

## DETERMINANTS ASSOCIATED WITH OBESITY AND PHYSICAL ACTIVITY IN THE PUBLIC AND PRIVATE SCHOOLS OF THE CITY OF PALERMO

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### ABSTRACT

**Introduction:** Obesity is a medical condition associated with premature death and it is a risk factor for many chronic diseases. In this context, performing a regular physical activity promotes a healthy lifestyle, with significant health benefits. The aim of the study was to investigate behaviors that increase the risk of obesity and the determinants that encourage physical activity among adolescents.

**Materials and methods:** The HBSC (Health Behavior in School-aged Children) questionnaire was administered to students in Palermo's private and public schools. For the sampling of public schools the protocol of the HBSC Surveillance System was followed; for the private ones it was opportunistic.

**Results:** Private school students are more likely to exercise more than 3 days per week (OR 1.58) and are more likely to exercise more than 2 times a week (OR 2.08). Obese students in private schools in Palermo are more likely to perform physical activity for less than 3 days a week (OR 3.52) and a higher risk of not having breakfast (OR 10.11) and a snack between main meals (OR 3.82) every day. For all the schools examined, it emerged that obese subjects are more likely not to consume fruit (OR 3.13), to stay more than 6 hours a day in front of PCs and video games (OR 3.24) and more than 2 hours a day in front of TV (OR 3.79). Male students are more likely to perform physical activity for more than 3 days per week (OR 1.48) and intense physical activity at least 2 times per week (OR 1.76)

**Conclusions:** It is necessary to intervene early with training on school and family in order to promote correct and responsible food choices and increase the level of physical activity among students. Therefore prevention interventions must be an integral part of coherent strategies based on tests of agreed effectiveness in order to minimize the risk linked to the development of diseases.

**Keywords:** Surveys and Questionnaires, Students, Adolescent Behavior, Sicily, Body Weight, Physical Activity.

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### Introduction

As some studies suggest<sup>(1,2)</sup>, the acquisition of behavioral patterns during childhood and adolescence tends to make these behaviors constant even in adulthood. Participation in various types of motor activity not only represents a significant value for the adoption and maintenance over time of a healthy and active lifestyle, but allows you to

counteract the risks and disorders caused by a sedentary lifestyle<sup>(3,4)</sup>. Although the benefits of physical activity on individual health are recognized, less than a third of children and adolescents practice sufficient levels of physical activity<sup>(3)</sup>.

Many studies have found that practicing regular physical activity produces considerable psychophysical benefits: it reduces the risks for the onset of cardiovascular diseases, prevents the onset of

endocrine diseases such as type 2 diabetes mellitus, contributes to the correct skeletal and muscular development preventing obesity and overweight, improving self-esteem and decreasing the risk of depression<sup>(5-7)</sup>.

It is interesting to note that participation in recreational and sporting activities represents, among the behaviors implemented by adolescents, one of the most important resources for implementing processes of socialization, identification and structuring of the character<sup>(8,9)</sup>. International guidelines recommend a moderate or intense daily physical activity for at least 60 minutes for boys in the age of development<sup>(1)</sup>.

Moderate physical activities (energy consumption: 3.5 - 7 Kcal/min) include: walking, cycling, dancing, doing activities in the gym and swimming pool, doing housework.

Intense physical activities (energy consumption: over 7 Kcal/min) include: running, step, karate, judo and most competitive sports (10).

Teens use their free time in front of television or videogames<sup>(11)</sup>, which represent passive forms of entertainment that reduce the needs and opportunities for physical activity<sup>(12)</sup> and become factors responsible for increasing overweight<sup>(13,14)</sup>. The international guidelines<sup>(15)</sup> recommend not exceeding two hours a day dedicated to watching the monitor (TV, video games, computers, internet), because this practice is related to the increase in overweight. In addition, it should be remembered that the correct diet has a strong impact on health throughout life as it is considered as one of the main determinants modifiable for the onset of chronic diseases<sup>(3)</sup>.

In this context, the consumption of fruit and vegetables, guaranteeing the intake of water, fiber, vitamins and minerals, contribute to a healthy diet counteracting the onset of obesity<sup>(16,17)</sup>. In fact, national and international guidelines recommend the regular consumption of "5 portions of fruit and vegetables per day"<sup>(3)</sup>.

Designing actions that promote the well-being of present and future communities is the goal of Public Health, and in this perspective research in the field of the health of populations in the age of development becomes a priority. Given that many behaviors that will be definitive in adulthood begin to be structured precisely in this age (11-15 years old), it is necessary to define interventions, programs and policies, effective for the education and promotion of their health.

Based on these considerations, our study, in order to contribute to the knowledge of such behaviors, had the objective to analyze the associated factors favoring physical activity and obesity by stratifying them by age, sex and type of school attended (public or private Palermo).

## Materials and methods

The implementation of the study was made possible thanks to the collaboration between the School of Medical Specialization in "Hygiene and Preventive Medicine" of the University of Palermo, the S.I.A.N. (Food Hygiene, Surveillance and Nutritional Prevention Service, Servizio Igiene degli Alimenti e Nutrizione in Italian) of Palermo and the D.A.S.O.E. (Department of Health Activities and Epidemiological Observatory, Dipartimento Attività Sanitarie Osservatorio Epidemiologico in Italian) of the Sicily Region. In the period between January 2014 and December 2015 to the students of the private and public schools of Palermo, the HBSC (Health Behavior in School-aged Children) questionnaire was given with the informed consent signed by one of the two parents<sup>(18)</sup>.

	Public school (N=318)		Private school (N=285)	
	Male, N (%)	Female, N (%)	Male, N (%)	Female, N (%)
11 years old	57 (37.25)	47 (28.48)	53 (61.63)	33 (38.37)
13 years old	54 (35.29)	58 (35.15)	61 (58.65)	43 (41.35)
15 years old	42 (27.45)	60 (36.36)	60 (63.16)	35 (36.84)
<b>Total</b>	153 (100)	165 (100)	174 (100)	111(100)

**Table 1:** Sample composition by age and gender.

As shown in Table 1, the sample consists of 318 students for public schools (153 males and 165 females) and 285 students for private schools (174 males and 111 females). In both cases, 97% of the subjects were Italians. The sampling procedure used for public schools was performed according to the HBSC study protocol<sup>(18)</sup>; the sampling of private school was of convenience, selecting only students of 11, 13 and 15 years of first and third year of middle school, and second-highest schools of the following schools in Palermo: Istituto Salesiano Don Bosco, Istituto Paritario S.M. Mazzarello, Istituto Marcellino Corradini, Istituto Paritario Campus Lincoln, Istituto Paritario Platone, Istituto Paritario Trinacria, Istituto Maria SS. del Rosario. The questionnaire was filled out correctly by 97.5% of the

selected public school subjects and 95% of the selected private school subjects. The statistical significance level chosen for all analyzes was 0.05. For the qualitative variables the absolute and relative frequencies have been calculated. Statistically significant Odds-Ratio (OR) are presented with a 95% confidence interval (CI). The BMI (Body Mass Index) was calculated by adjusting it for age and weight<sup>(19)</sup>.

The variables considered were: “days of physical activity per week (at least 60 minutes per day)”; “Intense exercise frequency per week”; “Consumption of fruit every day”; “Breakfast every day”; “Numbers of hours per day spent on the PC and playing video games”; “Snack between meals”. In Table 5 dichotomization is shown. Statistical analyzes were performed using the software STATA® 14<sup>(20)</sup>.

**Results**

In Palermo public schools, the frequency of overweight and obese males was found to be 34.04% in 11-year-olds, 26.5% in 13-year-olds and 22.58% in 15-year-olds (Table 2). Approximately 70% of the sample consists of normal-weight subjects. In private schools the frequency of overweight / obese males shows a downward trend that goes from 34.62% of 11-year-olds, to 22.03% of 13-year-olds, to 18.52 of 15-year-olds (Table 2).

		Public school (N=318)			Private school (N=285)		
		11 years old, N (%)	13 years old, N (%)	15 years old, N (%)	11 years old, N (%)	13 years old, N (%)	15 years old, N (%)
Underweight	Male	3 (6.38)	6 (12.24)	3 (7.32)	2 (3.85)	4 (6.78)	1 (1.85)
	Female	3 (7.69)	9 (18.37)	9 (16.67)	3 (9.09)	6 (15.38)	6 (17.65)
Normal	Male	28 (59.57)	30 (61.22)	29(70.73)	32 (61.54)	42 (71.19)	43 (79.63)
	Female	32 (82.05)	33 (67.35)	37 (68.52)	24 (72.73)	28 (71.79)	24 (70.59)
Overweight	Male	11 (23.40)	8 (16.33)	7 (17.07)	13 (25.00)	10 (16.95)	9 (16.67)
	Female	3 (7.69)	6 (12.24)	8 (14.81)	5 (15.15)	5 (12.82)	3 (8.82)
Obese	Male	5 (10.64)	5 (10.20)	2 (4.88)	5 (9.62)	3 (5.08)	1 (1.85)
	Female	1 (2.56)	1 (2.04)	0 (0.00)	1 (3.03)	0 (0.00)	1(2.94)
Total	Male	47 (100)	49 (100)	41(100)	52 (100)	59 (100)	54 (100)
	Female	39 (100)	49 (100)	54 (100)	33 (100)	39 (100)	34 (100)

**Table 2:** Absolute and relative frequency for BMI categories in male and female divided by age and school of origin.

The percentage of underweight in private schools is thus distributed: 3.85% for 11-year-olds, 6.78% for 13-year-olds and 1.85% for 15-year-olds. In women in private schools there is a percentage of

overweight/obese 18.18% in 11-year-olds, 12.82% in 13-year-olds, 12% in 15-year-olds and percentages of underweight are higher than in male peers (Table 2).

	Public school (N=318)			Private school (N=285)		
	11 years old, N (%)	13 years old, N (%)	15 years old, N (%)	11 years old, N (%)	13 years old, N (%)	15 years old, N (%)
Never	6 (5.94)	11 (10.00)	16 (15.84)	5 (5.81)	8 (7.69)	11(11.58)
1 day	7 (6.93)	9 (8.18)	7 (6.93)	6 (6.98)	4 (3.85)	6 (6.32)
2 days	37 (36.63)	26 (23.64)	27 (26.73)	29 (33.72)	21 (20.19)	12 (12.63)
3 days	15 (14.85)	17 (15.45)	14 (13.86)	10 (11.63)	21 (20.19)	13 (13.68)
4 days	9 (8.91)	17 (15.45)	13 (12.87)	9 (10.47)	17 (16.35)	13 (13.68)
5 days	9 (8.91)	13 (11.82)	11 (10.89)	15 (17.44)	11 (10.58)	17 (17.89)
6 days	2 (1.98)	6 (5.45)	4 (3.96)	5 (5.81)	11 (10.58)	8 (8.42)
7 days	16 (15.84)	11 (10.00)	9 (8.91)	7 (8.14)	11(10.58)	15 (15.79)
<b>Total</b>	101(100)	110(100)	101(100)	86(100)	104(100)	95(100)

**Table 3:** Question: “In the last week, how many days did you exercise (at least 60 minutes a day)?”. Distinction of public and private school in the city of Palermo.

As shown in Table 3, a small part of the sample does not practice physical activity, with higher percentage levels in public schools than in private ones. The percentage rate of intense physical exercise performed after school hours shows that around 30% of teenagers report that they exercise twice or three times a week; in private schools there are higher percentages with levels between 35% and 45% (Table 4).

Table 5 shows the statistically significant OR associated with physical activity and overweight-obesity. Private school students are more likely to exercise more than 3 days per week (OR 1.58) and are more likely to exercise more than 2 times a week (OR 2.08). Obese students in private schools in Palermo are more likely to perform physical activity for less than 3 days a week (OR 3.52) and a higher risk of not having breakfast in the morning (OR 10.11) and a snack between main meals. (OR 3.82) every day. For all the schools examined, it emerged that obese students are more likely not to consume fruit (OR 3.13), to stay more than 6 hours a day in front of PCs and video games (OR 3.24) and more than 2 hours a day in front of television (OR 3.79). 11-year-old obese were more likely not to consume fruit (OR 5.14) and 13-year-old obese were more likely to avoid snacking between meals (OR 5.28). Male students were more likely to perform physical activity for more than 3 days per week (OR 1.48) and

intense physical activity at least 2 times per week (OR 1.76); however, if obese or overweight were more likely to perform physical activity for less than 3 days per week (OR 2.00), not to have breakfast every day (OR 2.75) and to stay for more than 6 hours per day in front of the PC (OR 3.24).

	Public school (N=318)			Private school (N=285)		
	11 years old, N (%)	13 years old, N (%)	15 years old, N (%)	11 years old, N (%)	13 years old, N (%)	15 years old, N (%)
Everyday	14 (13.59)	13 (12.04)	9 (8.82)	13 (15.12)	10 (9.71)	11(11.83)
4-6 times a week	12 (11.65)	18 (16.67)	13 (12.75)	12 (13.95)	24 (23.30)	17 (18.28)
2-3 times a week	33 (32.04)	30 (27.78)	31 (30.39)	39 (45.35)	44 (42.72)	33 (35.48)
Once a week	9 (8.74)	8 (7.41)	18 (17.65)	8 (9.30)	7 (6.80)	13 (13.98)
Once a month	6 (5.83)	4 (3.70)	3 (2.94)	2 (2.33)	3 (2.91)	3 (3.23)
Less than once a month	10 (9.71)	16 (14.81)	10 (9.80)	2 (2.33)	4 (3.88)	5 (5.38)
Never	19 (18.45)	19 (17.59)	18 (17.65)	10 (11.63)	11 (10.68)	11 (11.83)
<b>Total</b>	103 (100)	108(100)	102 (100)	86 (100)	103 (100)	93 (100)

**Table 4:** Intense physical activity in free time (number of times per week). Distinction of public and private school in Palermo city.

## Discussions and conclusions

In function of a participatory choice and not imposed on correct lifestyles and healthy behaviors, the quality of information and communication, the ability to arouse interest, curiosity and the development of critical skills are crucial, especially among young people<sup>(21)</sup>. The information and training campaigns aimed at the correct lifestyles and risks linked to wrong habits are important for the purpose of educating middle and high school students in order to reduce the costs of public health. It is therefore essential that prevention interventions are an integral part of coherent local, regional and national strategies based on tests of agreed effectiveness in order to minimize the risk related to the development of diseases related to the psychic sphere (such as anxiety and depression), that lead to the risky consumption of alcohol as already seen in a recent study carried out at the University of Palermo on a sample of University students<sup>(22)</sup>.

Given that in several countries of the world there has been an increase in obesity and overweight, attention has been focused on the study of risk and protection factors and their impact on development in pre-adolescent and adolescent age<sup>(23-25)</sup>.

Studies have shown that obesity and overweight are associated with depressive symptoms, low self-esteem and other psychosocial issues<sup>(26, 27)</sup>.

Other research has shown that some variables can mediate the relationship between overweight and psychosocial problems; for example, it was highlighted how the perception of one's body is a variable that explains the presence of symptoms of psychological distress among obese adolescents<sup>(23)</sup>.

Our study involving the public and private schools of Palermo highlighted differences related to sex and age. The knowledge of the correct life styles is the starting point for a program capable of producing effective intervention tools focused on young people to better understand the mechanisms of psychological development and to facilitate the process of evolutionary growth. The frequency of physical activity tends to decrease with increasing age and with the increase in school commitments, in this context the study emerges as part of the sample reports not to perform physical activity during the week both in the school context and during free time. This situation is certainly more marked in public schools where, compared to private schools, dedicated spaces and sports equipment are lacking or lacking altogether and is linked to geographical differences in the context of the Country between North and South.

In a survey on school sports administered in South Tyrol to the question "Do you think that physical education is adequately supported and promoted in terms of equipment and organizational conditions in your school?" 19% of teachers in middle and high schools replied: "No", in a context in which 91% of this sample believes that matter is quite important compared to other<sup>(28)</sup>.

In addition, the study shows that obese students report wrong eating habits (no breakfast, no fruit consumption and no snack between meals) and more sedentary (high number of hours per day in front of the PC and video games). These results confirm the data in the scientific literature for which subjects in excess weight have unfair eating habits and a sedentary lifestyle. The main limitation of the study is the sampling that was performed differently for the recruitment of public and private school students; this is due to the low number of private schools compared to the public and to a different availability given by schools for the recruitment in the study; moreover, being addressed to students of one city it is not possible to generalize the results to other Italian cities; finally it was not possible due to the excessive number of explanato-

ry variables to make an inference between all the possible causes and all the variables taken into consideration.

Dependent variable	Independent variable	OR	(CI 95%)	P-value
Overweight and obese (Private school)	≥ 3 days of physical activity per week*	1		0.026
	<3 days physical activity days per week*	1.97	(1.08 - 3.58)	
Overweight and obese if male	≥ 3 days of physical activity per week*	1		0.01
	<3 days physical activity days per week*	2	(1.18-3.37)	
Obesity (Public and Private school)	Fruit consumption every day	1		0.05
	No fruit consumption	3.13	(1.01 - 9.75)	
Obesity (Public and Private school)	Breakfast every day	1		0.021
	No breakfast	2.85	(1.17 - 6.95)	
Obesity (Public and Private school)	<6 hours per day at the PC and video games	1		0.026
	≥6 hours per day at the PC and video games	3.24	(1.15 - 9.14)	
Obesity (Private school)	Breakfast every day	1		0.004
	No breakfast	10.11	(2.08 - 49.11)	
Obesity (Private school)	Snack between meals	1		0.041
	No snack between meals	3.82	(1.06 - 13.79)	
Obesity (Private school)	≥ 3 days of physical activity per week*	1		0.05
	<3 days physical activity days per week*	3.52	(1.01 - 12.39)	
Obesity if male	≥ 3 days of physical activity per week*	1		0.015
	<3 days physical activity days per week*	3.12	(1.24-7.81)	
Obesity if male	Breakfast every day	1		0.046
	No breakfast	2.75	(1.01-7.44)	
Obesity at 11 years old	Fruit consumption at least 2 times a week	1		0.029
	No fruit consumption	5.14	(1.18-22.39)	
Obesity at 13 years old	Snack between meals	1		0.029
	No snack between meals	5.28	(1.19-23.46)	
Intense exercise ≥ 2 times a week	Public school	1		<0.001
	Private school	2.08	(1.48 - 2.93)	
Intense exercise ≥ 2 times a week	Female	1		0.001
	Man	1.76	(1.26-2.47)	
≥ 3 days of physical activity per week *	Female	1		0.018
	Man	1.48	(1.06-2.05)	
≥ 3 days of physical activity per week *	Public school	1		0.007
	Private school	1.58	(1.14 - 2.19)	

\* at least 60 minutes a day

**Table 5:** Odds Ratio - Statistically significant factors associated with overweight/obesity and factors associated with physical activity.

Because the role of lifestyles, eating habits and physical activity is widely recognized within the complex etiology of obesity and overweight<sup>(29)</sup>, the interventions aimed at the prevention of overweight will have to act jointly on the increase of physical activity and on the consumption of healthy food. To this end, the most effective interventions, which can be carried out in schools, are those articulated on several fronts:

- Consolidate a surveillance system aimed at defining the prevalence of overweight and obesity, nutritional patterns and physical activity in adolescents because the role of lifestyles, eating habits and physical activity is widely recognized within the complex etiology of obesity and overweight.
- Promote in schools the availability of correct food choices with special regard to excessive energy intake from caloric snacks and sweetened drinks and energy drinks.
- To increase the time dedicated to physical activity for both children and adolescents both in the school and in the free time, encouraging them to perform at least 60 minutes of physical activity on a daily basis.
- Encourage the creation at the Local Health Units of operative staff who guarantee specific preventive advice on food choices and motor activity for middle and high school students.

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