TPM Vol. 33, No. 1, 2026
ISSN: 1972-6325
https://www.tpmap.org/

THE EFFECT OF PHYSICAL ACTIVITY ON ANTHROPOMETRIC MEASUREMENTS IN ADOLESCENTS (11–15 YEARS) : A FIELD STUDY IN SOME MIDDLE SCHOOLS IN CONSTANTINE

BOUTOBZA NOUARI[1], ABDELDJELIL CHAHRAZED[2], BENYAMINA MOHAMMED MEHDI[3], AZZAM AHMED[4], SELLAMI ABDERRAHIM[5], BELABED ABDERRAHIM[6], GASMI ABDELMALEK[7]

[1]LABORATORY FOR EXPERTİSE AND ANALYSİS OF SPORTS PERFORMANCE « LEAPS »,ISTAPS, UNIVERSITY ABDELHAMIDMEHRI CONSTANTINE 02 (ALGERIA), EMAIL ID : nouari.boutobza@univ-constantine2.dz
[2]LABORATORY FOR EXPERTİSE AND ANALYSİS OF SPORTS PERFORMANCE « LEAPS »,ISTAPS, UNIVERSITY ABDELHAMIDMEHRI CONSTANTINE 02 (ALGERIA), EMAIL ID : chahrazed.abdeldjelil@univ-constantine2.dz
[3]LABORATORY FOR EXPERTİSE AND ANALYSİS OF SPORTS PERFORMANCE « LEAPS », ISTAPS, UNIVERSITY ABDELHAMIDMEHRI CONSTANTINE 02 (ALGERIA), EMAIL ID : mehdi.benyamina@univ-constantine2.dz
[4]LABORATORY FOR EXPERTİSE AND ANALYSİS OF SPORTS PERFORMANCE « LEAPS »,ISTAPS, UNIVERSITY ABDELHAMIDMEHRI CONSTANTINE 02 (ALGERIA), EMAIL ID : AHMED.AZZEM@UNIV-CONSTANTINE2.DZ
[5]LABORATORY FOR EXPERTİSE AND ANALYSİS OF SPORTS PERFORMANCE « LEAPS »,ISTAPS, UNIVERSITY ABDELHAMIDMEHRI CONSTANTINE 02 (ALGERIA), EMAIL ID : abderrahim.sellami@univ-constantine2.dz
[6]LABORATORY FOR EXPERTİSE AND ANALYSİS OF SPORTS PERFORMANCE « LEAPS », ISTAPS, UNIVERSITY ABDELHAMIDMEHRI CONSTANTINE 02 (ALGERIA), EMAIL ID : abderrahim.belabed@univ-constantine2.dz
[7]LABORATORY FOR EXPERTİSE AND ANALYSİS OF SPORTS PERFORMANCE « LEAPS »,ISTAPS, UNİVERSİTY Abdelhamidmehri Constantine 02 (Algeria), Email ID : Abdelmalek.gasmi@univ-constantine2.dz

Received: 15/02/2026 **Acceepted**: 29/05/2026

ABSTRACT
This study aims to analyze the predictive role of physical activity levels in modifying anthropometric measurements and body composition among adolescents (11–15 years old) attending middle schools in the Constantine province of Algeria. The sample included 456 students of both sexes, classified according to their Body Mass Index (BMI) as: normal weight, overweight, or obese. The study relied on standardized measurements of weight, height, BMI, fat mass, and lean mass, in addition to assessing physical activity levels (NAP). Results showed:

- ✓ A high prevalence of obesity (34.4%), overweight (28.5%), and normal weight (37.1%).
- ✓ Most students were physically inactive or had low activity levels.
- ✓ Strong inverse relationships were found between physical activity and BMI, fat mass, and weight.
- ✓ A direct relationship exists between physical activity and lean body mass.

Regression models showed that physical activity explains:

- ✓ 7% of the variance in lean body mass.
- ✓ 26% of the variance in fat mass.
- ✓ 20% of the variance in weight.

The results indicate the important protective role of physical activity and improving body composition in adolescents.

KEYWORDS: Physical activity – Body Mass Index (BMI) – Adolescents – Fat mass – Lean body mass.

INTRODUCTION

Childhood and adolescent obesity is one of the most pressing global health issues of the 21st century, given its direct link to an increased risk of cardiovascular and metabolic diseases at an early age. World Health Organization reports indicate a continuous rise in overweight and obesity rates among adolescents, particularly in developing countries experiencing rapid shifts in physical activity and dietary patterns (World Health Organization, 2024).

Adolescence is a critical period in terms of physical growth, hormonal changes, and behavior, where body composition is significantly influenced by the level of daily physical activity. The literature indicates that a decrease in physical activity, coupled with an increase in sedentary behaviors, directly contributes to an increase in fat mass and a decrease in lean mass, thus increasing the likelihood of developing obesity during this sensitive stage (Janssen & Leblanc, 2010).

Physical activity is defined as any bodily movement resulting from muscle contraction and requiring energy expenditure. It is a fundamental element in maintaining energy balance and improving the functions of vital organs (Caspersen et al., 1985). Numerous studies have demonstrated that regular physical activity, particularly moderate to vigorous activity, leads to improved body composition by reducing fat mass and increasing muscle mass, in addition to improving aerobic fitness in children and adolescents (Ekelund et al., 2012; Ortega et al., 2008).

Despite the availability of a considerable number of international studies on the impact of physical activity on body composition, scientific data concerning adolescents in the Algerian context remains limited, especially those employing advanced analytical approaches that consider the interaction between physical activity, gender, and body mass index categories within the school setting. Therefore, this study aims to fill this gap by analyzing the predictive role of physical activity in modifying anthropometric measurements among Algerian adolescents (11–15 years old), with a focus on gender-related differences and body mass index categories

1. Problematique

Adolescence is a period marked by a range of biological and behavioral changes that make it one of the most susceptible age groups to body composition imbalances and increased fat accumulation, especially with low levels of physical activity. Despite growing research interest in obesity among this age group, field studies in Algerian schools investigating the contribution of physical activity to predicting anthropometric measurements remain limited.

Therefore, the research problem can be formulated as follows:

Does physical activity contribute to predicting anthropometric measurements (BMI, fat mass, lean mass, and weight) in adolescents (11–15 years old?

Does the effect of physical activity differ according to gender and BMI categories (normal weight, overweight, and obesity) among adolescents?

3. Research Hypotheses

3.1General Hypothesis:

The level of physical activity significantly contributes to predicting anthropometric measurements (BMI, fat mass, lean mass, and weight) in adolescents (11–15 years old).

3.2Sub-Hypotheses

1 The level of physical activity contributes statistically to predicting body fat mass (MG), lean body mass (MM), and weight in adolescents (11–15 years).

2. The effect of physical activity varies according to sex and body mass index (BMI) categories (normal weight, overweight, obese) in adolescents.

4. THEORETICAL FRAMEWORK

4.1. Physical Activity: and its Physiological Effects: Physical activity is defined as any muscular movement that requires energy expenditure (Caspersen et al., 1985). The literature indicates that regular physical activity contributes to improved energy balance, increased metabolic rate, improved cardiovascular and respiratory function, and reduced fat accumulation (Janssen & Leblanc, 2010).

4.2. **Anthropometric Measurements**: These include weight, height, BMI, skinfold thickness, and estimates of body fat mass and lean body mass. The Durnin & Womersley equations (1974) are among the most widely accepted methods for accurately measuring body fat percentage in the field (Durnin & Womersley, 1974).

4.3. **Physical Activity and Body Composition in Adolescents**: Numerous studies indicate that physical activity improves body composition by:

•Reducing fat mass (Ekelund et al., 2012)

•Increasing muscle mass (Ortega et al., 2008)

•Improving aerobic fitness (Janssen & Leblanc, 2010). Males generally benefit more than females due to hormonal differences, particularly testosterone levels (Ortega et al., 2008)

5 -STUDY METHODOLOGY

5 -1-Study Methodology: The study adopted a descriptive-analytical approach, as it was suitable for the nature of the topic and its objectives.

5 -2-Study Sample: The study sample consisted of 456 male and female students, aged between 11 and 15 years, randomly selected from several middle schools in the Constantine province. The sample was classified into three categories according to Body Mass Index (BMI): normal weight, overweight, and obese.

5 -3-Measurement Tools: The following measurements were taken**:**

•Weight and height measurement.

•Calculation of Body Mass Index (BMI).
•Estimation of body fat mass using the Durnin & Womersley equations (1974).
•Determination of physical activity level using a validated international questionnaire (Martin, 2000).
5 -4-Statistical Analysis: The data were processed using SPSS 26 software to calculate: means, standard deviations, correlation, and multiple regressions.

7- RESULTS

7-1- Presentation of descriptive statistics for the research variables:

Table No. (01): Lowest value, highest value, arithmetic mean, and standard deviation for the study variables

variables	mean arithmetic	standard deviation	highest value	Lowest value
Imc	24.43	5.47	49.04	14.98
NAP	1.53	1.11	2.03	1.28
VO2max	36.06	5.42	52.00	26.60
MM	44.37	9.46	78.04	23.63
MG	14.97	8.70	75.97	3.93
Weight (kg)	59.34	15.61	113.30	27.70

The descriptive results showed that the mean body mass index (BMI) was (24.43 ± 5.47), which places the sample, on average, within the overweight category, with relatively high values for body fat mass (14.97 ± 8.70). The level of physical activity (NAP) was also recorded at a low average (1.53 ± 0.11), reflecting the prevalence of physical inactivity in the school environment.

7-2- Displaying the correlation matrix for all variables under study:

Table No. (02): Displaying the correlation matrix.

Correlations							
		imc	NAP	VO2max	MM	MG	weight
imc	Pearson Correlation	1	-.515**	-.612**	.586**	.901**	.857**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	456	456	456	456	456	456
NAP	Pearson Correlation	-.515**	1	.731**	-.271**	-.509**	-.447**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	456	456	456	456	456	456
VO2max	Pearson Correlation	-.612**	.731**	1	-.480**	-.596**	-.623**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	456	456	456	456	456	456
MM	Pearson Correlation	.586**	-.271**	-.480**	1	.478**	.872**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	456	456	456	456	456	456
MG	Pearson Correlation	.901**	-.509**	-.596**	.478**	1	.847**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	456	456	456	456	456	456
weight	Pearson Correlation	.857**	-.447**	-.623**	.872**	.847**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	456	456	456	456	456	456
**. Correlation is significant at the 0.01 level (2-tailed).							

7-3-Frequencies and percentages of the study sample:

Table No. (03): Distribution of sample members according to the body mass index variable.

Variable	Frequency	Percentage (%)
Normal weight	169	37.10%
Overweight	130	28.50%
Obesity	157	34.40%
Total	456	100%

Table No. (04): Frequencies and percentages of the distribution of the sample members according to the variables of gender and body mass index.

Total	IMC			Statistics	gendre
	Obesity	Overweight	Normal weight		
231	74	67	90	Frequency	Female
100	32	29	39	Percentage %	
225	83	63	79	Frequency	Male
100	36.90	28	35.10	Percentage %	
456	157	130	169	Frequency	Total
100	34.40	28.50	37.10	Percentage %	

7-4- Physical Activity Level among Adolescent Students:

Table No. (05): Distribution of Activity Level Categories (NAP)

(NAP)	Number	Percentage %
Physical inactivity	186	40.79
Light activity	242	53.07
Moderate activity	24	5.26
Active	04	0.88
Total	456	100

7-5- The effect of physical activity on lean mass:

Table No. (06): Results of the multiple hierarchical regression of the body mass index variable (normal weight, overweight, obesity) on the relationship of physical activity and sports to lean mass among students (11-15) years old.

MM								The variable	
the reaction quotient model.				The basic model					
Sig	Value of T	coefficient B	R	Sig	Value of T	coefficient B	R	Predictor variable	
-	-	-	-	0.001<	-5.99	-24.24	*0.27	Physical activity	
0.67	-0.42	-1.85	0.48	-	-	-	-	NAP	Interaction *
<0.001	9.60	5.23						IMC	
36.88				81.58				Constant	
0.23				0.07				Coefficient of Determination 2R	
0.16				0.07				R^2 change	
92.10				35.90				F change	
<0.001				<0.001				Sig F change	
67.60				35.90				F Anova	
<0.001				<0.001				Sig F Anova	

The relationship is statistically significant. Significance level = 0.05

•The relationship between NAP and MM is direct ($p < 0.01$).

•Males have higher MM than females.
•Physical activity accounts for 7% of the variation in lean body mass

7-6- The effect of physical activity on fat mass:

Table No. (07): Results of the multiple hierarchical regression of the body mass index variable (normal weight, overweight, obesity) on the relationship of physical activity and sports to fat mass among students (11-15) years old.

IMG								The variable	
the reaction quotient model.				The basic model					
Sig	Value of T	coefficient B	R	Sig	Value of T	coefficient B	R	Predictor variable	
-	-	-	-	0.001<	-12.59	-41.88	0.51*	Physical activity	
<0.001	-5.39	-17.96	0.69	-	-	-	-	NAP	*
<0.001	13.44	5.59						IMC	Interaction
31.51				79.25				Constant	
0.47				0.26				Coefficient of Determination 2R	
0.21				0.26				R^2 change	
180.73				158.51				F change	
<0.001				<0.001				Sig F change	
200.99				158.51				F Anova	
<0.001				<0.001				Sig F Anova	

The relationship is statistically significant. Significance level = 0.05
•Physical activity explains 26% of the variance in MG.
•The relationship is strong and statistically significant ($p < 0.01$).
•Males score lower in MG at the same activity level.

7-7- The effect of physical activity on weight:

Table No. (08): Results of the multiple hierarchical regression of the body mass index variable (normal weight, overweight, obesity) on the relationship of physical activity and sports to weight among students (11-15) years old.

weight								The variable	
the reaction quotient model.				The basic model					
sig	Value of T	coefficient B	R	Sig	Value of T	coefficient B	R	Predictor variable	
-	-	-	-	0.001<	-10.66	-66.12	*0.45	Physical activity	
<0.001	-3.24	-19.81	0.67	-	-	-	-	NAP	*
<0.001	14.18	10.82						IMC	Interaction
68.39				160.82				Constant	
0.45				0.20				Coefficient of Determination 2R	
0.25				0.20				R^2 change	
201.06				113.60				F change	
<0.001				<0.001				Sig F change	
182.36				113.60				F Anova	
<0.001				<0.001				Sig F Anova	

The relationship is statistically significant. Significance level = 0.05
NAP accounts for 20% of the variation in weight.
•IMC is strongly correlated with weight (r = 0.857)

8- Hypothesis Testing:

8 -1-Testing the First Sub-Hypothesis:

The correlation matrix showed a strong and statistically significant inverse relationship between physical activity level and body mass index (r = -0.515), fat mass (r = -0.509), and weight (r = -0.447). A significant positive relationship was also found between physical activity and lean mass (r = -0.271) at a significance level of $p < 0.01$.

The results of the multiple hierarchical regression confirm that the level of physical activity explains:
%26 -of the variance in fat mass.
%7 -of the variance in lean mass.
%20 -of the variance in weight.

This supports the first sub-hypothesis and confirms the predictive role of physical activity in modifying body composition. 8-2- Testing the Second Partial Hypothesis:
The interaction models showed that the effect of physical activity on fat mass and weight varies according to BMI categories, with the effect being more pronounced in the overweight and obese categories. The results also showed gender-related differences, with males recording higher lean mass and lower fat mass at the same level of physical activity compared to females.

9- DISCUSSION

The results of this study confirm that physical activity is a crucial factor in improving body composition in adolescents, as it was clearly associated with a decrease in fat mass and an increase in lean mass. These results are consistent with the findings of several studies that have indicated the protective role of physical activity against obesity and metabolic disorders during adolescence (Janssen & Leblanc, 2010; Ekelund et al., 2012.(
The high percentage of students classified as physically inactive or lightly active (over 90%) reflects a worrying reality within Algerian educational institutions and is consistent with the findings of Benmohammed et al. (2017) On the limited physical activity among Algerian adolescents.
The strong inverse relationship between physical activity and fat mass is explained by the principle of energy balance, where higher activity levels lead to increased energy expenditure and reduced fat storage, especially given the adolescent body's sensitivity to changes in movement (Astrand & Rodahl, 2003). The higher lean mass in males is attributed to hormonal and structural differences, particularly the effect of testosterone on muscle tissue development (Ortega et al., 2008.(
Furthermore, the strong correlation between body mass index (BMI) and fat mass ($r = 0.901$) confirms the validity of using BMI as a field indicator for assessing obesity in adolescents, a finding supported by World Health Organization (WHO, 2024) recommendations.
The results also highlight the existence of social and cultural dimensions that limit female participation in physical activity, necessitating the adoption of educational policies that are sensitive to specific needs and encourage regular physical activity within the school environment. 10- Conclusion:
Physical activity is a key predictor of improved anthropometric measurements and body composition in adolescents (11–15 years). The results underscore the need to include regular physical education programs within Algerian educational institutions, with particular attention to overweight and obese groups, and especially to females.

BIBLIOGRAPHY

1. Astrand, P. O., & Rodahl, K. (2003). Textbook of work physiology: Physiological bases of exercise. McGraw-Hill.
2. Benmohammed, K., Valensi, P., & Nguyen, T. (2017). Epidemiology of overweight and obesity in adolescents in Algeria. Journal of Metabolic Disorders, 14(2), 125–134.
3. Caspersen, C. J., Powell, K. E., & Christenson, G. (1985). Physical activity, exercise, and physical fitness: Definitions and distinctions. Public Health Reports, 100(2), 126–131.
4. Durnin, J., & Womersley, J. (1974). Body fat assessed from total body density and its estimation from skinfold thickness. British Journal of Nutrition, 32(1), 77–97.
5. Ekelund, U., et al. (2012). Moderate to vigorous physical activity and cardiometabolic risk factors in children and adolescents. JAMA Pediatrics, 166(8), 1–8.
6. Janssen, I., & Leblanc, A. G. (2010). Systematic review of health benefits of physical activity in school-aged children. International Journal of Behavioral Nutrition and Physical Activity, 7, 40.
7. Ortega, F. B., Ruiz, J. R., Castillo, M. J., & Sjöström, M. (2008). Physical fitness in childhood and adolescence: A marker of health. Sports Medicine, 38(4), 269–280.
8. World Health Organization. (2024). Obesity and overweight. WHO Press.