the Ethics and Research Committee on Human Beings of the institution of origin (num.: 3,221,394). All students also signed a specific Free and Informed Consent Term.

For the accomplishment of this research there was consent from both the direction of the school and the Physical Education teacher. The tests performed in this research were already applied at the beginning and end of the year at the institution, generating the least impact on the curricular structure. In view of that it was proposed only the use of these data in order to understand their behavior in relation to the summer school vacation period (lasting two months).

The attributes of the HRPF analyzed in this research were: waist circumference, height, body mass, flexibility, muscle strength/endurance and cardiorespiratory fitness. Therefore, Body Mass Index (BMI) and waist-to-height ratio (WHtR) were calculated. The tests were performed with

a interval of 48-hour break and on the first day, body composition, flexibility and muscle strength/endurance tests were carried out and on the second day, only the cardiorespiratory fitness test was performed.

To measure waist circumference, a measuring tape was used, considering the midpoint between the last rib and the iliac crest. To verify height, a stadiometer of WELMY was used and measurement was taken with the subjects barefoot and after a brief inspiration. Afterwards, the WHtR was calculated, determined by calculating the ratio between the measurement of waist circumference and height, both in centimeters. Body mass was measured using a digital scale from the WELMY brand –w300, recording in kilograms and the Body Mass Index was calculated using the formula ($BMI = \text{body mass}/\text{height}^2$). Flexibility was measured through the sit and reach test using the Wells Bank (centimeters reached). Abdominal strength/endurance was measured using the sit-up test (number of repetitions in one minute). Cardiorespiratory fitness was measured using the 6-minute running/walking test, performed on the running track (meters covered). All instruments and protocols used to select the tests were based on the test and evaluation manual of the Projeto Esporte Brasil¹⁸.

To characterize the sample, sociodemographic variables (sex categorized as male and female and age in years) and anthropometric measures

of height (cm), body mass (kg) and BMI (kg/m²) were analyzed. Continuous variables were expressed as mean and standard deviation and the categorical variable as frequency and relative percentage. Data distribution was assessed using

the Kolmogorov-Smirnov test. For inferential statistics, the paired t-test and non-parametric Wilcoxon test were used, adopting a significance level of 5% ($p \leq 0.05$). All analyzes were performed using SPSS software, version 20.0.

Results

TABLE 1 shows the variables that characterize the participants of the study. It was observed that, in the school post-vacation

moment, all the characterization variables showed significant differences in relation to the school pre-vacation period.

TABLE 1 - Characterization of the sample in the pre and post school vacation periods (n: 34).

Variables	Pre-vacation X (\pm dp)	Post-vacation X (\pm dp)	P
Age (Years)	13.1 \pm 0.4	13.2 \pm 0.54	0.031*#
Height (m)	1.59 \pm 0.07	1.60 \pm 0.07	0.001*
Body Mass (kg)	50.1 \pm 9.82	52.3 \pm 9.60	0.001*
BMI (kg/m ²)	19.7 \pm 2.91	20.2 \pm 3.06	0.017*
Sex (n/%)	Girls: 14 (41.2) Boys: 20 (58.8)		

X = mean;
 \pm sd= standard deviation;
 BMI = body mass index;
 * = Statistically significant difference between pre and post vacation values;
 # = Value extracted from nonparametric test.

The HRPF in the pre and post vacation moments can be seen in TABLE 2. There were significant changes in body composition outcomes and flexibility levels. As

for the outcomes of muscle strength/endurance and cardiorespiratory fitness, no differences were found after the school vacation period.

TABLE 2 - Values of the HRPF components in the pre and post school vacation periods (n: 34).

Variables	Pre-vacation X (\pm dp)	Post-vacation X (\pm dp)	P
WC (cm)	67.2 \pm 6.83	68.8 \pm 6.99	0.001*
WHtR (cm)	0.42 \pm 0.04	0.43 \pm 0.04	0.013*
CF (m)	1039.2 \pm 225.3	1010.7 \pm 232.7	0.365
Muscle strength/endurance (rep/min)	28.7 \pm 8.38	30.5 \pm 10,7	0.156
Flexibility (cm)	23.1 \pm 12.3	25.9 \pm 11.5	0.001*

X = mean;
 \pm sd= standard deviation;
 WC = Waist circumference;
 WHtR = Waist-to-height ratio;
 CF = Cardiorespiratory fitness;
 * = Statistically significant difference between pre and post vacation values ($p \leq 0,05$).

TABLE 3 presents the HRPF variables in the pre and post vacation moments analyzed among boys and girls. During the post-vacation period, there were significant differences in both

sexes concerning circumference and flexibility, with post-vacation differences in muscle strength/endurance only in girls. No significant differences were observed in the other variables.

Discussion

To summarize, the findings of the present study indicate that the school vacation period does not have a negative influence on most of the variables analyzed, improving the flexibility levels, preserving the muscle strength/endurance and cardiorespiratory fitness. However, there was an increase in body composition variables, such as increased WC and WHtR. When observing the effects of school vacation among boys and girls, there was an increase in waist circumference and improvements in flexibility levels regardless of sex, while only girls showed improvements in abdominal strength/endurance.

Regarding the findings about body composition, a significant increase can be observed in the WC and WHtR, suggesting that there was a rise in the percentage of body fat in the vacation period. Still, SILVA et al.¹⁷ demonstrated that after the vacation period, students showed an increase in body adiposity, in which 31.6% of the sample reached levels below the recommended for this variable.

A hypothesis for the increase in the WHtR and WC, possibly generating greater body fat accumulation, may be associated with nutritional factors, such as increase in food intake, especially those with excess sugars and fat, thus, this factor may have contributed to the energy imbalance and body fat gain of students¹⁹. However, it is worth emphasizing that these considerations are only hypotheses regarding the raise in these variables, thus not attributing a causal relationship. Another circumstance that must be observed is the maturational stage of individuals, mainly due to adolescence, period of constant biological and morphological changes, such as the growth spurt, characterized by the abrupt increase in body structures. Thus, body composition changes found can also be usual of the age 20.

Observing the values of body composition for boys and girls, changes in WC are identified in both sexes, however in the WHtR, there were no changes. A probable logical explanation is due to the fact that the students present an increase in height and WC, thus maintaining the same values for the WHtR.

Therefore, because the measurement of WHtR and WC are considered good markers for body fat in the abdominal region, being quite associated with efficient, fast and easily applicable cardiovascular risk factors, it is essential to use them in the school environment regularly to

evaluate overweight, obesity and cardiovascular health of children and adolescents^{21,22}.

In relation to the cardiorespiratory component, of great importance to cardiovascular health, two months of school vacation were not enough to cause significant changes to this variable. In a study carried out by CARREL et al.¹⁶, with overweight adolescents, it was observed that improvements obtained in the CF after nine months in an intervention program in Physical Education classes were lost during the three months of school vacation. However, it is worth stating that the samples have different characterizations in relation to nutritional status.

SILVA et al.¹⁷ noticed findings opposed to the present study, in which after vacation, adolescents had a longer time spent in the 1600m test, thus demonstrating a reduction in cardiorespiratory capacity. Moreover, after the vacation period, there was a significant reduction in the percentage of students who reached the appropriate reference values, decreasing from 37.9% to 26.3%.

In view of the results related to the CF, the current literature is still contradictory. It can be considered that the vacation was not negative for this outcome in the present study, for both girls and boys preserved the values of distance covered in the end of the school year, however, more than 70% of students showed results below the appropriate cutoff points for this variable after vacation. Thus, physical assessments should be done frequently in order to diagnose and to instruct students to maintain an active routine with physical exercises during the school year and the vacation period, for a better cardiovascular health, quality of life and participation in Physical Education classes.

Similar results to the CF were found concerning the muscle strength/endurance, in which the school vacation did not provide significant changes to this variable when evaluated in general. Corroborating the present study, SILVA et al.¹⁷ showed that after two months of school vacation, changes in abdominal strength/endurance were not identified. However, when analyzed by sex, only girls showed improvements after the period in which they had performed fewer repetitions than boys and exceeded the amount of repetitions in the post-vacation period. Despite an unexpected result for this variable, in the study by CHRISTODOULOS; FLOURIS and TOKMAKIDIS²³ there were improvements in this outcome in girls after the vacation period. The

abdominal strength/endurance can be affected by body maturation, still, at about age 12, girls reached the highest peak of pubertal growth, thus, the improvements in the results presented by girls after school vacation may also have been influenced by the maturation changes of this period²⁴.

From another perspective, although the results on abdominal tests do not present statistical differences in the general analysis, there were positive changes in the percentage of students in the ranges above the appropriate criteria for health, in which, before the vacation, 45% of the students were above the normative criteria and after that period, the number increased to 59%. Thus, the importance of not limiting the evaluation to statistical analysis is emphasized, but we also highlight the importance of the distribution of these data and the evaluation of each student based on their age and test performance, as small changes during the vacation can generate positive contributions about health of individuals, keeping them in healthy zones for the components of the HRPF.

Considering the flexibility component, the results were unexpected, as the findings demonstrated that the vacation period significantly improved the flexibility levels, regardless of the sex of the participants. In addition, the prevalence of schoolchildren in the present study reaching good levels of flexibility after the vacation period was 74%, which is somewhat satisfactory.

Although the present study did not verify the levels of physical activity before and after vacation, it is clear that the more active the adolescent, the greater his/her relationship with flexibility improvements, due to the greater elasticity of skeletal muscle, tendons and ligaments²⁵. We speculate that due to a greater period of free time, adolescents may have been more involved in physical activity during the vacation, contributing indirectly to improving flexibility. Moreover, LIMA et al.²⁶ showed a direct relation between the increase in muscle strength levels and flexibility.

To our knowledge, no other study showed similar results with the current research for the flexibility outcome, nor does the literature present relational evidence among vacations and improvements in flexibility levels. Some considerations were expressed

to understand this fact. A plausible explanation may be the excess of time that the students remain seated in the classroom during the school year, which may generate inappropriate postural habits, consequently causing limitations to joint amplitude, muscle extensibility and plasticity of ligaments and tendons²⁷. Furthermore, another study also confirmed that the vacation period does not change the flexibility levels in active children, however, it significantly reduces for children with little physically active during the school year²³. This finding highlights the importance of Physical Education, confirming that children with lower levels of physical activity during the school year tend to have greater losses for flexibility during the vacation period.

As limitations of the present study, it is possible to highlight the low *n* sample, mainly due to students who were not present in both moments of physical evaluations. Another gap left by the study, in which it could assist in the interpretation and understanding of the results, would be the application of questionnaires about behaviors during school vacation, such as physical activity levels, screen time and nutritional aspects. In addition, more research is needed about vacation period and HRPF levels in adolescents, especially with large samples and longitudinal study designs, in order to understand the behavior of these variables in different age groups over time. As strengths of this study, we highlight the relevance of testing, measuring and evaluating the HRPF of adolescents as well as understanding how the vacation factor influences, in order to diagnose and assist schoolchildren in relation to health aspects, mainly in the preventive character. Still, all tests and measurements are made for schoolchildren, have easy applicability, the ability to analyze large samples in a short time and excellent reliability.

Although the importance of the HRPF in adolescents, more effective interventions by Physical Education Teachers are needed in their planning, to evaluate and instruct students to acquire healthy lifestyle habits in childhood and adolescence, during school vacations as well as the school year, in order to improve or maintain their HRPF attributes at adequate levels, preserving good health and quality of life.

Conclusion

In summary, the period of school vacation can provide an increase in body composition outcomes, preserve the levels of CF and cause significant improvements in the levels of flexibility of students regardless of sex. Abdominal strength/endurance levels seem to increase only in girls over school vacation.

Acknowledgements

We thank the College of Application (UFSC) and the Physical Education Teachers for the motivation and help in all processes of this research and also to the colleagues who participated in the data collections.

Conflict of interests

Have no conflict of interests to declare.

Resumo

Efeitos do período de férias na aptidão física relacionada a saúde de escolares.

O objetivo do estudo foi verificar os efeitos do período de férias de verão nos níveis de aptidão física relacionada à saúde (ApFRS) de escolares do 7º e 8º ano do ensino fundamental. O delineamento do estudo caracteriza-se como observacional, considerado longitudinal de curto prazo. As avaliações físicas foram realizadas antes e após o período de férias escolares de verão. Os componentes da aptidão física analisados foram: Aptidão cardiorrespiratória- teste de corrida ou caminhada de 6 minutos, composição corporal- medidas de índice de massa corporal, circunferência de cintura e relação cintura:estatura, força/resistência muscular- teste de resistência abdominal (sit-up) e flexibilidade- teste de sentar e alcançar. Como análise estatística, utilizou-se o teste t pareado, adotando-se $p \leq 0,05$. Observou-se aumento significativo no índice de massa corporal, circunferência de cintura, relação cintura/estatura e flexibilidade após o período de férias. No entanto, não houve alterações significativas para aptidão cardiorrespiratória e força/resistência muscular. Além disso, analisando meninos e meninas separadamente, não foram encontradas diferenças para a relação cintura/estatura e apenas as meninas apresentaram melhorias na força/resistência muscular.

PALAVRAS-CHAVE: Avaliação Física; Promoção da saúde; Prevenção; Adolescentes.

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Submitted: 03/04/2021

Revised: 11/17/2021

Accepted: 06/23/2022