OBESITY OF CHILDREN IN THE PROVINCE OF COSENZA[1]

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1. Introduction

Overweight and obesity are defined as abnormal or excessive fat accumulation that could compromise health. The determinant of obesity and overweight is the imbalance between the calories consumed and those expended. In particular, it is generally accepted that an increased intake of energy-dense foods that are high in fat and an increase in physical inactivity are important contributors, although the etiology of obesity also involves genetic, hormonal, social and environmental components. According to the World Health Organization, since 1975 the number of people suffering from obesity has almost tripled (WHO, 2018).

In particular, the prevalence of overweight and obesity in children has risen greatly worldwide too, becoming one of the biggest challenges for public health in the 21st century (European Union, 2014; WHO, 2017). Moreover, in 2016, the number of overweight or obese children under the age of 5 was estimated to be over 41 million and over 340 million children and adolescents aged 5-19 were overweight or obese in the world. The prevalence of overweight and obesity among children and adolescents aged 5-19 has risen from just 4% in 1975 to just over 18% in 2016 (WHO, 2018).

According to the mapping carried out by the European Commission's Joint Research Centre scientists, current rates of overweight and obesity among children and adolescents in Europe are alarming nearly everywhere in Europe, reaching well over 30% in some EU Member States (Caldeira et al., 2018).

Moreover, according to data supplied by the Italian national surveillance system OKkio alla SALUTE, the overall prevalence of overweight, obesity and morbid obesity in Italian children is 21.3%, 7.2% and 2.1% respectively. Childhood overweight and obesity in Italy are distributed differently across the country, and the prevalence in the central and southern Italian regions is greater than in the

northern Italian regions (OKkio alla SALUTE, 2017). In particular, looking at different classes of nutritional status in Calabria, we can see that the prevalence of underweight is 1.8%, the prevalence of normal weight is 56.8%, the prevalence of overweight is 25% and the prevalence of obese is 16.4%, inclusive of 4.7% of severing obese (Azzarito et al., Eds, 2017).

There is a consistent body of evidence to demonstrate that childhood obesity is associated with serious health consequences such as cardiovascular disease, diabetes, certain types of cancer that cause premature mortality and long-term morbidity, as well as with significant reductions in quality of life and a greater risk of teasing, bullying and social isolation. This burden of disease can be prevented through childhood obesity prevention policies and interventions at all levels of society, from communities, schools, families through to governments, private organisations and nongovernmental organisations (WHO, 2012).

The increasing prevalence and associated morbidity of childhood overweight and obesity, therefore, suggest the importance of carrying out early prevention actions from educational environments such as family and school.

2. Subjects and method

2.1. The project "Piatto della salute"

The promotion of health in schools encourages children and adults to become more aware of the importance of appropriate lifestyles (WHO, 2017). From this keyword, came the health education project "*Piatto della Salute*" promoted and managed by the Scientific Association "Biologists without Borders" of Cosenza (Italy) and addressed to the schoolchildren attending the primary schools in the province of Cosenza, Italy and to their families. Is was focused on the promotion of a healthy lifestyle, that is to say of that complex of effective behaviours to create and maintain over time the balance of health in each individual, which must be implemented both at school through genuine products supplied by school canteens, but above all in the continuation of the quality of the product even at home.

This project had several objectives:
- to analyse the lifestyles of the children enrolled in the primary schools of the province of Cosenza and to assess the prevalence of obesity, overweight and underweight in the same cohort;
- to make parents aware of the weight status of their children and about the importance of a healthy lifestyle dealing with correct eating habits and physical activity for the maintenance of psycho-physical wellbeing;

- to change improper eating habits responsible of weight gain, encouraging the consumption of organic products, so that we can understand the importance of proper nutrition by taking meals that are presented at school, avoiding junk foods that determine, in the long run, pathological conditions and going to modify some foods included in the menus while keeping the quality of the food served unchanged.

In that respect, it was necessary to act through various interventions:
- an informative meeting with the families, to pick up the authorisations for the participation of their children to the project;
- the survey to investigate the weight status and the lifestyles of the schoolchildren through the detection of anthropometric measurements regarding the children (height, weight, waist circumference) and the administration of a questionnaire aimed at outlining some aspects related to the lifestyles of the children enrolled in primary schools (i.e., breakfast and physical activity);
- an information and training initiative aiming at transferring research findings and at promoting healthy lifestyle behaviors, such as good dietary habits and regular physical exercise.

2.2. Subjects

The population consisted of students from primary schools in the province of Cosenza, Italy. This study was carried out between the school year 2015/2016 and the school year 2016/2017. A convenience sample was selected (Corbetta, 2014). It consisted of 748 schoolchildren from the 1st to the 5th class, aged 6 to 11 years, from schools of the province.

2.3. Data collection: questionnaire and anthropometric measurements

The measurements and the administration of a brief questionnaire took place in the schools attended by the children. These evaluations were carried out by the biologists belonging to the Scientific Association "Biologists without Borders" with the contribution of teachers and school staff who provided a special classroom and managed the list of children with regular parental authorisation.

Body weight was measured without shoes and minimal clothing using digital scales with an accuracy of 0.1 kg. Height was measured without shoes using a stadiometer to the nearest 0.1 cm. The measurement of waist circumference (WC) was carried out using non-elastic tape with an accuracy of 0.5 cm.

2.4.   Statistical analysis

Once the questionnaires were administered, data were imported and processed using the Statistical Package for Social Science (SPSS).

The variables collected included sociodemographic characteristics (gender, age), anthropometric measurements, the physical activity and the daily breakfast consumption. New variables were created: body mass index (BMI) was calculated as weight divided by the square of height (kg/m^2); waist to height ratio (WHtR) was calculated by dividing waist circumference by height, both measured in centimetres.

Normality of distribution was assessed by the Kolmogorov-Smirnov test. The independent samples t-test, accompanied by the Levene test for analysis of homogeneity of variances, was used to compare sample means from two independent groups when the distribution was normal. The non-parametric Mann-Whitney U test was used for comparisons when assumptions for t-test were not satisfied. ANOVA was used to assess the statistical significance of the difference between more than two study group means. Pearson correlation coefficients (*r*) were calculated to assess the link and the degree of relationship between variables. The chi-square test was used to assess the significance of the relationship in the double entry tables. A *p* value less than 0.05 was considered statistically significant.

2.5.   Definitions

Body mass index, defined as weight divided by the square of height (kg/m^2), is the most widespread method for the evaluation of body mass. It is used to assess obesity in children (Dietz, Robinson, 1998; Poskitt, 2000). Schoolchildren were classified into weight status categories on the basis of their BMI, according to the International Obesity Task Force standards for children described by Cole and Lobstein (2012). This approach uses age and gender-specific cut-off in children aged 2 to 17 years that predict a BMI less than 18.5 kg/m^2 (thinness), equal to or greater than 25 kg/m^2 (overweight), equal to or greater than 30 kg/m^2 (obesity), equal to or greater than 35 kg/m^2 (morbid obesity), respectively at age 18 years.

Waist circumference is a measure of abdominal adiposity in children, useful to identify those children at greatest risk for obesity-related ill health (Maffeis et al., 2001a, b; McCarthy, 2006). Abnormal waist circumference was defined in accordance with the criterion of greater than the 90th percentile using age and gender-specific cut-off points for waist circumference provided by McCarthy et al. (2001).

Waist to height ratio is an index of abdominal fat distribution with a predictive value for metabolic syndrome and cardiovascular disease risk. Age and gender

independent cut-off of 0.5 to differentiate low WHtR from high WHtR was used (McCarthy, Ashwell, 2006; Maffeis et al., 2008).

3. Results

3.1. Baseline characteristics

Baseline characteristics of the study cohort are described in Table 1. Of the 748 schoolchildren, 54.4% (407) are males and 45.6% (341) are females, with mean (±standard deviation) age of 8.49 (±1.45) and 8.38 (±1.39) years, body mass of 34.56 (±9.67) and 33.01 (±9.75) kg, height 1.34 (±0.09) and 1.32 (±0.10) m, BMI of 19.08 (±3.61) and 18.63 (±3.58), waist circumference of 63.76 (±9.00) and 61.66 (±9.30), waist to height ratio e of 0.47 (±0.58) and 0.46 (±0.60). The boys show significantly higher mean body mass, height and waist circumference and waist to height ratio compared to girls ($p<0.05$). The mean age and BMI are similar between the genders.

Table 1 − *Ages and anthropometric characteristics (means+SD) in schoolchildren from the province of Cosenza, by gender.*

	N	Males	Females	Total	*p value*
Age (years)	748	8.49±1.45	8.38±1.39	8.44±1.42	-
Weight (kg)	748	34.56±9.67	33.01±9.75	33.85±9.73	*<0.05*
Height (m)	748	1.34±0.09	1.32±0.10	1.33±0.10	*<0.05*
BMI (kg/m^2)	748	19.08±3.61	18.63±3.58	18.88±3.60	-
WC (cm)	741	63.76±9.00	61.66±9.30	62.80±9.20	*<0.001*
WHtR	741	0.47±0.58	0.46±0.60	0.47±0.06	*<0.05*

3.2. Weight status

Table 2 displays the prevalence of four weight status categories: underweight, normal weight, overweight and obesity, for the entire study cohort, by age. Of the total sample, 4.4% of children are underweight, 51.6% are normal weight, 27.5% are overweight, and 16.5% are obese (of which 5.8% are severed obese). The number of overweight and obese children at age 6 (27.1%) is significantly smaller than the number of overweight and obese older children. No gender differences is observed in the entire study cohort ($p>0.05$).

Table 2 *– Prevalence of underweight, normal weight, overweight and obesity in the entire study cohort, by age.*

	Underweight %	Normal weight %	Overweight %	Obese %	Total %
6	8.6	64.3	21.4	5.7	100.0
7	2.2	47.4	25.2	25.2	100.0
8	4.6	51.0	24.2	20.2	100.0
9	2.9	52.1	30.7	14.3	100.0
10	5.4	49.3	32.4	12.9	100.0
11	5.3	52.6	31.6	10.5	100.0
Total	4.4	51.6	27.5	16.5	100.0

N=748
p<0.05

Both for males and for females, about one out of two is overweight or obese (Tables 3, 4). Among males, the percentage of schoolchildren aged 6 that are overweight and obese is lower compared with older children.

Table 3 – *Prevalence of underweight, normal weight, overweight and obesity in males, by age.*

	Underweight %	Normal weight %	Overweight %	Obese %	Total %
6	4.9	80.5	9.7	4.9	100.0
7	-	49.2	26.2	24.6	100.0
8	2.9	47.1	26.9	23.1	100.0
9	3.7	53.7	28.0	14.6	100.0
10	3.8	46.8	38.0	11.4	100.0
11	2.8	47.2	41.7	8.3	100.0
Total	3.0	52.1	28.7	16.2	100.0

N=407
p<0.01

Table 4 – *Prevalence of underweight, normal weight, overweight and obesity in females, by age .*

	Underweight %	Normal weight %	Overweight %	Obese %	Total %
6	13.8	41.4	37.9	6.9	100.0
7	4.3	45.7	24.3	25.7	100.0
8	6.4	55.3	21.3	17.0	100.0
9	1.7	50.0	34.5	13.8	100.0
10	7.2	52.2	26.1	14.5	100.0
11	9.5	61.9	14.3	14.3	100.0
Total	6.2	51.0	26.1	16.7	100.0

N=341
p>0.05

3.3. Waist circumference and waist to height ratio

In the sample, 47.5% of schoolchildren has a waist circumference above the 90th percentile. Furthermore, waist circumference values above the cut-off point are observed in 51.5% of males and 42.8% of females. The rate of children with a waist circumference above the 90th percentile is generally lower for women compared to men, except for the schoolchildren aged 6 (Table 5).

Table 5 – *Children with WC>90th percentile, by age and gender.*

	N	Males %	Females %	Total %
6	70	34.1	55.2	42.9
7	134	62.5	44.3	53.0
8	198	52.9	39.4	46.5
9	137	48.1	39.7	44.5
10	146	50.6	46.4	48.6
11	56	57.1	33.3	48.2
Total	741	51.5	42.8	47.5

p>0.05

A significant positive correlation is observed between BMI-WC for all schoolchildren ($r=0.87$, $p<0.001$), in males ($r=0.89$, $p<0.001$) and in females ($r=0.82$, $p<0.001$) (Figure 1). Correlations, calculated for the different age groups separately, also show the significance ($p<0.001$).

Figure 1 – *Relationship between BMI and WC of schoolchildren, for males and females.*
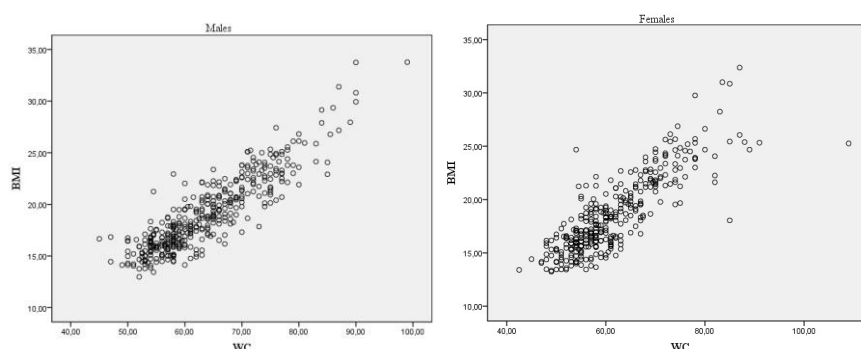
With regard to waist to height ratio, for the sample, around one in four schoolchildren has a WHtR greater than 0.5 (26.9%) and 73.1% has a WHtR equal to or less than the same cut-off point. Further, it appears that the prevalence of

children with a high WHtR has no significant association with gender (males 28.0%, females 25.5%) and age (Table 6).

Table 6 – *Children with* high *WHtR, by age and gender.*

	N	Males %	Females %	Total %
6	70	19.5	31.0	24.3
7	134	35.9	28.6	32.1
8	198	27.9	24.5	26.3
9	137	31.6	24.1	28.5
10	146	22.1	21.7	21.9
11	56	28.6	28.6	28.6
Total	741	28.0	25.5	26.9

BMI and WHtR has a positive correlation in the sample ($r=0.781$, $p<0.001$). Positive correlation is present even when considering males ($r=0.810$, $p<0.001$) and females separately ($r=0.747$, $p<0.001$), and for the different age groups ($p<0.001$).

Furthermore, Figure 2 shows a comparison of WHtR means relating to the weight status of schoolchildren. Overweight and obese children show-significantly higher WHtR means in relation to underweight and normal weight ones ($p<0.001$).

Figure 2 – *WHtR means compared among weight status categories.*
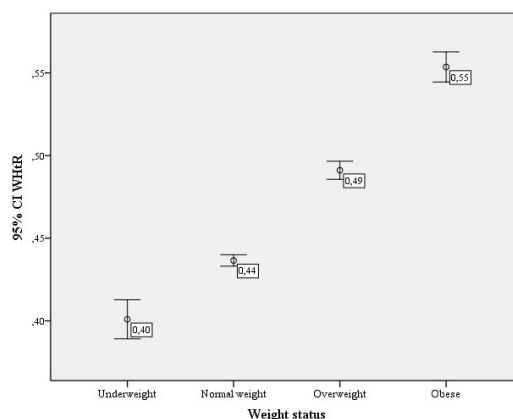
3.4. Lifestyle behaviours: breakfast and physical activity

Healthy eating and regular physical activity can contribute preventing childhood overweight and obesity. In this respect, there is evidence suggesting an association between breakfast and weight status in children (Rosato et al., 2016):

for example, skipping breakfast is associated with overweight or obesity (Koca et al., 2017). The lack of physical activity in children is another health risk factor which is predictive of similar disorders (Hills et al., 2007; Wijnhoven et al., 2015).

With regard to eating habits of the sample, 8 out of 10 children usually have breakfast (82.2%), even though is not negligible the rate of those skipping the first meal of the day (17.8%). There are no statistically significant differences between males (83.3% vs 16.7%) and females (80.9% vs. 19.1%).

Concerning weekly physical activity, the rate of children doing sport at least two times a week is 73.9% in the total sample, with a significantly greater proportion of females (78.6%) than males (70.0%) getting recommended exercise ($p<0.05$).

Relating children weight status with their breakfast habit, a higher frequency of overweight and obese is shown among children skipping the meal (Table 7).

Table 7 −*Weight status categories by breakfast habits.*

	Underweight %	Normal weight %	Overweight %	Obese %	Total %
Children having breakfast	4.6	54.1	26.3	15.0	100.0
Children skipping breakfast	3.8	39.8	33.1	23.3	100.0
Total	4.4	51.6	27.5	16.5	100.0

N=748
p<0.05

Our data analysis, moreover, shows that physical inactivity for children corresponded with an increase of their BMI (Table 8).

Table 8 −*Weight status categories by physical activity.*

	Underweight %	Normal weight %	Overweight %	Obese %	Total %
Children practicing sport	4.5	54.4	27.3	13.8	100.0
Children not practicing sport	4.1	43.6	28.2	24.1	100.0
Total	4.4	51.6	27.5	16.5	100.0

N=748
P<0.01

4. Conclusion

In post-modern societies, eating habits and the lack of physical activity are transforming the population, which is increasingly accusing overweight or even obesity problems. If in the past being overweight was considered a factor of privilege, characterising socio-economic well-being, today it is no longer the case, the bad eating habits are making excessively large the percentage of overweight people, especially among young people.

The need to intervene is evident, especially in younger age groups to correct this trend, with policies to spread the culture of food, a determining factor in ensuring a healthy future for the populations to come.

In this study we verified the condition of a school population, thanks to a sample study carried out by the Scientific Association "Biologists without Borders" of Cosenza (Italy), to verify whether, even at the micro-territorial level, the worrying proportions that occur at the national level are repeated.

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SUMMARY

Obesity of the children in the province of Cosenza

Overweight and obesity are defined as abnormal or excessive fat accumulation that could compromise health. According to the World Health Organization, the number of overweight and obese children has risen greatly worldwide becoming one of the biggest challenges for public health in the 21st century. The increasing prevalence and associated morbidity of childhood overweight and obesity suggest the importance of carrying out early prevention actions from the educational environments such as family and school.

This paper provides data on the prevalence of overweight and obesity among children in the province of Cosenza collected in the context of the health education project "Piatto della Salute". This study was carried out between the school year 2015/2016 and the school year 2016/2017. A convenience sample was selected. It consisted of 748 schoolchildren aged 6 to 11 years, from the 1st to the 5th class of the primary schools in the Calabrian province. For the sample, anthropometric measurements were directly measured and information on physical activity and breakfast habit were obtained through the administration of a questionnaire.

About one out of two children was overweight or obese and the prevalence was significantly smaller at age 6. A significant positive correlation was observed between BMI-WC and BMI-WHtR. Breakfast habit and physical activity were significantly associated with a lower prevalence of overweight and obesity.

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