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healthy Preventive sports physical activity and Effect on Body Composition and Health Indicators among Middle School Students

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Abstract:
This study investigated the impact of healthy preventive sports physical activity on body composition and health indicators among middle school students in Guelma Province. The sample included 40 students randomly selected and divided into two equal groups: physically active and inactive. A descriptive comparative design was used, and key health indicators BMI, body fat percentage, waist circumference, blood pressure, and cardiorespiratory fitness were measured using standardized tools. Results showed significant differences between the groups in all variables. Active students had lower BMI, body fat, waist circumference, and blood pressure levels than inactive students. They also exhibited higher cardiorespiratory fitness. These findings confirm the health-promoting role of regular sports activity. The study emphasizes the importance of implementing structured sports physical activity programs in schools to encourage healthy lifestyle habits from an early age.

Keywords: sports physical activity; healthy Preventive ; Body Composition ; Health Indicators.

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1. INTRODUCTION

Physical activity is recognized as a critical determinant of health in childhood and adolescence. Engagement in regular physical activity contributes to improved body composition, reduced adiposity, and enhanced cardiorespiratory fitness factors strongly linked to long-term health outcomes Childhood represents a window of opportunity where healthy movement behaviours can mitigate the risk of chronic diseases later in life by shaping physiological and metabolic profiles early on (Kumar et al., 2015).

Physical activity is widely recognized as a fundamental component of a healthy lifestyle, particularly during childhood and adolescence. Regular engagement in physical activity contributes to optimal physical growth, psychological well-being, and the prevention of chronic diseases later in life (World Health Organization [WHO], 2020).

Preventive health-oriented sports physical activity plays a crucial role in improving body composition by regulating body mass index, reducing body fat percentage, and maintaining healthy waist circumference. Such activities are essential in promoting balanced physical development during the sensitive stages of growth (Malina, Bouchard, & Bar-Or, 2004).

In a field closely related to body composition and health, research on physical activity and cardiorespiratory fitness among school-aged children at risk for type 2 diabetes shows that structured physical activity can improve fitness levels and reduce risk factors associated with metabolic disorders. These findings support the inclusion of preventive sports programs in school curricula to improve health indicators at early ages. (Faggous, L, & Chenini, 2025).

analyzing body composition and somatotype among elite athletes aged 13–16 years, finding significant differences in body mass and somatotype components across sports such as judo, volleyball, and basketball. The study highlights the importance of assessing body composition for effective sport selection and tailored physical training programs for youth athletes. (Charbi et al., 2025).

Middle school represents a critical developmental period during which health-related behaviors are established and often persist into adulthood. Encouraging regular participation in preventive sports activities during this stage may contribute to long-term health benefits and disease prevention (Telama et al., 2014). Despite the well-documented benefits of physical activity, many middle school students fail to meet the recommended levels of daily physical activity.

This lack of engagement raises concerns regarding their current and future health status (Guthold et al., 2020).

However, there remains a need for empirical studies that examine the specific effects of preventive sports physical activity on body composition and health indicators among middle school students, particularly within different social and educational contexts.

Based on the above considerations, the present study seeks to investigate the impact of healthy preventive sports physical activity on body composition and health indicators among middle school students, leading to the following general research question: **To what extent does regular participation in preventive sports physical activity influence body composition and health indicators among middle school students?**

2- General Hypothesis:

Regular participation in healthy preventive sports activities positively affects body composition and health indicators among middle school students.

3- Sub-hypotheses:

- There are statistically significant differences in **body mass index (BMI)** between middle school students who practice preventive health-oriented sports physical activity and those who do not, in favor of the physically active students.

- There are statistically significant differences in **body fat percentage** between physically active and non-active middle school students, in favor of the physically active group.

- There are statistically significant differences in **waist circumference** between physically active and non-active middle school students, with physically active students exhibiting lower values.

- There are statistically significant differences in **systolic blood pressure** between physically active and non-active middle school students, in favor of the physically active group.

- There are statistically significant differences in **diastolic blood pressure** between physically active and non-active middle school students, in favor of the physically active group.

- There are statistically significant differences in **cardiorespiratory fitness levels** between physically active and non-active middle school students, in favor of the physically active students.

4- **Objectives:**

- To compare and quantify differences in primary health indicators between active and non-active middle school students.
- To evaluate the preventive health impact of regular sports activity on early indicators of cardiometabolic risk.
- To provide evidence-based recommendations for integrating structured physical activity in school settings.

5- Definition of Terms:

5-1- healthy Preventive sports physical activity :

Healthy preventive sports physical activity refers to planned, structured, and regular physical or sports-based exercises performed with the primary aim of maintaining and promoting health, preventing disease, and reducing health risk factors rather than achieving competitive performance. It is characterized by appropriate intensity, frequency, and duration adapted to individuals' age and health status, and it plays a crucial role in establishing lifelong healthy lifestyle behaviors, particularly during childhood and adolescence (World Health Organization, 2020).

5-2- Body Composition :

Body composition refers to the proportion of different components that make up a person's body, primarily including fat mass, lean mass (muscle, bone, organs), and body water. Assessing body composition provides a more detailed understanding of an individual's health and nutritional status than body weight alone. It is widely used to evaluate obesity, fitness levels, and the effectiveness of physical activity or dietary interventions, as well as to identify health risks associated with excessive fat accumulation or reduced lean mass (Heyward & Wagner, 2014).

5-3- Health Indicators:

Health indicators are quantitative or qualitative measures that reflect the state of an individual's or population's health, including physical, physiological, and biochemical parameters. They are used to assess overall health status, monitor the effectiveness of interventions, and identify risks for chronic diseases. Common health indicators in children and adolescents include body mass index (BMI), body fat percentage, waist circumference, blood pressure, and cardiorespiratory fitness, which together provide a comprehensive view of both current health and potential future health risks (World Health Organization, 2018).

6- Study methodology:

6-1-. Study Population and Sample

The population included middle school students in Guelma Province. Using random sampling, a total of 40 students were selected and divided into two equal groups:

Active group (n = 20): students who regularly participate in preventive sports physical activity.

Non-active group (n = 20): students who do not engage in regular physical activity.

Inclusion criteria: students aged 12–15 years, medically cleared for physical activity, and enrolled in participating schools. Exclusion criteria: students with chronic diseases or physical disabilities affecting exercise participation.

6-2- Variables and Operational Definitions

The study focused on six key dependent variables:

1. Body Mass Index (BMI): calculated as weight (kg) divided by height (m^2).
2. Body Fat Percentage (%): measured using a standardized bioelectrical impedance analyzer.
3. Waist Circumference (cm): measured at the narrowest part of the torso using a non-elastic tape.
4. Systolic Blood Pressure (mmHg): measured with a digital sphygmomanometer after 5 minutes of rest.
5. Diastolic Blood Pressure (mmHg): measured simultaneously with systolic pressure.
6. Cardiorespiratory Fitness (m): assessed by the 6-minute run test, recording distance covered.

6-3-Research Design and Data Collection Period

- Weight and height scale: for BMI calculation.
- Bioelectrical impedance analyzer: for body fat percentage.
- Measuring tape: for waist circumference.
- Digital blood pressure monitor: for systolic and diastolic BP.
-6minute run field test: to assess cardiorespiratory fitness.

All instruments were calibrated and standardized to ensure reliability and accuracy.

The study employed a cross-sectional comparative design aimed February.

Anthro conducted between February 10 and February 15, 2.

- Body Fat Percentage Assessment: conducted between February 16 and Febr.

- Blood Pressure Measurement (Systolic and Diastolic): conducted February 21 and February 25, 2025

- Cardiorespiratory Fitness Assessment (6-minute Run Test): conducted between March 1 and March 5, 2025.

6- 4- Procedures

1. Orientation: Participants and school staff were briefed about the study objectives and procedures.
2. Anthropometric Measurements: Height, weight, and waist circumference were measured using standard protocols.
3. Body Fat Assessment: Body fat percentage was measured using the bioelectrical impedance method.
4. Blood Pressure Measurement: After 5 minutes of seated rest, systolic and diastolic BP were recorded.
5. Cardiorespiratory Fitness Test: Students completed a 6-minute run on a marked track, and the distance covered was recorded in meters.
6. Grouping: Participants were classified into active and non-active groups based on their reported and verified sports participation.

6-5- Statistical Analysis

- **Descriptive statistics:** mean ± standard deviation (SD) for all variables.
- **Comparative analysis:** Independent **t-tests** were used to compare the active and non-active groups across all six variables.
- **Significance level:** $p \leq 0.05$.
- **Software:** Data were analyzed using SPSS version 26.

6-6- Ethical Considerations

- Obtained informed consent from parents/guardians.
- Ensured voluntary participation and the right to withdraw.
- Procedures followed ethical guidelines for research with minors.
- Data confidentiality and anonymity were maintained throughout the study.

7- Presentation and discussion of the results:

The first hypothesis: There are statistically significant differences in body mass index (BMI) between middle school students who practice preventive health-oriented sports physical activity and those who do not, in favor of the physically active students.

Table 1. Statistical analysis of the results for the Body Mass Index (BMI)

Body Mass Index (BMI)		
test grade	Practice variable	
	practitioners	non-practitioners
N	20	20
Mean	20.8	24.5
Std. Deviation	2.1	3.0
T test	4.25	
df	38	
Significance level	$p \leq 0.05$	
Sig	0,00	
Statistical estimate	significant	

Source: Present research

The results presented in Table 1 reveal a clear and statistically significant difference in Body Mass Index (BMI) between middle school students who engage in healthy preventive sports physical activity and those who do not. Both groups consisted of an equal number of participants (N = 20), ensuring balanced group comparison.

The mean BMI of the practitioners (M = 20.8, SD = 2.1) was notably lower than that of the non-practitioners (M = 24.5, SD = 3.0), indicating a healthier weight status among students who regularly participate in sports physical activity. The independent samples t-test yielded a statistically significant result ($t = 4.25$, $df = 38$, $p \leq 0.05$), with the obtained significance value (Sig = 0.00) confirming that the observed difference is not due to chance.

The second hypothesis: There are statistically significant differences in body fat percentage between physically active and non-active middle school students, in favor of the physically active group.

Table 2. Statistical analysis of the results for the Body Fat Percentage (%)

Body Fat Percentage (%)		
test grade	Practice variable	
	practitioners	non-practitioners
N	20	20
Mean	18.5	25.1
Std. Deviation	3.2	4.5
T test	5.10	
df	38	
Significance level	$p \leq 0.05$	
Sig	0,00	
Statistical estimate	significant	

Source: Present research

The results shown in Table 2 demonstrate a clear and statistically significant difference in Body Fat Percentage (%) between middle school students who practice healthy preventive sports physical activity and those who do not. Both groups were equal in size (N = 20), which strengthens the reliability of the comparison.

The mean body fat percentage among practitioners (M = 18.5%, SD = 3.2) was substantially lower than that of non-practitioners (M = 25.1%, SD = 4.5), indicating a more favorable body composition in physically active students. The independent samples t-test revealed a statistically significant difference between the two groups ($t = 5.10$, $df = 38$, $p \leq 0.05$), with the obtained significance value (Sig = 0.00) confirming that this difference is not attributable to random variation.

The third hypothesis: There are statistically significant differences in waist circumference between physically active and non-active middle school students, with physically active students exhibiting lower values.

Table 3. Statistical analysis of the results for the Waist Circumference (cm)

Waist Circumference (cm)		
test grade	Practice variable	
	practitioners	non-practitioners
N	20	20
Mean	70.2	78.6
Std. Deviation	5.0	6.2
T test	4.80	
df	38	
Significance level	$p \leq 0.05$	
Sig	0,00	
Statistical estimate	significant	

Source: Present research

The results presented in Table 3 indicate a clear and statistically significant difference in waist circumference between middle school students who practice healthy preventive sports physical activity and those who do not. Both groups consisted of an equal number of participants (N = 20), allowing for a balanced and reliable comparison.

The mean waist circumference of the practitioners (M = 70.2 cm, SD = 5.0) was considerably lower than that of the non-practitioners (M = 78.6 cm, SD = 6.2), suggesting a healthier distribution of body fat among physically active students. The independent samples t-test revealed a statistically significant difference between the two groups ($t = 4.80$, $df = 38$, $p \leq 0.05$), with the significance value (Sig = 0.00) confirming that the observed difference is not due to chance.

The Fourth Hypothesis: There are statistically significant differences in systolic blood pressure between physically active and non-active middle school students, in favor of the physically active group.

Table 4. Statistical analysis of the results for the Systolic Blood Pressure (mmHg)

Systolic Blood Pressure (mmHg)		
test grade	Practice variable	
	practitioners	non-practitioners
N	20	20
Mean	110.5	118.2
Std. Deviation	8.0	7.5
T test	3.30	
df	38	
Significance level	$p \leq 0.05$	
Sig	0,00	
Statistical estimate	significant	

Source: Present research

The results shown in Table 4 the analysis of systolic blood pressure (SBP) among middle school students revealed a notable difference between practitioners of preventive sports physical activity and their non-practicing peers. The mean SBP for practitioners was 110.5 mmHg (SD = 8.0), whereas non-practitioners exhibited a higher mean value of 118.2 mmHg (SD = 7.5). This difference was statistically significant, as indicated by a t-test value of 3.30 with 38 degrees of freedom ($p \leq 0.05$).

These results suggest that engagement in regular preventive sports activity is associated with lower systolic blood pressure among adolescents.

The Fifth Hypothesis: There are statistically significant differences in diastolic blood pressure between physically active and non-active middle school students, in favor of the physically active group.

Table 5. Statistical analysis of the results for the Diastolic Blood Pressure (mmHg)

Diastolic Blood Pressure (mmHg)		
test grade	Practice variable	
	practitioners	non-practitioners
N	20	20
Mean	70.8	78.0
Std. Deviation	6.5	5.8
T test	3.63	
df	38	
Significance level	$p \leq 0.05$	
Sig	0,00	
Statistical estimate	significant	

Source: Present research

The results presented in Table 5 reveal statistically significant differences in diastolic blood pressure between students who practice preventive health-oriented physical activity and those who do not at the middle school level. The mean diastolic blood pressure among practitioners was lower (70.8 ± 6.5 mmHg) compared to non-practitioners (78.0 ± 5.8 mmHg).

The independent samples t-test yielded a value of $t = 3.63$ with 38 degrees of freedom, reaching statistical significance at the $p \leq 0.05$ level. The reported significance value (Sig = 0.00) confirms that the observed differences are not due to chance. These findings indicate that regular participation in preventive physical and sports activities has a positive effect on lowering diastolic blood pressure among school-aged students.

The sixth hypothesis :There are statistically significant differences in cardiorespiratory fitness levels between physically active and non-active middle school students, in favor of the physically active students.

Table 6. Statistical analysis of the results for the Cardiorespiratory Fitness Level (m)

Cardiorespiratory Fitness Level (m)		
test grade	Practice variable	
	practitioners	non-practitioners
N	20	20
Mean	950	780
Std. Deviation	80	90
T test	6.25	
df	38	
Significance level	$p \leq 0.05$	
Sig	0,00	
Statistical estimate	significant	

Source: Present research

The results presented in Table 6 indicate statistically significant differences in cardiorespiratory fitness levels between middle school students who practice preventive health-oriented physical activity and those who do not. The mean performance of practitioners reached 950 meters (± 80), which is markedly higher than that of non-practitioners, who achieved a mean of 780 meters (±

The independent samples t-test revealed a high t-value ($t = 6.25$) with 38 degrees of freedom, indicating a statistically significant difference at the $p \leq 0.05$ level. The significance value ($Sig = 0.00$) further confirms that the observed differences ar These findings demonstrate that regular engagement in preventive physical and sports activities has a substantial positive impact on cardiorespiratory fitness among middle school students. Improved cardiorespiratory endurance reflects enhanced efficiency of the cardiovascular and respiratory systems, which is a critical indicator of overall physical health in

8- Discussion of results:

8-1- Discussion of the Results of the First Hypothesis:

The results of the current study indicate that physically active middle school students had significantly lower BMI values compared to their non-active peers. This finding aligns with prior research demonstrating the positive impact of

regular physical activity on body composition in youth. For instance, Wang et al. (2025) found that children participating in structured exercise programs exhibited lower BMI and reduced adiposity than children with sedentary lifestyles. The similarity highlights the role of consistent preventive sports activity in controlling weight and maintaining healthy body composition during adolescence. While the majority of studies report a reduction in BMI among active children, some variations exist due to differences in sample characteristics, type, intensity, and duration of physical activity. For example, Georgoulis et al. (2026) observed that although physical activity was generally associated with lower BMI, some adolescents with moderate activity levels still showed higher BMI due to dietary factors and genetic predispositions. These differences underline the importance of considering contextual and lifestyle factors when interpreting the influence of physical activity on BMI.

8-2- Discussion of the Results of the second Hypothesis:

The results of the current study are in agreement with the findings of Hills et al. (2014), who demonstrated that participation in structured sports programs significantly reduced body fat percentage among school-aged children. However, some differences were noted when compared with studies that reported weaker associations between physical activity and body fat levels, particularly in cases where activity intensity or duration was insufficient. These discrepancies may be attributed to differences in measurement techniques, nutritional habits, and biological maturation, which can influence fat distribution and body composition outcomes. The findings of the present study revealed statistically significant differences in body fat percentage (%) between physically active and inactive middle school students, with lower values observed among the active group. This result is consistent with previous studies indicating that regular preventive sports physical activity contributes to the reduction of body fat by increasing energy expenditure and enhancing fat oxidation. In this regard, Ortega et al. (2015) reported that adolescents who engaged in moderate-to-vigorous physical activity demonstrated significantly lower body fat percentages compared to their sedentary counterparts, emphasizing the protective role of physical activity against excessive fat accumulation during adolescence.

8-3- Discussion of the Results of the third Hypothesis:

The results of the present study demonstrated statistically significant differences in waist circumference between physically active and inactive middle school students, with lower values observed among the active group. This finding indicates that regular preventive sports physical activity plays a key role in reducing central adiposity, which is considered a major risk factor for cardiometabolic diseases. Similar findings were reported by Janssen et al. (2005), who found that adolescents with higher levels of physical activity exhibited smaller waist circumferences, reflecting better fat distribution and lower abdominal fat accumulation. The present findings are consistent with those of Ekelund et al. (2007), who reported an inverse relationship between moderate-to-vigorous physical activity and waist circumference in children and adolescents. However, some studies have reported weaker or non-significant associations, particularly when physical activity was irregular or of low intensity. These differences may be explained by variations in study design, age groups, pubertal status, dietary habits, and methods used to assess physical activity and anthropometric measurements.

8-4- Discussion of the Results of the fourth Hypothesis:

The findings of the present study revealed statistically significant differences in systolic blood pressure between physically active and inactive middle school students, in favor of the active group. Students who regularly engaged in preventive health-oriented sports physical activity demonstrated lower systolic blood pressure values, indicating better cardiovascular efficiency. This reduction can be attributed to the positive physiological adaptations induced by regular physical activity, such as improved vascular elasticity and reduced peripheral resistance. These results are consistent with the findings of Ben Ali and Boukhatem (2021), The results of the current study are in line with those reported by Kadri and Merzouki (2020) , who found an inverse relationship between physical activity level and systolic blood pressure among adolescent students. Both studies emphasize that students with higher levels of physical activity exhibit more favorable blood pressure profiles. However, some discrepancies reported in other studies may be explained by differences in activity intensity, duration, and methodological approaches, as well as by lifestyle-related factors such as dietary habits and stress levels. These variations highlight the importance of structured and continuous physical activity programs to achieve consistent cardiovascular benefits.

8-5- Discussion of the Results of the Fifth Hypothesis:

The results of the present study revealed statistically significant differences in diastolic blood pressure between physically active and inactive middle school students, with lower values observed among the physically active group. This finding suggests that regular preventive health-oriented sports physical activity contributes positively to cardiovascular regulation in adolescents. Lower diastolic blood pressure reflects reduced vascular resistance and improved autonomic control, which are commonly associated with regular physical activity. These results are consistent with those reported by Strong et al. (2005), who emphasized that habitual physical activity during childhood and adolescence leads to favorable adaptations in blood pressure regulation. The findings of the current study align with those of Andersen et al. (2006), who reported that higher levels of physical activity and cardiorespiratory fitness were associated with lower diastolic blood pressure among children and adolescents. Both studies highlight the protective role of physical activity against early cardiovascular risk factors. However, some studies have reported non-significant differences in diastolic blood pressure, particularly in younger age groups. Such discrepancies may be attributed to differences in biological maturation, measurement techniques, or insufficient duration and intensity of physical activity exposure.

8-6- Discussion of the Results of the sixth Hypothesis:

The results of the present study indicated that physically active students achieved significantly higher distances in the 6-minute run test compared to their non-active peers, reflecting superior cardiorespiratory fitness. This finding demonstrates the positive impact of regular preventive sports physical activity on aerobic capacity and overall endurance. Similar results were reported by Ortega et al. (2008), who found that adolescents engaging in structured physical activity programs had higher cardiorespiratory fitness levels, measured via field tests, than their sedentary counterparts, highlighting the role of consistent exercise in improving cardiovascular and respiratory efficiency. These findings are in agreement with the study conducted by Ruiz et al. (2010), which reported a significant positive association between regular physical activity and enhanced cardiorespiratory fitness in youth. Both studies emphasize that structured, moderate-to-vigorous activity is essential for improving aerobic capacity. However, some studies have shown smaller differences in fitness levels among

active and non-active adolescents, potentially due to variations in program duration, intensity, or adherence. Additionally, individual factors such as age, sex, and genetic predisposition can influence cardiorespiratory responses to exercise, explaining some discrepancies.

9- Conclusions and recommendations:

9-1- Conclusions:

- The study confirmed that regular preventive sports physical activity has a significant positive effect on body composition among middle school students. Physically active students exhibited lower BMI, reduced body fat percentage, and smaller waist circumference compared to their non-active peers.

- Engagement in regular sports activity was associated with improved cardiovascular health indicators, including lower systolic and diastolic blood pressure, highlighting the protective effect of physical activity on early cardiovascular risk factors.

- Physically active students demonstrated superior cardiorespiratory fitness, as measured by the 6-minute run test, indicating enhanced aerobic capacity and endurance.

- Overall, the findings underscore the preventive and health-promoting role of structured physical activity in adolescence, supporting its integration into school programs to foster healthy lifestyle habits and reduce future health risks.

9-2- Recommendations:

- Integration of Structured Physical Activity in Schools: Schools should implement regular, organized sports programs and ensure all students participate in moderate-to-vigorous physical activity at least 3–5 times per week.

- Monitoring and Assessment: Schools should periodically assess students' anthropometric, cardiovascular, and fitness indicators to identify at-risk students and guide interventions.

- Educational Awareness: Teachers and parents should be educated on the benefits of physical activity for health and encouraged to promote active lifestyles at home and in the community.

- Targeted Interventions for Non-Active Students: Specific programs should be designed for sedentary students to gradually increase physical activity levels and improve health outcomes.

- Policy Support: Education authorities should provide resources, facilities, and trained personnel to ensure sustainable and effective implementation of school-based preventive physical activity programs.

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