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Analysis of early obesity symptoms in children aged 11-12 years, a case study from southern Algeria

BETTAHER Zohra Chahinez
Normal Superior School of Bouzaréah,(ALGERIA)
zohra-chahinaz.bettahar@ensb.dz
Laboratoire de linguistique et sociodidactique du plurilinguisme (LISODIP)
RAOUAN Mohamed
Université of Amar Telidji, Laghouat, (ALGERIA)
m.raouan@lagh-univ.dz
Laboratory of cognitive dimensions and applied concepts in sports training sciences through multiple approaches
CHACHOU Ahmed Ali
Université of Amar Telidji, Laghouat, (ALGERIA)
a.chachou@lagh-univ.dz
Laboratory of cognitive dimensions and applied concepts in sports training sciences through multiple approaches
KERROUM Bachir
Université of Amar Telidji, Laghouat, (ALGERIA)
b.karroum@lagh-univ.dz
Laboratory of cognitive dimensions and applied concepts in sports training sciences through multiple approaches

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Abstract:
The objectives of this study are to analyse morphological data and determine the body profile of schoolchildren aged 11 to 12. Our sample consists of 90 children from primary schools in the municipality of Laghouat, in southern Algeria. To develop the research tool, we used anthropometric measurements and assessed body mass index (BMI) to identify earlier obese children and those at risk of obesity. In order to properly supervise and guide these children towards appropriate sports activities, we studied their physical fitness based on basic physical tests, so that we could assess their body mass index at the same time.
The experimental procedures and statistical analysis show that there is a correlative relationship between body mass index and physical fitness, with a correlation coefficient of -0.437 and a T-test of -1.310, at a significance level of 0.005*, which shows strong significance. Between the practice of children's activities at the age of 11-12 years and the body mass index which represents an essential indicator of early obesity.
Keyword: obesity, body mass index, physical fitness, children aged 11-12 years

1. INTRODUCTION

Childhood obesity is now regarded as a major public health issue, due to its rapid global rise and its early impact on children's health. The world health organization highlights that overweight and obesity affect a growing number of children and adolescents worldwide,

including in developing countries (WHO, 2022). In this context, several research have shown that the early years of life are critical period in the develipment of weight imbalance, particulary through the early onset of adiposity and the lasting influence of eatong habits (Rolland-Cachera et al., 1984; Ong et al., 2002).

The work of Koletzko et al. (2009) has also showed that young child's diet plays a key role in regulating growth and metabolism, particulary when the balance between energy intake and physiological needs is disrupted. Furthermore, inceased sedentary lifestyles and the greater availability of high calorie foods have been identified as major factors contributing to the development of childhood obesity (WHO, 2024). Thus, obesity results from a combination of biological, behavioural and environmental determinants that interact from a very young age.

Obesity is a very dangerous condition, especially when it occurs at a young age. It is therefore essential to monitor and control diet, as well as lack of physical activity. To this end, physical activity is beneficial, provided it is continuous, appropriate and structured. Children need to move and play. This is a period when they acquire motor skills through obstacles, balls, rhythms, etc. They should be encouraged to run, jump, crawl, climb, spin, swing, pull, push, carry, practise balance exercises, hang, etc. These activities will contribute to the development of their motor skills, but also to the development of their personality and self-esteem. The time spent on physical activity will usually be fairly short.

Spontaneous physical activity in young children is intermittent. It is characterised by a rapid succession of short periods of intense physical activity (a few minutes) and periods of rest. As children grow, the nature and purpose of physical activity changes. Children's psychomotor development evolves with age, passing through different stages, knowledge of which is important for prescribing personalised physical activity.

In early school age (11 to 12 years), children are still energetic and have greater ability for rapid movements and different rhythms. This period is conducive to the acquisition of motor skills and the learning of a large number of basic techniques, thanks to physical conditioning and coordination exercises, particularly in the context of multidisciplinary activities.

In the case of children aged 11 to 12, the early identification of signs of obesity is particulary important, as this period corresponds to a transitional phase marked by significant morphological functional changes. In the southern Algeria, this issue warrants specific attention due to the observed increase in overweight young people and the need for reliable assessment tools to identify early symptoms. As several studies have shown, the analysis of morphological components can contribute to the early detection of children at risk and guide prevention strategies (Must et al., 1991; Lobstein et al., 2004).

Obesity

Obesity is defined as an excessive accumulation of adipose tissue in the body, leading to adverse health effects. This chronic condition is generally associated with a long-term energy imbalance linked to diet and lifestyle, and its diagnosis is based primarily on body mass index.

Sedentary lifestyle

is defined as 'a state in which movement is reduced to a minimum and energy expenditure is roughly equal to resting energy metabolism'. It is defined as 'a state in which movement is

reduced to a minimum and energy expenditure is roughly equal to resting energy metabolism'. It can be defined as physical activity (PA) that is zero or below the recommended minimum threshold, which is the equivalent of 30 minutes per day of brisk walking at least 5 days per week. It corresponds to physically passive behaviours (watching television, playing video games, working on a computer or talking on the phone while seated).

Physical inactivity

Physical inactivity is one of the major determinants of childhood obesity. According to Guinhouya (2013), childhood obesity results from a sustained energy imbalance, in which reduced physical activity plays a central role, interacting with other environmental and behavioural factors. Similarly, Canadian guidelines note that the aetiology of obesity is multifactorial, but that it is strongly associated with insufficient physical activity, sedentary behaviours and excessive calorie intake. In the same vein, research from the scientific community highlights that the rise in sedentary lifestyles among children and adolescents contributes to the increase in obesity and justifies prevention strategies focused on promoting an active lifestyle.

Nutritional physical activity

Another 'nutritional' definition describes it as 'any bodily movement produced by the contraction of skeletal muscles resulting in an increase in energy expenditure above resting expenditure' (Merlaud and Terral, 2016). It is characterised by its nature (type), intensity, duration, frequency.

Several studies have shown that an early rebound in body fat is a significant predictor of future obesity in children. Rolland-Cachera and colleagues, in particular, have demonstrated that an early onset of this rebound is associated with an increased risk of obesity in adolescence and adulthood. Other reviews confirm that a rapid rise in the BMI curve, physical inactivity and a sedentary lifestyle are early warning signs in children aged 11–12.

According to Baquet et al. (2007), the relationship between the load and effect of the level and type of physical activity on health has not yet been determined in children. However, Strong et al. (2005) had previously shown that the beneficial effects of physical activity on various health determinants were more pronounced in obese or overweight children. According to Baquet et al. (2007), the most active children have a lower percentage of body fat.

The prevalence of overweight children appears to be increasing. The transformation of Algerian society has likely influenced the eating habits of children, who are consuming more and more industrial products with a very high glycaemic index. These habits seem to become established throughout their school years. A small percentage of schoolchildren participate in organised physical activities; they move and exercise very little, as schoolwork and extra lessons take up most of their time.

In 2019, JM Musung conducted a study to determine the prevalence of overweight and obesity among adolescents attending public and private schools in Lubumbashi, Democratic Republic of Congo. The study found that overweight and obesity among adolescents in schools are a reality in Lubumbashi. It is recommended that the prevalence of overweight and obesity for this age group be determined at the national level in order to prevent and manage these conditions.

This study aims to analyse the early signs of obesity in chidren 11to 12 in southern Algeria, in ordre to better understand the morphological manifestations of this phenomenon and to propose appropriate interventionstrategies. It forms part of a prevention approach based on the early identification of risks and the improvement of dietary and physical activity habits.

It is imperative that this report sounds the alarm and spurs urgent action to improve dietary habits and physical activity in the region, in particular by creating environments that encourage healthy behaviour. In this regard, the obesity rate in south Algeria has risen dramatically in recent years, requiring coordinated action from institutional leaders, sports club coaches and parents, with the latter needing to monitor their children's diets. This action must be based on rigorous scientific methods in order to prevent childhood obesity.

What methods are useful for analyzing and diagnosing early symptoms of obesity in children aged 11-12 years, and What scientific measures are useful for identifying children at risk of early obesity?

What is the best tool for diagnosing obesity?

What activities are preferable at this age and do they represent a tool that minimizes the risk of obesity?

Study hypothesis:

There are scientific measures that can be used to determine obesity indicators from an early age.

The assessment of morphological components makes it possible to identify symptoms of obesity in children.

- Biometrics (body mass index) can be used to determine body type and diagnose obesity.
- Is adapted sports practice beneficial for obese children at an early age?

Study objectives

- Determine the specific scientific measures that can be used to screen for obesity at an early age.
- Analyse morphological data useful for diagnosing symptoms of obesity.
- Demonstrate the importance of adapted physical activity and encourage children suffering from obesity to participate in it.

2. Experimental approach

7.1 Methodology: In this study, we used a cross-sectional design to assess the relationship between physical activity levels and health-related physical fitness indicators in school-age children at risk of developing obesity. A descriptive approach was adopted for the study design.

7.2 Sample and selection methods: We limited the study population to 90 children in urban areas in laghouat district in the fourth and fifth grades of primary school, provided that they belonged to the age group (10-12 years), which was divided into two categories:

7.3 Tools of investigation

7.3.1 Mesures morphologiques

In this method, the following three morphological components were assessed: age, height and weight.

For height, a professional anthropometric tape measure was used, and for weight, a medical scale was used.

Table 1: Protocol for measuring morphological components

Criteria	**Body measurements** **Measurement methods**	**Unit of measurement**
Height	Measured using an anthropometer to measure the length of the body when standing with the legs together	Centimetres
Weight	Measured using medical scales	Kilograms

7.3.2 Anthropometric tests 'Body Mass Index BMI'

BMI was calculated by dividing weight (in kilograms) by height squared (in metres).

BMI = Weight (kg) / Height² (m)

7.3.3 Statistical tools

Given the nature of the study, the arithmetic mean, standard deviation and T-test were used.

3. Analysis of results

8.1 Analysis of results for the first hypothesis

- Assessment of morphological components allows the identification of symptoms of obesity in children.

Table 2. Presentation of morphological measurement results

Metadata for the study sample						
Category of age	**Sex**	**Nomber**	**Lenth**		**Weigth**	
			SD	**$\bar{X}$**	**SD**	**$\bar{X}$**
11 years old	**Boys**	16	0.050	151	5.403	33
	Girls	24	0.056	153.77	6.032	39.88
12 years old	**Boys**	15	0.060	158.01	5.830	37.10
	Girls	35	0.067	159.33	5.403	4522.
Total		90	0.064	154.52	6.236	38.30

According to the table below, we observe a degressive progression of morphological components (height and weight) which begins at 11 years and continues until 12years. In boys, we observe an increase of 7.01 cm for height and almost 4.10 kg for weight. In girls, the increase is 5.56 cm for height and almost 5.34 kg for weight.

8.2 Analysis of the second hypothesis

- Biometrics (body mass index) can be used to determine body type and diagnose obesity.

To better address the hypothesis below, we applied the BMI formula to our study sample.

Table 3: Presentation of body mass index results for our sample

Body mass index in children						
Variable	Body mass index			Arithmetic mean	Standard deviation	Sample trend
Level	Health risk	Need for improvement	Health fitness	24.32	1.78	Need for improvement
Frequency	20	90	-			
Percentage	17%	83%	-			

Once the data has been collected, it is necessary to comply with the reference scale for thinness and overweight, as defined by the Gramm fitness model.

Table 4: Presentation of body mass index for ages 9–10 according to the FITNESS GRAM standards classification

Weight categories according to (FITNESS GRAM standards)					
Category		**Thinness**	**Health fitness**	**Need for improvement**	**Health risk**
Boys	**11years old**	≤14.4	14.5-19.7	19.8-22.6	≥22.7
	12years old	≤14.8	15.9-20.5	20.6-23.6	≥23.7
Girls	**11years old**	≤15.2	15.3-20.3	20.4-23.5	≥23.6
	12years old	≤15.6	16.7-21.2	21.3-24.6	≥24.7

Table 2 shows the cut-off points for determining weight categories for males and females according to body mass index (Laurson et al., 2011b).(Laurson et al., 2011a), which divide weight into four categories or zones.

The results of our sample show that 82% of children need to improve their physical condition, i.e. they need to lose weight, and that 18% are overweight. The need for physical activity and dietary control is therefore indisputable.

8.3 Analysis of the third hypothesis

- Engaging in appropriate physical activity is beneficial for obese children from an early age.

This hypothesis led us to administer basic physical tests to determine whether there was a relationship between the child's physical condition and their degree of overweight.

Table 5: Presentation of the results of the physical athletic data from our sample

Level of physical activity among children at risk of obèsity				
Variable	Physical activity	Arithmetic	Standard	Sample

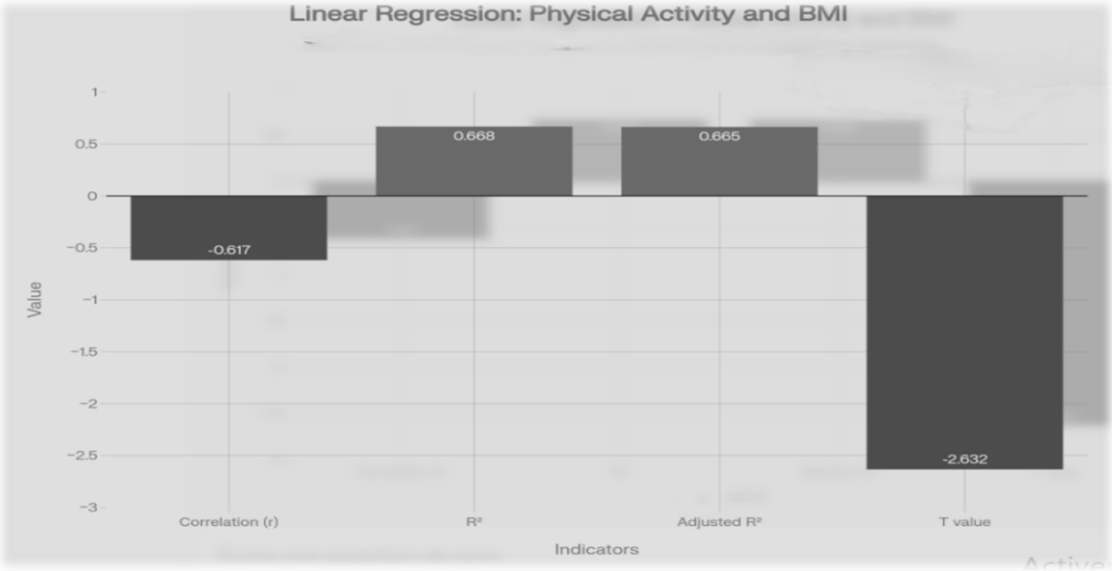
				mean	deviation	trend
Level	Low	Moderate	High	1.64	0.06	Low
Frequency	85	24	-			
Percentage	75%	25%	-			

Table 3 shows that the majority of children in our sample do not engage in physical activity, with a percentage of 79%, and that 21% of them engage in moderate physical activity.
To better establish the existence of a relationship between sports participation and the risk of obesity, we used the R-person statistical correlation test and the T-test for differences.

Table n°6 : Results of linear regression analysis of physical activity level and body mass index

Results of linear regression analysis of physical activity level and body mass index						
Independent variable	Dependent variable	Correlation coefficient	Determination coefficient	Corrected determination coefficient	T	Significance level
Level of physical activity	mass index	-0.617	.668	.665	-2.632	.000*

The table below shows that the correlation coefficient between the level of physical activity and body mass index is (-0.437), indicating a significant correlation. The T-test also shows (T = -1.310) a significance level of 0.005*. The relationship between body mass index and physical activity is therefore very strong.



Graph 1: the correlation coefficient between the level of physical activity and body mass

4. Discussion

4.1. Discussion of the first hypothesis

The application of anthropometric methods, such as body measurements (height, weight), provides some clues about physical condition, especially when it comes to young populations. Nadjem Nabil and Doudou Belkacem (2019, p. 102) emphasised that 'this age group is considered a period of discovery, full of vitality and creativity'. Measuring height and weight at an early age can help prevent certain diseases, such as obesity, diabetes, etc. The results of our sample regarding height and weight trends paint a representative picture of what these children will be like as adults.

The simple explanation for the obesity epidemic is that physical activity is less necessary nowadays and that low-cost, high-calorie food is more readily available, thus creating an 'obesogenic' environment ' (Lucy Cooke, 2012). Genetics play a very important role in morphological growth, but the environment also plays a role in the obesity epidemic: 'Children are growing up in a world that offers them many opportunities for passive entertainment and an abundance of food.

4.2. Discussion of the second hypothesis

Biometrics (body mass index) can be used to determine body type and diagnose obesity. There are few studies on the activity levels of young children, but their results indicate that infants and children under three years of age tend to reduce their physical activity and increase the time they spend on screen-based entertainment (Fisher, al., 2017). The results of our study on the 9-10 age group show that 18% of children are overweight. This is due to several factors: nutrition, heredity, social environment, but above all inactivity and the consumption of non-organic products. In addition, 78% of the sample need to improve their physical fitness. It is therefore necessary to engage in appropriate and structured physical activity, as well as to follow a strict diet. BMI is a very reliable indicator that provides a predictive view of the symptoms of obesity.

To limit this epidemic, which threatens children and continues into adulthood, it is important to create an environment in which children can participate in compulsory physical activity at school. Physical inactivity is a risk factor for obesity (Hills, King, & Armstrong, 2007), while physical activity (PA) appears to have a protective effect on fat gain during childhood and adolescence (Kim et al., 2008).

According to the WHO (2003), primary prevention is 'any action or measure aimed at reducing the incidence of a disease in a population'. Primary prevention of obesity in children refers to 'any strategy that prevents overweight and the progression of overweight to obesity in individuals aged 0 to 18 years' (WHO, 2003).

4.3. Discussion of the third hypothesis

Engaging in appropriate physical activity is beneficial for obese children from an early age.

Physical fitness is defined as "the ability to perform daily tasks with vigour and promptness, without excessive fatigue, and to have sufficient energy to fully enjoy leisure time and cope with emergency situations " (Presidential Council for Physical Fitness and Sports, 2000). In our study, we analysed the correlation between physical fitness and body mass index. The results showed a very strong correlation (r = 0.617) between the two, as

inactivity causes overweight: inactivity decreases energy expenditure and increases caloric intake. "Any bodily movement produced by skeletal muscles that results in a substantial increase in energy expenditure above resting energy expenditure " (Surgeon General's Report, 2001). The components of physical fitness are muscle strength, endurance and cardiovascular capacity (oxygen transport and utilisation), to which can be added the metabolic and morphological determinants of physical fitness.

Sedentary behaviour, inactivity and physical activity are different and independent concepts. Al-Arjan and Al-Nader (2014, p. 168) emphasised that 'poor health-related physical fitness in children and adolescents, particularly obese adolescents, is closely linked to the onset of a number of psychological and social problems'.

10. CONCLUSION

New tools are now available, including an international definition of childhood obesity. A better understanding of these methods and their use will enable a more in-depth analysis of this phenomenon (Tremblay et al., 2012). Physical activity is a major factor in improving physical condition, increasing energy expenditure and, consequently, health. Thanks to its beneficial effects on physical, mental and social health, appropriate physical activity should be prescribed as part of the management of overweight and obesity. It is essential to take into account the individual, sociocultural and environmental determinants of children and adolescents so that physical activity remains enjoyable. The main objectives of prescribing physical activity are to restore the desire to exercise, to encourage regular practice and to sustain this activity over time, which is a sign of 'lasting good health'. After an accurate diagnosis using relevant and validated tools (interviews, questionnaires, medical examinations, stress tests, physical tests, etc.), the age, degree of obesity, level of physical fitness of the child or adolescent, and family environment should be used to develop a short- and medium-term action plan.

Regardless of the quality of the prescription, physical activity is only beneficial if it is actually practised. Enjoyment remains the main driver of physical activity at any age, and it is better to be somewhat active, regardless of the type of physical activity (including sports), than to be completely sedentary. Adopting an active lifestyle is key to preventing and combating obesity, from childhood to adulthood. In 2012, recommendations for physical activity in preschool children stated that they should accumulate at least 180 minutes of physical activity per day (at any intensity), including a variety of activities in different environments and exercises that develop motor skills.

There are many programmes aimed at preventing childhood obesity (Brambilla and al., 2010; HUG, 2011; Monasta and al., 2011; Waters and al., 2011; Xu et al., 2012). They generally include management of the main risk factors and adopt the following interventions:

- Organising awareness days on the importance of diagnosing the symptoms of obesity, including the child's family environment.
- Implementing a nutritional guide proposed by medical specialists and validated by the Ministry of Health.
- Introducing adapted or recreational physical activity in primary schools for obese pupils.
- An adaptive physical activity programme to combat sedentary lifestyles (including education on the importance of exercise).

- Dietary advice (and education on balanced nutrition).
- In some cases, interventions targeting the individual's environment, social and family sphere, and lifestyle habits.

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