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Porto | 2009

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Esta investigação realizou-se no Serviço de Higiene e Epidemiologia da Faculdade de Medicina da Universidade do Porto, sob a orientação da Professora Doutora Carla Lopes e Co-orientação da Professora Doutora Elisabete Ramos.

Porto | 2009


Dissertação da candidatura ao grau de Mestre em Saúde Publica apresentada à Faculdade de Medicina da Universidade do Porto

Porto | 2009

**AGRADECIMENTOS**

Este trabalho só foi possível realizar, com a ajuda preciosa de todos aqueles que nele participaram. Por isso, deixo aqui os meus mais sinceros agradecimentos:

- À Professora Doutora Carla Lopes, pela orientação, dedicação e empenho na realização deste projecto e pela transmissão de conhecimentos.

- À Dra. Elisabete Ramos e restantes membros do EPITeen, pela integração na equipa e bom ambiente de trabalho.

- À minha filhota Inês, ao meu marido Jorge, à minha Mãe e ao meu Pai pelo tempo em que não pude estar com vocês, mas como sempre digo *"Mais vale 10% de tudo, do que 100% de nada"*.

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# 1 | ABSTRACT

Adolescents' eating habits developed during infancy reflect food choices later in life and are first influenced by family, friends, fashion, mass media and other external factors.

**AIMS:**

1. We want to evaluate perceived body image and food intake in normal weight and obese Portuguese adolescents of 13-years-old, members of the EPITeen cohort; 2. We also intend to compare adolescents' energy intake between two periods of the day: until lunch and after lunch, and to evaluate the association of that distribution with obesity and body image.

**METHODS:**

From a total 2788 adolescents, born in 1990 and registered in public and private schools of Porto, we included 1235 adolescents (54.2% were girls, 71.6% frequented public school) to answer the first objective.

A sub-sample of 115 (57.4% girls, 70.4% frequent public school), who filled a 3-non-consecutive-days dietary record, was used for answering to the second objective.

Evaluation included extensive data collection comprising demographic, social, clinical and behavioral characteristics of the children and the family, including food frequency, dietary records and physical activity. Weight and height were measured and individuals were classified according to the age and sex specific BMI reference percentiles developed by the United States Centers for Disease Control and Prevention; participants were considered normal weight if BMI < $85^{th}$ percentile, risk of overweight if BMI was between $85^{th}$ and $95^{th}$ percentile, and obese if BMI > $95^{th}$ percentile. Body image dissatisfaction was calculated as the difference between perceived body image and desired image, using Stunkard's silhouettes.

Adolescents' food intake was achieved by the Food Frequency Questionnaire which is validated for Portuguese population and adapted to adolescents. The 3-non-consecutive-days dietary record, were computed in Food Processor Plus SQL®. Six meals a day were identified (breakfast, morning snack, lunch, afternoon snack, dinner and evening snack). We divided these meals in two periods – before lunch (included all adolescents that eat more calories until lunch) and after lunch (included all adolescents that eat more calories after lunch).

**RESULTS:**

Objective 1: Sixteen percent of adolescents were overweight and 10.7% were obese. Concerning body dissatisfaction, 37.2% were satisfied with their body image, 39.5% adolescents wanted to be thinner and 23.2% wanted to be fatter. The adolescents that wanted to be fatter had significantly lower intake of total energy intake and in vitamin C and E intake.

Obese adolescents who wanted to be fatter had a significantly higher intake of protein and sodium intake. In normal weight adolescents who wanted to be fatter had a significantly lower intake of fat, vitamin C and E intake.

Also, normal weight adolescents who had higher consumption of croissants and bakery, chocolate snacks, coca-cola and other sodas had lower probability of wanted to be thinner compared to those who are satisfied with their image. After adjustment for sex, type of school and parents' BMI the OR (CI 95%) are 0.60 (0.40-0.89); 0.55 (0.35-0.88); 0.41 (0.22-0.76); 0.53 (0.28-1.00) respectively.

Obese adolescents that consume more sodas had a higher probability of wanted to have a thinner figure; after adjustment for sex, type of school and parents' BMI the OR, CI 95%= 1.53, 0.47-5.02.

Objective 2: Twenty percent of adolescents were overweight and 10% were obese. The analysis of the 3-non-consecutive-days dietary record showed that adolescents' total energy mean(sd) intake (TEI) was 2391(91) calories. Mean energy intake was 1231 calories before lunch and 1328 calories after lunch, $p$ = 0.055 which is in the limit of significance. Concerning protein, fat and carbohydrates intake no significantly differences were found in the two periods of day. Adolescents who were dissatisfied with their body image had a higher probability of eating more calories after lunch, OR (CI95%) = 1.33(0.59-3.01). Concerning eating habits, 45.2% adolescents ate six meals per day (breakfast, lunch, dinner and 3 snacks), 40.0% ate 5 meals and 14.8% ate 4 meals and no significant differences in snacks frequency according to BMI Classes, body fat percentage or body dissatisfaction.

**CONCLUSIONS:**

A high percentage of adolescents (62.7%) reported being dissatisfied with their body image and more desired to be thinner. Normal weight adolescents who desired to be thinner ate less croissants and bakery, chocolate snacks, coca-cola and other sodas. Obese adolescents who desired to be thinner drink more sodas.

Adolescents' energy intake in the two periods of the day is in the limit of significance; also no significantly differences were found in energy intake in the two periods of the day and obesity in adolescents as well in body dissatisfaction.

# 2 | RESUMO

Os hábitos alimentares dos adolescentes são desenvolvidos durante a infância e mantêm-se estáveis na vida adulta e são directamente influenciados pelos hábitos dos pais, amigos, moda, televisão e mass media e outros factores externos.

**OBJECTIVOS:**

1. Com este estudo pretende-se avaliar a insatisfação com a imagem corporal e a ingestão alimentar em adolescentes Portugueses com 13 anos de idade, membros da cohorte do EPITeen. 2. Também se pretende comparar a ingestão alimentar entre dois períodos do dia: maior ingestão de calorias antes e depois do almoço e avaliar essa associação com a obesidade e imagem corporal.

**MÉTODOS:**

Do total dos 2788 adolescentes, nascidos em 1990 e inscritos nas escolas publicas e privadas do Porto, foram incluídos 1235 adolescentes (54.2% raparigas, 71.6% frequentava escola pública) para responder ao primeiro objectivo. Foi considerada uma sub-amostra de 115 adolescentes (57.4% raparigas, 70.4% frequentava a escola pública), que preencheram o registo alimentar de 3 dias não consecutivos, para responder ao segundo objectivo.

A avaliação inicial inclui uma recolha extensa de dados sobre características demográficas, sociais, clínicas e comportamentais dos adolescentes e sua família, incluindo frequência alimentar, diários alimentares e actividade física. Obteve-se a altura e o peso dos adolescentes e estes foram classificados de acordo com os percentis de referência para sexo e idade do CDC: os adolescentes eram considerados normo ponderais se o IMC fosse menor que percentil o 85, risco de excesso de peso se IMC estivesse entre os percentis 85 e 95 e obesos se IMC maior que percentil 95. A insatisfação com a imagem corporal foi calculada como a diferença entre a imagem percebida e a desejada, através das silhuetas de Stunkard.

A avaliação da ingestão alimentar foi obtida através da aplicação do Questionário de Frequência Alimentar que esta validado para a população Portuguesa e adaptado para adolescentes e também de um registo alimentar de três dias não consecutivos, sendo os dados obtidos posteriormente tratados no programa Food Processor Plus SQL®. Foram identificadas seis refeições diárias (pequeno-almoço, merenda da manha, almoço, merenda da tarde, jantar e ceia). As refeições forma divididas em dois períodos: antes do almoço (inclui os adolescentes que tem maior ingestão de calorias antes do almoço) e depois do

almoço (inclui os adolescentes que tem maior ingestão de calorias depois do almoço).

**RESULTADOS:**

Objectivo 1: dezasseis por cento dos adolescentes tinha excesso de peso e 10.7% eram obesos. Verificou-se que 37.2% dos adolescentes estavam satisfeitos com a sua imagem corporal, 39.5% queriam ser mais magros e 23.2% queriam ser mais gordos. Os adolescentes que queriam ser mais gordos tinham uma ingestão significativamente menor das calorias totais ingeridas, vitamina C e E. Os adolescentes obesos que queriam ser mais gordos tinham uma ingestão significativamente maior de proteína e sódio.

Os adolescentes com peso normal que queriam ser mais gordos tinham uma ingestão significativamente menor de gordura, vitamina C e E. Estes últimos que tinham uma ingestão maior de croissants e produtos de pastelaria, snacks de chocolate, Coca-Cola e outros refrigerantes tinham uma probabilidade mais pequena de quererem ser mais magros comparado com os que estavam satisfeitos com a imagem corporal. Depois de ajustados para sexo, tipo de escola e IMC dos pais, o OR (IC 95%) eram: 0.60 (0.40-0.89); 0.55 (0.35-0.88); 0.41 (0.22-0.76); 0.53 (0.28-1.00) respectivamente.

Os adolescentes obesos que consumiam mais refrigerantes tinham uma probabilidade maior de quererem ser mais magros em relação aos quês estavam satisfeitos com a sua imagem corporal. Depois de ajustados para sexo, tipo de escola e IMC dos pais, o OR (IC 95%) era: 1.53 (0.47-5.02).

Objectivo 2: vinte por cento dos adolescentes tinha excesso de peso e 10% era obeso. Da analise dos diários de 3 dias, verificou-se uma ingestão média de 2391(91) calorias. A média de ingestão era de 1231 calorias ate ao almoço 2 1328 calorias após o almoço, p = 0.055 no limite da significância. No que diz respeito à ingestão de proteínas, gordura e hidratos de carbono não foram encontradas diferenças significativas nos dois períodos de ingestão considerados.

Os adolescentes insatisfeitos com a imagem corporal tinham uma probabilidade maior de ingerir mais calorias depois do almoço, OR (IC 95%) = 1.33 (0.59-3.01).

Cerca de 45.2% dos adolescentes faziam as 6 refeições por dia, 40.0% faziam 5 refeições e 14.8% faziam 4 refeições por dia e não foram encontradas diferenças significativas na ingestão de snacks de acordo com as classes de IMC, gordura corporal e insatisfação com a imagem corporal.

**CONCLUSÃO:**

A maioria dos adolescentes (62.7%) estava insatisfeita com a sua imagem corporal e queria ser mais magra. Os adolescentes normoponderais que queriam ser mais magros comiam menos croissants e produtos de pastelaria, snacks de chocolate, Coca-Cola e outros refrigerantes. Os adolescentes obesos que queriam ser mais magros bebiam mais refrigerantes. A ingestão de calorias dos adolescentes nos dois períodos considerados esta no limite da significância; também nãos se encontraram diferenças significativas nos dois períodos do dia de acordo com as classes de obesidade e insatisfação coma a imagem corporal.

# 3 | INTRODUCTION

The importance of food in health promotion and disease prevention is well known. It is commonly assumed that we should obtain our daily energy and nutrient needs from four or more meals a day, which will increase the ability to meet nutrient requirements and promote a feeling of wellbeing [1].

Evaluating and characterizing eating habits of a population is very complex, because is a consequence of human behaviour [2,3], the definition of eating episodes, the natural tendency to modified eating habits every day, the concept of eating only what's social acceptable 2[,4], cultural and ecological factors, the technical limitations, data base and statistical limitations that provide nutritional information 2[,5] among other thing.

**ADOLESCENCE**

In this century, family structure change because women start working out of home and the meal pattern have undefined hours, meals are less elaborated, fast to eat and sometimes people eat alone [6]. Adolescent's food preferences are developed during infancy and remain stable and are reflected in food choices later in life.

Adolescents' eating habits are first influenced by family, friends and mass media. In this phase the body still in development and the search for the perfect body, sometimes leads to inadequate intake which leads to nutritional unbalances that interfere with normal growth and health condition 6. Adolescence is often considered a critical period for many psychological and behavioral transitions, including feeding practices.

The development of eating behaviors and food habits of the adolescents is affected by factors such as availability of and preference for particular foods, portion size, cultural values regarding food types and preparation, parent's beliefs and family practices, mealtime structure and feeding styles [7,8,9] friends and peers eating habits and other social factors such as publicity. It is common to see adolescents dieting, smoking, eating out of home as become a sign of independency and usually adolescents buy low quality foods 8.

Nutritional status at adolescence is of a particular concern 8, as overweight and obesity at this period o f life is associated with adult mortality and morbidity and has become a serious public health problem. Obese children/adolescents tend to become obese adults, putting them at greater risk of heart disease, hypertension,

diabetes and cancer 9. It is generally observed that obesity rates are increasing, whereas energy intakes are decreasing.

In Portugal, 30% of the adolescents in school year 2003/2004 were obese and the prevalence of overweight in children aged 7-years old is 29.5% and 32.5% are overweight/ obese at 9,5 years [10]. In Portugal, 90.8% students considered themselves as average and 4.6% considered themselves as obese [11]; the obese and overweight adolescents reported a negative attitude toward appearance and wish to change.

**Body image and Obesity**

Adolescents are often dissatisfied with their body image [12,13,14] and want to change something about their bodies, specially to lose weight [15].

Self-reported dieting become frequent in adolescence 11 even in normal weight adolescents, which increases risk factor of eating disorders and become a major concern to health professionals, schools and parents, but those that succeed in losing weight improve their body image [16].

Overweight and obese adolescents were more often dissatisfied with their body image [17,18,19], have low self-esteem 16[,19], there is a higher risk of developing depression and it is common sense that obese adolescents had more difficulty to make new friends [19,20]. Dissatisfied adolescents with body weight were more involved in risk behaviors, such as bullying and smoking [20]. Adolescence is a revolutionary period and many of them cut communications with family and experience difficulties of expressing and talking about themselves, although mothers are the first source of health information. Sabbah et al 15 found that among girls, body weight dissatisfaction was positively associated with difficulty in talking to both parents. Body dissatisfaction is very common and has a strong relation with BMI [21].

Eight-year-old girls were also dissatisfied with their current body image and desire to be thinner 14. Gender differences may be explained by difference in pubertal timing, because girls were more often dissatisfied with their body image 15 and they were often dieting to loose weight and boys wanted more to gain muscle. Among girls, age seems to be associated with constant dieting as well mother's attention to their diet; peers influence does not seem to be predictive of weight concern, but both boys and girls that reported to make an effort to look like

magazine people were more likely to become weight concerned . Girls are more likely to report body dissatisfaction (no differences found between races 12) but there are a growing number of boys that are also dissatisfied and increase across age groups 13. Meland et al 13 found that girls are more dissatisfied with their body image: 39% think they are fat, 68% want to change body but 57% said they were not on a current diet. Ozmen et al found that 47.2% adolescents were dissatisfied with their body image and there were 10.1% of overweight/obese adolescents. In this study there were 7.7% overweight girls and 1.1% obese, but 22.7% girls classified themselves as fat; 7.7% boys classified themselves as obese but there were 10.3% overweight and 1.1% obese boys. Sabbah et al 15 had 16.5% overweight adolescents, 32.1% of them were dissatisfied with their weight and 8.6% were dieting or need to diet (23.4%); 20.5% adolescents were dissatisfied with their weight but were not overweight and 7.5% were overweight but satisfied with their weight. The present study adolescents' are dissatisfied with their body image and are often obese. In Portugal 11, girls reported dieting more than boys, 15.3% overweight adolescents and 6% of those who were not obese were also dieting. Fonseca et al 11 did not find significant differences between overweight and obese adolescents concerning physical activity and sedentary behavior (watching TV). In a study to increase physical activity, reduce sedentary behaviors and improve dietary habits in adolescents, Huang et al 16 found that teens reduce fat intake and sedentary behavior and increase fruit and vegetables intake and physical activity, which leads to weight loss and body satisfaction.

**Food intake and body dissatisfaction**

Adolescents dissatisfied with their body image tend to adopt health eating patterns in spite only 5% adolescents' eat 5 fruits and vegetables [22].

Obese women in an attempt to loose weight tend to skip meals and that often result in a higher intake of snacks and sweet foods [23] but dissatisfied women tend to adopt healthful diets [24].

Adolescents who were dissatisfied with their body image and wanted to loose weight were often dieting and reduced intake snacks and some meals [25] , sweet foods, fat foods, meat, and increase whole meal products and low-fat milk [26], had a more frequent use of artificial sweeteners, eating and drinking low fat or fat free products [27].

**CIRCADIAN INTAKE**

All over the years many studies tried to explain the regulation of food intake [28], which focus on homeostasis-type models and behavioral factors that influence intake (stomach content and hunger and diurnal rhythms, social facilitation and palatability). There are many factors which might influence the circadian rhythm of food intake, such as circadian oscillator, ultra radian oscillator, biochemical need for food, environmental (light vs. dark), behavioral (active vs. asleep), opportunistic, habitual an social [29],30. Human eating behavior depends on biological, genetic, psychological, social and cultural aspects [30,31,32]. Eating frequency and eating behavior differ from one culture to another, which leads to a various ways of preparing food, different norms of food consumption, time and quantity of meals and amount of total energy intake 30.

Eating between meals has become part of our culture. Certain aspects of eating behavior, such as the time of day that a meal take place, may have important consequences for weight control [33], so energy intake must be balanced with energy expenditure to maintain body weight since obesity became a major concern. The diurnal distribution of intake has a cultural-specific pattern**:** American students showed a pattern of increasing meal sizes over the day; Dutch students eat small meals during the day and larger meals in the evening; French students eat large meals in the early afternoon [34]. Traditionally as the day progresses average meal size increases, and again eating a large proportion of food energy in the morning could lead to a decrease overall intake [35]. Castro also found that the short-term intake is controlled on the basis of its weight and volume as opposed to its food energy content 35,[36]. Halberg et al 33 has suggested that the metabolic efficiency of energy utilization from macronutrients may show circadian variability. Energy intake in the morning after awakening was found to lead to higher weight loss relative to when the same intake occurred in the evening. Bellisle et al [37] reviewed several epidemiological studies about people's usual frequency of eating and body weight loss, but they concluded that there is no evidence that weight loss on hypoenergetic regimens is altered by meal frequency.

Recent data form Australia, United States and Europe show increased self-reported energy intake associated with obesity [38]. Bellisle et al [39] have suggested a possible contribution of daily rhythms of food intake in the development of overweight in children. The data on diurnal rhythms in obesity are scarce. Many

studies describe a “night eating syndrome” which occurs in patients with a “diet depression”, in which people have an evening hyperphagia and morning anorexia, suggesting a disturbance in the diurnal pattern of food intake. In his study with children, obese and fat children ate less at breakfast and more at dinner than leaner peers 39.

Kant el al found that adolescents had a larger energy intake is before 5p.m. [40] in USA. Some studies found that a grater ingestion in the morning leads to a better weight reduction than the larger ingestion be in the evening 40,[41]. In Brazil [42] 7.6% are overweight adolescents and female adolescents have a higher percentage – 10.5% of overweight. Keim et al 41 conclude that the meal ingestion pattern affected body weight and composition changes during weight reduction. These observations suggest that the distribution of daily energy intake may affect energy expenditure, energy storage and therefore body weight.

Studies using the diet dietary technique demonstrated that there are substantial and important changes in eating behavior that occur over the course of the day 31. Lennernäs et al suppose that the disinterest of some investigators in circadian energy intake and its effect on metabolism and the lack criterions that define eating episodes as well the few strategies to analyze data, be one of the reasons of the existence of few studies in this area [43]. In a study about people with night eating syndrome, O’Reardon et al [44] found that controls had a higher 24-hour caloric intake during the weekends to weekdays due to a slightly higher intake in the second hour period. Controls also have a significantly lower caloric intake in the first 8 hours of the day 6 a.m. to 1:59 p.m., not different between 2 p.m. to9:59 p.m. and a significantly greater during the last 8 hour period (10 p.m. to 5:59 a.m.).

### Meal eating patterns

There are a number of suggestions to define a meal: according to time of the day, amount of food ingested, presence of other people, food quality or food quantity and time between meals [45]. Recently it was suggested that an “eating episode” identifies each moment of food intake and it has to be each person to define their meal 43. Western societies recommended a structured distribution of food takings: breakfast, lunch, dinner and snacks. Cultural aspects, such as amount of food consumed, time and total number of meals, place the food is taken, people

with who we eat, social status of food and economical status of each society determine the importance of each meal all through the day 30.

Castro 31 defined meal all the food ingestion with at least 209 kcal. He also 31 found that eating a large amount in the morning result in lower total energy intake and eating a large amount in the evening result in a higher total intake. He did not found differences between weekdays and weekend days 31.

The most important question is what we defined as a meal or as a snack. The majority of investigators defined those episodes based on time of consumption and/or nutrient composition of the eating episodes [46].

Bellisle et al [47] considered that a meal is only described like that if contributes with 50 kcal or (or more 100 to 200kcal) and has to separated by 15 minutes to the next meal (also applied times of 45 and 90 minutes). In a study in Germany [48], the authors define a meal based on what the participants identify that in their food registrations and it was independent of quantity and quality of food and drink ingested. Winkler et al 48 considered only six meals a day – three principal meals and three between meals in their study regarding to their aims. In a study in Holand [49], people defined six meals a day by eating habits. Winkler et al 48 defined "meals" the principals and between meals as "events" and concludes that 31% of people have 3 meals and a event a day; 31% had three meals and 2 "events", 15% had only two meals, 13% had 3 meals and 3 events, 1% only eat a meal a day and 7% eat one meal and one event.

We want to determine whether meal ingestion pattern – large morning meals vs. large evening meals – affects changes in body weight but did not find significant differences between the two periods of intake and obesity, body dissatisfaction or fat percent. Benton et al [50] found that people that eat breakfast and a small snack in the middle morning reported feeling less hungry at lunch, the larger the caloric intake the less subjects reported hunger. Kant et al 1 found that women in CSFII aged 19-50 years consumed a mean of 18% of their energy intake from morning (before11a.m.) 36% from midday (11.00 a.m. – 4.49 p.m.), and 46% from evening (after 5.00 p.m.).

Castro 31 found that eating a large amount in the morning result in lower total energy intake and eating a large amount in the evening result in a higher total intake. He did not found differences between weekdays and weekend days.

Bellisle et at 39 found that the traditional large meals of the day (lunch and dinner) represented larger proportions of daily energy intake in fat and obese children and the smaller meals were inversely related to corpulence. Overweight children tended to eat less at breakfast and more at dinner than normal and underweight peers. The more caloric meals were lunch an dinner in overweight children and smaller meals were less caloric than in control children.

Many studies have demonstrated that missing breakfast or other meal has consequences in cognitive performance, mood all through the day [51]. In the present study all adolescents had breakfast and also lunch and dinner.

Fricker et al [52], found that breakfast accounts with 15%, 14% and 13% of TEI in normal weight, pre-obese and obese people respectively. Lunch contributes with 37% of TEI in normal weight and 40% in the other groups and dinner's contribution is 38% of the total energy intake in all groups.

The average reported energy intake by 14-19-yeras-old Danish adolescents was distributed 34% from fat, 49% from carbohydrate and 14% by protein and 3% from alcohol. Included sugar accounts in 12.8 to 13.8% of daily intake. In Poland fat intake is also higher than recommendations and protein and carbohydrates were lower [53]. Swedish 15-year-old energy intake in week days varies for 19% for breakfast, 19-18% for lunch, 28-26% for dinner, 20-21% for light meals and 14-18% for snacks. On weekends breakfast supplies 22%, lunch 12%, dinner 32-27%, light meals 17% and snacks 20-26%. Also in Moscow, protein contributed 12-13%, fat 29-32% of dietary energy, and the study carried out in 10-15-year-old children showed low and infrequent consumption of milk and dairy products, as well of fruit, fruit juice and vegetables 53.

#### SNACKING

Eating between meals, snacking, has become part of the culture of the industrialized countries. Several studies report that 20% of children skipped breakfast and that was compensated for during the rest of day by snacking. Adolescents of Southern Europe have three main meals (breakfast, lunch and dinner) and one to three snacks or sometimes more [54]. Snacks contribution to energy intake in adolescents varies from 20% to 39% [55]. Keim et al 41 studied a 4 meals-day with energy distribution 15% breakfast, 35% lunch and 35% at dinner and 15% evening snack in the AM group and the PM group with a distribution of

15% breakfast, 15% lunch, 35% dinner and 35% evening snack. About 50% of Sweden and Finland adolescents skipped breakfast in spite of being a prepared school lunch free of charge 56.

Snacking is less frequent in Portugal, Spain, Italy and Greece than France, Nordic Countries and USA, and Portuguese adolescents prefer cakes and biscuits, soft drinks and also fruit and milk while Spanish adolescents prefer chips and savory snacks and Italians prefer pizza. As seen before concerning energy intake, fat is above recommendations and carbohydrates are below, but added sugars were very consumed 54.

In the present study 52 (45.2%) students eat six times a day, only one eat breakfast, lunch and dinner and 17 students (14.8%) eat three principal meals and a snack, 46 (40%) eat two snacks and 52 (45.2%) eat three snacks a day. In our study, 13% of total daily intake is form breakfast, 22% from morning snack, 31% from lunch, 21% from afternoon snack, 29% from dinner and 24% from evening snack. Kearney et al [49] found that dinner had a major contribute to total daily energy intake (35%), follow by lunch (22%), evening snack (14%), breakfast (13%), afternoon snack (9%) and morning snack (7%). On Winkler et al 48 study dinner accounts with 33% TEI, lunch 29% of TEI, breakfast 17%, morning and afternoon snacks 7% each and 6% at evening snack.

French students reported 2.7 meals a day and 1.3 snack (the traditional three meals and one or more snacks) 34. Snacks differ from meals in size and nutritional content: more carbohydrates, less fat and less protein and they contribute in 18% do total daily intake. Snack occurs at times when hunger feelings are present, but meals bring more energy than snacks so they reduce hunger more. Sixty percent of French 16-17-year-old students snack and 45% children snack [56,57]. In Denmark and Norway the students bring sandwiches from home and about 80% of students have dinner. Breakfast is skipped by 15% of adolescents; the afternoon snack is similar in energy content to breakfast. A Brazilian study 42 with 17-19 years adolescents conclude that 96,6% of students eat three or more times a day: 36,7% of those eat 4 times/day, 28,8% eat 4 times/ day and 21,8% eat 6 times/day and only 9,9% eat only 3 times/day. They also verified a little percentage of obese adolescents because 80% of the students eat at home and most of them work, dispending more energy.

**OBESITY, FOOD INTAKE AND PHYSICAL ACTIVITY**

The International Obesity Task Force (IOTF) asserts that the principal causes of the epidemic of overweight and obesity are twofold: an increasing abundance of 'energy dense' foods and drinks which promote excessive "calorie" consumption and support a ubiquitous 'snacking' culture leading to a pervasive "passive over-consumption" of energy; and the systematic public and commercial developments which restrict opportunities for physical activity – leading to an almost universal sedentary state [58]. Several studies suggested that eating in the morning produce greater saciety trough out the day with less food intake in the evening and lower BMI[59]. Rolland-Cachera et al *57* also find that there is no significant correlation between food intake and corpulence of children. The obese group had a percent of protein higher in the daily caloric intake than the non-obese 57. Cho et al [60] found that people that skip breakfast have higher mean BMI. Baecke *et al* [61] found that mean daily intake of total energy was higher in males than females. About 55% of energy intake was consumed at lunch and dinner, while about 35% was consumed as snacks.

Even scientific evidence is lacking, reducing nocturnal eating is a weight loss strategy often recommended in the popular press 41. Loss of fat mass was affected by the order in which subjects received their meal. They found that more weight was lost with the large AM meal pattern compared to the large PM meal Pattern. In a recent study with normal weight women, BMI and underestimation of food intake are inversely correlated and there were not found associations between food underestimation and percent of body fat. In obese people underestimation of food intake is associated with psychological factors 3. Another study also demonstrated that there were not positive correlations between BMI and energy intake [62]. Lahti-Koskib et al [63] verified that the ingestion of complex carbohydrates and weight are inversely correlated. Marti-Henneberg et al [64] have positive correlations between BMI and energy density in all ages men and women didn't have any correlations between BMI and energy density. Voss et al [65] found that energy intake is inversely correlated with obesity, but they suppose that many subjects probably underestimated their energy intake.

Obese adolescents are also less physical active 11,[20] and body dissatisfaction is associated with more hours of watching TV 11,[20]. The National Health Board estimates that about 48% of adolescents and young adults practice physical

activity, 1% have 90' a week of physical activity, 8.8% practices between 90' to 3 hours a week of physical activity. In Portugal, 31.5% of 7 to 9 years old children are obese 10, 10.2% of 13 years old adolescents are overweight and 16.5% are at risk of overweight [66]. In 1997/1998 Lissau et al [67] found that 13-year-old boys' BMI was 190.0kg/$m^2$ and 15 years old boys was 20.6 kg/$m^2$, and 13 and 15 years old girls' BMI was 19.4 kg/$m^2$ and 20.5 kg/$m^2$ respectively, so obesity is increasing widely. Physical activity has also an important role in obesity since adolescents stop exercise, especially girls who are more influenced by fashion and dislike their physical appearance, but leisure activities increase: the numbers of hours sitting in front of a computer working or playing video games, watching TV and outside activity decrease.

The sedentary lifestyle in industrialized countries has a particular effect in adolescents. An increased energy intake and a reduced level of physical activity and more sedentary lifestyles with more time spent watching TV and computer game playing are the most important factors behind adolescents obesity. Adolescents eat large quantities of food while watching TV. On weekdays 18,3% of total daily energy intake was consumed watching TV and on weekends 26,4% of total energy intake was consumed watching TV [68]. Snacks on week days were consume during television viewing and less during weekend days on week days, more than one-quarter of the children's daily energy was consumed during television viewing and on weekdays, 20% of daily energy was consumed while watching TV 68. Families that watch TV during meal time consumed fewer fruit and vegetables and more pizza, snacks and sodas. Advertising also influences children food choices, particularly fast food and food or high sugar products 70[,68]. Stroebele et al [69] also found that at least one meal per day is eaten watching TV, and there is a significant increase in meal frequency while watching TV (at least one additional meal is done, which result on an increase overall daily intake). Adolescents eat large quantities of food while watching TV 69. On weekdays 18,3% of total daily energy intake was consumed watching TV and on weekends 26,4% of total energy intake was consumed watching TV68. Snacks on week days were consume during television viewing and less during weekend days on week days, more than one-quarter of the children's daily energy was consumed during television viewing and on weekdays, 20% of daily energy was consumed while

watching TV 68. Approximately 46% of daily energy intake was estimated to come form foods/beverages reportedly consumed in the evening snack.

Adolescents that eat the dinner meal with their family, consume large quantities of fruit, vegetables and dairy drinks and they skip breakfast less time [68,70].

The presence of other people might simply extend the amount of time spent at a meal and, thus, increase the amount eaten. Meals eaten with other people present are 44% larger than meals eaten alone 32,[71]. Castro found that meal size is affect by the presence of other people but does not appear to be related to the number of meals ingested during the day. Castro et al also verified that people eat large amounts of food when are with other people than alone 71.

Eating out has been associated with higher intake of dietary fat and energy compared with eating at home. People also eat now larger portions than before.

Vending machines at school might promote the ingestion of caloric foods by adolescents, because they are cheap and ready to eat, full filled of fat and sugar and lower in nutritive ingredients and also decrease food consumption.

Food consumed at home had better micronutrient density than food outside home. Eating outside the home accounts for above 30% of daily energy intake in UK students 57. Children from low socioeconomic levels had home intake lower nutrient density and got a larger proportion of their daily foods from shops or cafes.

Obese people purchase less food when accompanied by others than when alone and non-obese subjects do the opposite 71. Breakfast is the smallest meal and dinner the highest, snacks are small and often eaten alone and the meals usually are with other persons.

During weekdays and weekends snacking is particularly common in the Nordic countries 56. The most popular snacks are soft drinks, cakes, buns, chips and ice cream. Swedish 15-year-old energy intake in week days varies for 19% for breakfast, 19-18% for lunch, 28-26% for dinner, 20-21% for light meals and 14-18% for snacks. In some studies working class children were fat or obese than children of executive or liberal professions families 57, meaning, a higher proportion of overweight subjects is observed in social subgroups where the daily diet was more caloric. Fat subjects tended to consume less carbohydrate and more protein than the lean.

# 4 | AIMS

- To relate perceived body image and food intake in normal and overweight Portuguese adolescents born in the year of 1990.

- To compare adolescents' energy intake between two periods of the day: until lunch and after lunch, and to evaluate the association of that distribution with obesity and body dissatisfaction.

# 5 | Participants and Methods

**PARTICIPANTS**

The sample included 13-year-old urban adolescents, members of the Epidemiological Health Investigation of Teenagers in Porto (EPITeen) cohort [72]. During the assembling o f the cohort, the executive boards of Porto schools that provide teaching to 13-year-old students (27 public and 24 private) were approached and asked to provide students' addresses, as previously reported 66. In compliant schools, we identified 2788 eligible adolescents (2126 in public and 662 in private schools); from this only 2161 (1651 public and 510 private school) agreed to participate and provide information at least for part of the planned assessment.

**METHODS**

The initial evaluation included extensive data collection, comprising two self-administered questionnaires (one completed at home, another at school), and a physical examination performed at school, between 8a.m. and 10a.m. by a team of experienced nurses, nutritionists and physicians. A 12 hours overnight fasting blood sample was drawn from consenting participants.

The home questionnaire inquired about demographic, social, behavioral and clinical characteristics of the children and the family. It was also sent a food frequency questionnaire and physical activity. At school, during the research team visit, children answered an additional questionnaire comprising further information on physical activity, smoking and alcohol intake and included questions about body dissatisfaction choosing body images with Stunkard's silhouettes[73]. Body image dissatisfaction was calculated as the difference between current perceived body image and desired body image.

With the subject standing, waist circumference was measured to the nearest centimeter with a flexible and no distensible tape, midway between the lower limit of the rib cage and the iliac crest, avoiding exertion of pressure on the tissues.

Anthropometrics measures were obtained with the subject in light indoor clothes and no shoes. Weight was measured using a digital scale – Tanita ® (in kilograms, to the nearest tenth), and height was measured (in centimeters, to the nearest tenth) using a portable stadiometer. Body Mass Index (BMI) was calculated as weight (kg) divide by squared height ($m^2$) and according to the age and sex specific BMI reference percentiles developed by the United States Centers for

Disease Control and Prevention[74], participants were considered normal if BMI < 85th percentile, risk of overweight if BMI was between 85Th and 95th percentile, and obese/overweight if BMI > 95th percentile[75]. For this study we considered non obese adolescents and overweight adolescents (that included pre-obese and obese). Parental BMI was calculated using self-reported weight and height and classified according to World Health Organization (WHO) [76]. Adolescents' with no information of weight were excluded.

Leisure time activities were classified according to answers to a multiple choice question proposing four subjective intensity categories (mainly sitting, mainly standing, active or very active. Average weekend time spent watching TV, playing computer and reading was recorded and added to compute total time spent in sedentary activities.

Adolescents filled a food frequency semi-quantitative questionnaire (FFQ), which is validated for adults [77,78] and was adapted to adolescents 72. This FFQ includes a food list and a close section frequencies categories ("never to less than one a month" to "six or more times a day"). The food intake was estimated by multiply/cross the item frequency referred by the respective pre-defined medium portion. Adolescents' with incomplete information and outliers in the FFQ were excluded. We use Food Processor Plus SQL® software to convert the food in nutrients adapted for Portuguese population.

Adolescents also filled a three non-consecutive-days diet record with one weekend day and two week days. We use Food Processor Plus SQL® software to convert the food in nutrients adapted for Portuguese population 77. Participants were asked to write the time of the day and place (in or out home) at which food and beverage were consumed, quantities of which food or beverage (glasses, cups, spoons) and food preparation (recipes, commercial brands). All the questionnaires were sent to adolescents' home with information of how to fill the questionnaires. The total energy intake was calculated by the average of the contribution of the individual items in three days. Meals were identified and the compositions of the individual items composing the meal were summed and considered the average of the three days. All adolescents' were reminded to registry drinks that were consumed those days, including water but we verify that many of them did not do that registration.

Six meals a day were identified (breakfast, morning snack, lunch, afternoon snack, dinner and evening snack). We divided these meals in two periods – before lunch (breakfast, morning snack and lunch) and after lunch (afternoon snack, dinner and evening snack. The first group included all adolescents that eat more calories until lunch and the second group included all adolescents that eat more calories after lunch. Adolescents' with incomplete information were excluded.

### Statistical analysis

Statistical analysis was performed using the SPSS®. Proportions were compared using the Chi-square test and a significant level of 0.05 was assumed. To estimate the magnitude of the association of eating snacks and obesity, body dissatisfaction and fat percentage, odds ratios (OR) and 95% confidence intervals were computed used the logistic and multinomial regression.

# 6 | RESULTS

The results and discussion of this study are presented in to papers that will be submitted to publication.

6. 1 – Adolescents' perceived body image, obesity and food intake.

6.2 – Daily energy intake and meal distribution on obesity and body dissatisfaction in 13 years old adolescents.

## 6.1 – Adolescents' perceived body image, obesity and food intake.

**ADOLESCENTS' PERCEIVED BODY IMAGE, OBESITY AND FOOD INTAKE.**

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**ABSTRACT**

**Aim:** to compare perceived body image and food intake in normal weight and obese adolescents.

**Methods:** Our sample included 1235 students with 13-years-old, members of the Epidemiological Health Investigation of Teenagers in Porto (EPITeen) cohort, 54.3% girls, 16.5% were overweight and 10.7% were obese. The questionnaire inquired about demographic, social, clinical and behavioral characteristics of the adolescents and the family, including food frequency and physical activity. Body image dissatisfaction was calculated as the difference between perceived body image and desired image, using Stunkard's silhouettes. Anthropometric measures were obtained and CDC percentiles references were used to classify obesity classes (normal if BMI < 85$^{th}$ percentile, risk of overweight if BMI was between 85$^{Th}$ and 95$^{th}$ percentile, and obese if BMI > 95$^{th}$ percentile).

**Results:** Thirty seven percent of adolescents were satisfied with their body image, 39.5% wanted to be thinner and 23.2% wanted to be fatter. The adolescents that wanted to be fatter had significantly lower intake of total energy intake and in vitamin C and E intake. Obese adolescents who wanted to be fatter had a significantly higher intake of protein and sodium intake. In normal weight adolescents who wanted to be fatter had a significantly lower intake of fat, vitamin C and E intake. Also, normal weight adolescents who had higher consumption of croissants and bakery, chocolate snacks, coca-cola and other sodas had lower probability of wanted to be thinner compared to those who are satisfied with their image. After adjustment for sex, type of school and parents' BMI the OR (CI 95%) are 0.60 (0.40-0.89); 0.55 (0.35-0.88); 0.41 (0.22-0.76); 0.53 (0.28-1.00).Obese adolescents that consume more sodas had a higher probability of wanted to have a thinner figure; after adjustment for sex, type of school and parents' BMI the OR, CI 95%= 1.53, 0.47-5.02.

**Conclusion:** A high percentage of adolescents (62.7%) reported being dissatisfied with their body image and more desired to be thinner. Normal weight adolescents who desired to be thinner ate less croissants and bakery, chocolate snacks, coca-cola and other sodas. Obese adolescents who desired to be thinner drunk more sodas.

## 1 – Introduction

Adolescence is often considered a critical period for many psychological and behavioral transitions, including feeding practices. It is common that adolescents change food habits and meal patterns, which are affected by factors such as availability and preference for some foods, parents' and family practices, peers beliefs and the chance of buying low quality foods away from home [1,2,3,4,5]. Nutritional status at adolescence is of a particular concern, as overweight and obesity at this period of life are associated with adult mortality and morbidity .

Previous studies suggested that physical appearance and body image may influence perceived health [,6] , resulting of a discrepancy between an individual's perceived current body size and perceived ideal body size. Adolescents are often dissatisfied with their body image and want to change something about their bodies, especially to lose weight.

Dieting become frequent in adolescence [7,8] , even in normal weight adolescents and has been described as a risk factor of eating disorders . Girls are more likely to report body dissatisfaction [9] but there are a growing number of boys that are dissatisfied. Also body dissatisfaction increases across age groups .

It has been described that overweight [10,11] and obese [12] adolescents were often dissatisfied with their body image and they are trying to lose weight , also have low self-esteem [,16], had more difficulty to make new friends [,20] so are in risk of developing depression. Adolescents dissatisfied with their body weight were more involved in risk behaviors, such as bullying and smoking [13]. Huang et al [14] found that girls from PACE's study who maintained or lost weight during one year intervention study improved their body image. Obese adolescents are also less physically active [,20] and body dissatisfaction is associated with more hours of watching TV [,20].

Adolescents dissatisfied with their body image tend to adopt health eating patterns in spite only 5% adolescents' eat 5 fruits and vegetables[15]. Obese women in an attempt to loose weight tend to skip meals and that often result in a higher intake of snacks and sweet foods[16] but dissatisfied women tend to adopt healthful diets[17].

Adolescents who were dissatisfied with their body image and wanted to loose weight were often dieting and reduced intake snacks and some meals[18] , sweet foods, fat foods, meat, and increase wholemeal products and low-fat milk [19], had a

more frequent use of artificial sweeteners, eating and drinking low fat or fat free products [20].

The purpose of this study is to determine the relation between body dissatisfaction and food or nutrient intake in 13-years adolescents by BMI status.

## 2 – Participants and Methods

Our sample included 13-year-old urban adolescents, members of the Epidemiological Health Investigation of Teenagers in Porto (EPITeen) cohort [21]. The present analyses included 1235 adolescents (with complete information for key variables), 54.2% were girls, 71.6% frequented public school, 52.5% adolescents practiced sport. Concerning obesity 16.5% were overweight and 10.7% were obese. About parents' education 57.6% frequent 5 to 12 years of school. When analyzing parents' BMI, 47.9% were overweight and 17.8% were obese.

The initial evaluation included extensive data collection, comprising two self-administered questionnaires (one completed at home, another at school), and a physical examination performed at school by health professionals.

The home questionnaire inquired about demographic, social, behavioral and clinical characteristics of the children and the family. It was also sent a food frequency and a physical activity questionnaire. At school, during the research team visit, children answered an additional questionnaire comprising further information on physical activity, smoking, and alcohol intake and included questions about perceived body image using Stunkard's silhouettes[22]. Body image dissatisfaction was calculated as the difference between perceived and desired body image.

Anthropometric measures were obtained with the subject in light indoor clothes and no shoes. Weight was measured using a digital scale – Tanita ® (in kilograms, to the nearest tenth), and height was measured (in centimeters, to the nearest tenth) using a portable stadiometer. Body Mass Index (IMC) was calculated as weight (kg) divide by squared height ($m^2$) and according to the age and sex specific BMI reference percentiles developed by the United States Centers for Disease Control and Prevention [23] participants considered normal if BMI < $85^{th}$ percentile, risk of overweight if BMI was between $85^{Th}$ and $95^{th}$ percentile, and

obese/overweight if BMI > 95$^{th}$ percentile [24]. For this study we considered non obese adolescents and overweight adolescents (that included pre-obese and obese). Parental BMI was calculated using self-reported weight and height and classified according to World Health Organization (WHO) [25].

Leisure time activities were classified according to answers to a multiple choice question proposing four subjective intensity categories (mainly sitting, mainly standing, active or very active). Average weekend time spent watching TV, playing computer and reading was recorded and added to compute total time spent in sedentary activities.

Students filled a Food Frequency Questionnaire, which is validated for adults [26,27] and adapted for adolescents [28] and the Food Processor Plus SQL® software was used to convert the food in nutrients which is adapted for Portuguese population .

Statistical analysis was performed using the SPSS®. Proportions were compared using the Chi-square test and a significant level of 0.05 was assumed. To estimate the magnitude of the association of obesity status and food intake according to body dissatisfaction, odds ratios (OR) and 95% confidence intervals were computed using logistic and multinomial regression.

## 3 – Results

Adolescents were asked to identify their actual and desired figure with Stunkard's silhouettes, to evaluate body dissatisfaction (difference between perceived body image and desired body image): 37.2% were satisfied with their body image, 39.5% wanted to be thinner and 23.2% wanted to be fatter. Dissatisfied adolescents choose different desired figures: 28% only one figure thinner, 11.6% two or more figures thinner; 19% one figure fatter and 4.2% two or more figures fatter. A higher percentage of girls were found in adolescents who wanted to be thinner and a higher percentage of boys in adolescents that wanted to be fatter. A majority of overweight and obese adolescents' were dissatisfied with their current image and wanted to be thinner.

The adolescents that wanted to be fatter had significantly lower intake of total energy intake ($p<0.001$) and in vitamin C ($p= 0.003$) and vitamin E intake ($p=0.025$).

Obese adolescents who wanted to be fatter had a significantly higher intake of protein and sodium intake. In normal weight adolescents who wanted to be fatter had a significantly lower intake of fat, vitamin C and E intake.

Also, normal weight adolescents who had higher consumption of croissants and bakery, chocolate snacks, coca-cola and other sodas had lower probability of wanted to be thinner compared to those who are satisfied with their image. After adjustment for sex, type of school and parents' BMI the OR (CI 95%) are 0.60 (0.40-0.89); 0.55 (0.35-0.88); 0.41 (0.22-0.76); 0.53 (0.28-1.00).

Obese adolescents that consume more sodas had a higher probability of wanted to have a thinner figure; after adjustment for sex, type of school and parents' BMI the OR, CI 95%= 1.53, 0.47-5.02.

## 4 – Discussion

Weight problems, body image and dieting have increased widely among adolescents and become a major concern to health professionals, schools and parents. In order to access body satisfaction and perceived body weight and BMI, figure-stimuli are used [29].

In the present study 37.2% were satisfied with their body image, 39.5% wanted to be thinner and 23.2% wanted to be fatter. Theses results are consistent with other studies: 47.2% Turkish adolescents were dissatisfied with their body image and 10.1% were overweight/obese adolescents . About 16.5% of Palestinian15 adolescents' were overweight, 32.1% of them were dissatisfied with their weight and 8.6% were dieting or need to diet (23.4%); 20.5% adolescents were dissatisfied with their weight but were not overweight and 7.5% were overweight but satisfied with their weight.

Gender differences may be explained by difference in pubertal timing, because girls were more often dissatisfied with their body image 15 and they were often dieting to loose weight and boys wanted more to gain muscle26. Among girls, age seems to be associated with constant dieting as well mother's attention to their diet; peers influence does not seem to be predictive of weight concern, but both boys and girls that reported to make an effort to look like magazine people were more likely to become weight concerned .

Turkish adolescents' girls are more often dissatisfied with their body image: 22.7% girls classified themselves as fat but only 7.7% were overweight and 1.1% obese; 7.7% boys classified themselves as obese but there were 10.3% overweight and 1.1% obese.

In Norway girls are more dissatisfied with their body image: 39% think they are fat, 68% want to change body but 57% said they were not on a current diet. In Portugal , girls reported dieting more than boys, 15.3% overweight adolescents and 6% of those who were not obese were also dieting. These results are consistent with our results: girls are more dissatisfied with their body image and want to be thinner. Boys are also dissatisfied but they wanted to be fatter.

In the present study there were no significant differences in macronutrients intake in normal weight and overweight adolescents but significant differences were found in vitamin C and E intake.

Concerning fruit and vegetables intake, adolescents that consume more had a lower risk of being dissatisfied with body image and eating more than 400g is protective for obese adolescents. In a study to increase physical activity, reduce sedentary behaviors and improve dietary habits in adolescents, Huang et al 16 found that teenagers reduce fat intake and sedentary behavior and increase fruit and vegetables intake and physical activity, which leads to weight loss and body satisfaction. Adolescents dissatisfied with their body image tend to adopt health eating patterns in spite only 5% adolescents' eat 5 fruits and vegetables22.

Significant differences were found in croissants and bakery intake in normal weight adolescents, while in obese adolescents there were significant differences in cookies and sugar intake Normal weight adolescents that had a higher intake of snacks, sugar, drink more ice tea and eat more pizza had a higher risk to desire a fatter figure. Obese adolescents that consume more sodas were had a higher risk to have a thinner figure.

Normal weight adolescents had significant differences in croissants and bakery intake: who wanted to be thinner or fatter consume more quantities. Obese adolescents had significant differences in other cookies, chocolate and sugar intake – in spite of wanted a thinner image they had higher intake of those kind of foods. Obese adolescents that eat more sugar and sugar products ha a higher risk of being dissatisfied with body image. Adolescents who were dissatisfied with their body image and wanted to loose weight were often dieting and reduced intake

snacks and some meals25 , sweet foods, fat foods, meat, and increase wholemeal products and low-fat milk, had a more frequent use of artificial sweeteners, eating and drinking low fat or fat free products 26[,27].

One limitation of this study is that the food intake data was collected from students using self-reported questionnaires and it is possible that adolescents reported socially desirable answers however questionnaires were anonymous. Another limitation is the definition of body dissatisfaction because in the present study was calculated indirectly derived from a question of figure-stimuli.

There were few studies about this theme which imitate the comparison of our results with others, but the relation of adolescents' intake and body dissatisfaction is very important to prevent risk behaviors and unhealthy adults.

## 5 – Conclusions

A higher percentage of adolescents (62.7%) reported being dissatisfied with their body image and more desired to be thinner.

The adolescents that wanted to be fatter had significantly lower intake of total energy intake and in vitamin C and E intake.

Normal weight adolescents who desired to be thinner ate less croissants and bakery, chocolate snacks, coca-cola and other sodas.

Obese adolescents who desired to be thinner drink more sodas.

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## TABLES

**Table 1** – Adolescents' and parents' characteristics according to body dissatisfaction.

| n (%) | Wanted < actual 488 (39.5%) | Wanted = actual 460 (37.2%) | Wanted > actual 287 (23.2%) | *p* |
|---|---|---|---|---|
| **Sex** | | | | |
| Female | 287 (42.8%) | 281 (41.9%) | 103 (15.4%) | < 0.001 |
| Male | 201 (35.6%) | 179 (31.7%) | 184 (32.6%) | |
| **School** | | | | |
| Public | 344 (38.9%) | 315 (35.6%) | 228 (25.5%) | 0.008 |
| Private | 144 (41.1%) | 144 (41.4%) | 61 (17.4%) | |
| **Parents' education** | | | | |
| < 4 years | 59 (41.0%) | 43 (29.9%) | 42 (29.2%) | |
| 5 to 12 years | 285(39.8%) | 269 (37.6%) | 162 (22.6%) | 0.249 |
| > 12 years | 140 (38.5%) | 144 (39.6%) | 80 (22.0%) | |
| **Parents' BMI** | | | | |
| Normal weight | 110 (28.4%) | 170(43.8%) | 108 (27.8%) | |
| Overweight | 241 (40.5%) | 212 (35.6%) | 142 (23.9%) | < 0.001 |
| Obese | 120 (54.5%) | 68 (30.9%) | 32 (14.5%) | |
| **Obesity classes** | | | | |
| Normal weight | 195 (21.7%) | 419 (46.7%) | 284 (31.6%) | |
| Overweight | 162 (79.6%) | 39 (19.1%) | 3 (1.5%) | -- |
| Obese | 131 (98.5%) | 2 (1.5%) | 0 (0%) | |
| **Sport practice** | | | | |
| no | 242 (41.7%) | 210 (36.1%) | 129 (22.2%) | 0.270 |
| yes | 237 (37.1%) | 246 (38.6%) | 155 (24.3%) | |
| **Free time activity** | | | | |
| mainly sitting | 153 (44.9%) | 116 (34.0%) | 72 (21.1%) | |
| mainly standing | 123 (45.1%) | 102(37.4%) | 48 (17.6%) | 0.002 |
| active | 133 (35.0%) | 146 (38.4%) | 101 (26.6%) | |
| very active | 57 (30.6%) | 76 (40.9%) | 53 (28.5%) | |

**Table 2 –** Mean (standard deviation) of macro and micronutrients intake (adjusted for calories) according to body dissatisfaction classes.

| mean(dp) | **Wanted < actual** 488 | **Wanted = actual** 460 | **Wanted > actual** 287 | ***p*** |
|---|---|---|---|---|
| Calories (kcal) | 2284.0 (702.7) | 2558.7 (702.8) | 2522.2 (715.3) | <0.001 |
| Protein (g) | 106.0 (15.3) | 105.1 (17.8) | 104.3 (16.2) | 0,372 |
| Carbohydrates (g) | 317.2 (34.1) | 321.9 (37.8) | 319.4 (36.7) | 0.140 |
| Fat (g) | 87.7 (11.8) | 86.2 (12.9) | 87.3 (12.5) | 0.144 |
| Saturated fat (g) | 316.9 (4.6) | 316.9 (5.3) | 317.0 (4.9) | 0.937 |
| Colesterol | 366.1 (94.7) | 360.2 (99.4) | 365.7 (100.6) | 0.600 |
| Fiber (g) | 25.7 (5.9) | 25.6 (6.7) | 24.8 (6.3) | 0.098 |
| Cafeína | 408.2 (32.1) | 407.9 (32.5) | 410.4 (33.6) | 0.552 |
| Vitamin A total (g) | 2336.9 (1297.7) | 2272.8 (1173.5) | 2278.1 (1211.6) | 0.695 |
| Carotenoids (req) | 1152.3 (988.8) | 1107.8 (862.4) | 1158.8 (803.4) | 0.373 |
| Vitamin C (g) | 161.7 (66.3) | 160.5 (72.7) | 145.5 (59.5) | 0.003 |
| Vitamin E (g) | 10.3 (2.5) | 10.0 (2.5) | 9.8 (2.5) | 0.025 |
| Ca (g) | 1131.1 (342.1) | 1142.5 (332.6) | 1100.8 (312.1) | 0.240 |
| Na (g) | 2417.8 (404.0) | 2410.8 (419.9) | 2454.9 (436.0) | 0.344 |

**Table 3 –** Adolescents' macronutrients and micronutrients intake (adjusted to calories) according to body dissatisfaction by obesity classes.

| mean(dp) | **Wanted < actual** 488 | **Wanted = actual** 460 | **Wanted > actual** 287 | ***p*** |
|---|---|---|---|---|
| Calories (kcal) | 2284.0 (702.7) | 2558.7 (702.8) | 2522.2 (715.3) | <0.001 |

| | | | | |
|---|---|---|---|---|
| Protein (g) | | | | |
| Normalweight | 104.7 (14.6) | 105.4 (17.7) | 104.0 (15.7) | 0.543 |
| Overweight | 106.8 (15.7) | 102.5 (19.7) | 132.5 (36.1) | 0.007 |
| Carbohydrates (g) | | | | |
| Normalweight | 315.8 (34.7) | 321.7 (37.0) | 319.7 (36.5) | 0.169 |
| Overweight | 318.2 (33.7) | 323.2 (45.6) | 288.6 (51.2) | 0.237 |
| Fat (g) | | | | |
| Normalweight | 88.9 (12.2) | 86.1 (12.8) | 87.3 (12.5) | 0.039 |
| Overweight | 87.0 (11.6) | 86.8 (14.2) | 86.9 (5.2) | 0.994 |
| Saturated fat (g) | | | | |
| Normalweight | 317.4 (4.7) | 317.0 (5.3) | 317.0 (4.9) | 0.608 |
| Overweight | 316.6 (4.4) | 316.3 (5.8) | 317.8 (2.8) | 0.807 |
| Colesterol | | | | |
| Normalweight | 362.8 (82.4) | 360.9 (98.4) | 364.4 (99.5) | 0.890 |
| Overweight | 368.4 (102.2) | 353.1 (110.7) | 492.2 (149.8) | 0.077 |
| Fiber (g) | | | | |
| Normalweight | 25.7 (5.5) | 25.6 (6.7) | 24.7 (6.3) | 0.133 |
| Overweight | 25.7 (6.1) | 25.8 (6.8) | 27.9 (5.0) | 0.835 |
| Cafeína | | | | |
| Normalweight | 406.2 (29.9) | 408.0 (32.6) | 410.4 (33.7) | 0.352 |
| Overweight | 409.5 (33.5) | 406.5 (31.2) | 408.1 (28.2) | 0.857 |
| Vitamin A total (g) | | | | |
| Normalweight | 2237.6 (1163.6) | 2271.6 (1193.3) | 2261.1 (1186.7) | 0.947 |
| Overweight | 2401.4 (1377.8) | 2285.1 (960.8) | 3892.7 (2587.7) | 0.138 |
| Vitamina A carot | | | | |
| Normalweight | 1080.9 (828.7) | 1107.7 (876.8) | 1053.8 (804.1) | 0.707 |
| Overweight | 1199.7 (1081.1) | 1109.5 (706.8) | 1534.3 (694.7) | 0.742 |
| Vitamin C (g) | | | | |
| Normalweight | 155.2 (64.6) | 161.5 (73.6) | 145.1 (59.5) | 0.007 |
| Overweight | 166.0 (67.2) | 149.9 (62.5) | 191.1 (49.9) | 0.277 |
| Vitamin E (g) | | | | |
| Normalweight | 10.5 (2.5) | 10.0 (2.5) | 9.8 (2.5) | 0.012 |
| Overweight | 10.2 (2.5) | 10.6 (2.7) | 9.2 (1.2) | 0.446 |
| Ca (g) | | | | |
| Normalweight | 1102.6 (327.2) | 1142.5 (335.8) | 1099.7 (312.5) | 0.163 |
| Overweight | 1150.1 (350.9) | 1142.4 (301.8) | 1199.3 (308.5) | 0.960 |
| Na (g) | | | | |
| Normalweight | 2402.2 (424.7) | 2409.7 (428.6) | 2446.9 (430.9) | 0.430 |
| Overweight | 2428.2 (390.0) | 2421.7 (321.9) | 3212.6 (212.5) | 0.002 |

**Table 4 –** Food intake according to body dissatisfaction in normal weight adolescents.

**Table 5 –** Food intake according to body dissatisfaction in overweight adolescents.

| n (%) | Wanted to lose weight 195 (21.7%) | Wanted to maintain weight 419 (46.7%) | Wanted to gain weight 284 (31.6%) | p |
|---|---|---|---|---|
| **Fruit+vegetables** | | | | |
| < 400g | 116 (59.5%) | 225 (53.7%) | 171 (60.2%) | 0.170 |
| > 400g | 79 (40.5%) | 194 (46.3%) | 113 (39.8%) | |
| **Maria Cookies** | | | | |
| < once a month | 35 (17.9%) | 81 (19.3%) | 55 (32.2%) | |
| 1 – 4 times week | 79 (40.5%) | 184 (43.9%) | 105 (37.0%) | 0.363 |
| > 5 times week | 81 (41.5%) | 154 (36.8%) | 124 (43.7%) | |
| **Other cookies** | | | | |
| < once a week | 100 (25.5%) | 38 (33.3%) | 69 (32.1%) | |
| 1 – 3 times week | 50 (33.6%) | 194 (33.3%) | 69 (32.1%) | 0.537 |
| ≥ 3 times week | 61 (40.9%) | 106 (35.3%) | 77 (35.8%) | |
| **Croissants/bakery** | | | | |
| < once a week | 73 (37.4%) | 118 (28.2%) | 62 (21.8%) | |
| 1 - 4 times week | 48 (24.6%) | 103 (24.6%) | 87 (30.6%) | 0.004 |
| ≥ 3 times week | 74 (37.9%) | 198 (47.3%) | 135 (47.5%) | |
| **Chocolate** | | | | |
| < once a week | 96 (44.2%) | 162 (38.7%) | 123 (43.3%) | |
| 1 – 4 times week | 68 (34.4%) | 175 (41.8%) | 119 (41.9%) | 0.095 |
| ≥ 4 times week | 31 (15.9%) | 82 (19.6%) | 42 (14.8%) | |
| **Snacks** | | | | |
| < once a month | 102 (52.3%) | 184 (43.9%) | 124 (43.7%) | |
| 1xm – 2 times week | 59 (30.3%) | 126 (30.1%) | 86 (30.3%) | 0.131 |
| ≥ 2 times week | 34 (17.4%) | 109 (26.0%) | 74 (26.1%) | |
| **Sugar** | | | | |
| < once a month | 76 (39.0%) | 153 (36.5%) | 88 (31.0%) | |
| 1 – 6 times week | 59 (30.3%) | 126 (30.1%) | 84 (29.6%) | 0.254 |
| every day | 60 (30.8%) | 140 (33.4%) | 112 (39.4%) | |
| **Sodas** | | | | |
| < 2 times month | 45 (23.1%) | 63 (15.0%) | 58 (20.4%) | |
| 2xm – 2 times week | 83 (42.6%) | 179 (42.7%) | 122 (43.0%) | 0.087 |
| ≥ 3 times week | 67 (34.4%) | 177 (42.2%) | 104 (36.6%) | |
| **Ice tea** | | | | |
| < 2 times month | 82 (42.5%) | 169 (40.3%) | 101 (35.6%) | |
| 2xm – 2 times week | 86 (44.1%) | 181 (43.2%) | 125 (44.0%) | 0.323 |
| ≥ 3 times week | 27 (43.8%) | 69 (16.5%) | 58 (20.4%) | |
| **Coca-Cola** | | | | |
| < 2 times month | 109 (35.9%) | 198 (47.3%) | 135 (47.5%) | |
| 2xm – 2 times week | 71 (36.4%) | 171 (40.8%) | 112 (39.4%) | 0.196 |
| ≥ 3 times week | 15 (7.7%) | 50 (11.9%) | 37 (13.0%) | |
| **Pizza** | | | | |
| < once a month | 139 (20.0%) | 76 (18.1%) | 55 (19.4%) | |
| 1 – 2 times month | 101 (51.8%) | 233 (55.6%) | 146 (51.4%) | 0.819 |
| > 2 times month | 55 (28.2%) | 110 (26.3%) | 83 (29.2%) | |
| **Hambúrguer** | | | | |
| < once a month | 62 (31.8%) | 118 (28.2%) | 86 (30.3%) | |
| 1 – 2 times month | 94 (48.2%) | 208 (49.6%) | 130 (45.8%) | 0.738 |
| > 2 times month | 39 (20.0%) | 92 (220.%) | 68 (23.9%) | |

| n (%) | Wanted < actual<br>293 (87.7%) | Wanted = actual<br>41 (12.3%) | *p* |
|---|---|---|---|
| **Fruit+vegetables** | | | |
| < 400g | 172 (58.7%) | 23 (56.1%) | 0.751 |
| > 400g | 121 (41.3%) | 18 (43.9%) | |
| **Maria Cookies** | | | |
| < once a month | 114 (38.9%) | 17 (41.5%) | |
| 1 – 4 times week | 131 (44.7%) | 17 (41.5%) | 0.925 |
| > 5 times week | 48 (16.4%) | 7 (17.1%) | |
| **Other cookies** | | | |
| < once a week | 108(46.8%) | 14 (50.0%) | |
| 1 – 3 times week | 90 (39.0%) | 5 (17.9%) | 0.018 |
| ≥ 3 times week | 33 (14.3%) | 9 (32.1%) | |
| **Croissants/bakery** | | | |
| < once a week | 116 (39.6%) | 14 (34.1%) | |
| 1 - 4 times week | 66 (22.5%) | 13 (31.7%) | 0.430 |
| ≥ 3 times week | 111 (37.9%) | 14 (34.1%) | |
| **Chocolate** | | | |
| < once a week | 153 (52.2%) | 26 (63.4%) | |
| 1 – 4 times week | 110 (37.5%) | 8 (19.5%) | 0.059 |
| ≥ 4 times week | 30 (10.2%) | 7 (17.1%) | |
| **Snacks** | | | |
| < once a month | 55 (18.8%) | 7 (17.1%) | |
| 1xm – 2 times week | 75 (25.6%) | 11 (26.8%) | 0.962 |
| ≥ 2 times week | 163 (55.6%) | 23 (56.1%) | |
| **Sugar** | | | |
| < once a month | 106 (36.2%) | 20 (48.8%) | |
| 1 – 6 times week | 107 (36.5%) | 6 (14.6%) | 0.021 |
| every day | 80 (27.3%) | 15 (36.6%) | |
| **Sodas** | | | |
| < 2 times month | 47 (16.0%) | 9 (22.0%) | |
| 2xm – 2 times week | 135 (46.1%) | 15 (36.6%) | 0.451 |
| ≥ 3 times week | 111 (37.9%) | 17 (41.5%) | |
| **Ice tea** | | | |
| < 2 times month | 124 (42.3%) | 19 (46.3%) | |
| 2xm – 2 times week | 123 (42.0%) | 15 (36.6%) | 0.806 |
| ≥ 3 times week | 46 (15.7%) | 7 (17.1%) | |
| **Coca-Cola** | | | |
| < 2 times month | 149 (50.9%) | 20 (48.8%) | |
| 2xm – 2 times week | 115 (39.2%) | 15 (36.6%) | 0.649 |
| ≥ 3 times week | 29 (9.9%) | 6 (14.6%) | |
| **Pizza** | | | |
| < once a month | 66 (22.5%) | 10 (24.4%) | |
| 1 – 2 times month | 165 (56.3%) | 22 (53.7%) | 0.946 |
| > 2 times month | 62 (21.2%) | 9 (22.0%) | |
| **Hambúrguer** | | | |
| < once a month | 94 (32.1%) | 15 (36.6%) | |
| 1 – 2 times month | 138 (47.1%) | 15 (36.6%) | 0.425 |
| > 2 times month | 61 (20.8%) | 11 (26.8%) | |

**Table 6 –** Adjusted [a] odds ratio (95% confidence intervals) of adolescents' food intake according to body dissatisfaction in normal and overweight adolescents.

| | Normal weight | | |
|---|---|---|---|
| | **Wanted < actual** | **Wanted > actual** | **Obese** |
| OR (CI) | 195 (21.7%) | 419 (46.7%) | 334 (27.3%) |
| **Fruit+vegetables** | | | |
| < 400g | 1 | 1 | 1 |
| > 400g | 0.77 (0.54-1.09) | 0.80 (0.58-1.10) | 0.82 (0.42-1.60) |
| **Maria Cookies** | | | |
| < once a month | 1 | 1 | 1 |
| 1 – 4 times week | 0.79 (0.54-1.17) | 0.73 (0.58-1.38) | 1.10 (0.52-2.32) |
| > 5 times week | 0.87 (0.53-1.42) | 0.89 (0.51-1.03) | 0.99 (0.38-2.58) |
| **Other cookies** | | | |
| < once a week | 1 | 1 | 1 |
| 1 – 3 times week | 088 (0.55-1.42) | 0.95 (0.61-1.48) | 2.30 (0.78-6.76) |
| ≥ 3 times week | 0.64 (0.39-1.06) | 0.837 (0.54-1.80) | 0.53 (0.21-1.38) |
| **Croissants/bakery** | | | |
| < once a week | 1 | 1 | 1 |
| 1 - 4 times week | 0.78 (0.49-1.24) | 1.41(0.91-2.18) | 0.67 (0.29-1.56) |
| ≥ 3 times week | 0.60 (0.40-0.89) | 1.25 (0.84-1.49) | 0.97 (0.44-2.15) |
| **Chocolate** | | | |
| < once a week | 1 | 1 | 1 |
| 1 – 4 times week | 0.64 (0.44-0.95) | 0.87 (0.62-1.23) | 2.41 (1.02-5.66) |
| ≥ 4 times week | 0.65 (0.40-1.07) | 0.68 (0.43-1.08) | 0.79 (0.31-2.03) |
| **Snacks** | | | |
| < once a month | 1 | 1 | 1 |
| 1xm – 2 times week | 0.81 (0.54-1.22) | 1.04 (0.72-1.51) | 1.11 (0.50-2.47) |
| ≥ 2 times week | 0.55 (0.35-0.88) | 1.06 (0.71-1.56) | 1.20 (0.48-3.00) |
| **Sugar** | | | |
| < once a month | 1 | 1 | 1 |
| 1 – 6 times week | 0.93 (0.61-1.42) | 1.18 (0.79-1.76) | 3.31 (1.27-8.61) |
| every day | 0.87 (0.57-1.32) | 1.38 (0.94-2.01) | 1.06 (0.50-2.24) |
| **Sodas** | | | |
| < 2 times month | 1 | 1 | 1 |
| 2xm – 2 times week | 0.69 (0.44-1.09) | 0.70 (0.468-1.07) | 1.44 (0.63-3.31) |
| ≥ 3 times week | 0.41 (0.22-0.76) | 0.53 (0.31-0.90) | 1.53 (0.47-5.02) |
| **Ice tea** | | | |
| < 2 times month | 1 | 1 | 1 |
| 2xm – 2 times week | 1.00 (0.68-1.46) | 1.02 (0.72-1.45) | 1.19 (0.57-2.48) |
| ≥ 3 times week | 0.83 (0.49-1.41) | 1.30 (0.83-2.03) | 0.86 (0.33-2.23) |
| **Coca-Cola** | | | |
| < 2 times month | 1 | 1 | 1 |
| 2xm – 2 times week | 0.75 (0.52-1.09) | 0.90 (0.64-1.27) | 1.01 (0.48-2.09) |
| ≥ 3 times week | 0.53 (0.28-1.00) | 0.98 (0.59-1.61) | 0.59 (0.21-1.63) |
| **Pizza** | | | |
| < once a month | 1 | 1 | 1 |
| 1 – 2 times month | 0.80 (0.50-1.27) | 0.85 (0.56-1.30) | 1.00 (0.43-2.30) |
| > 2 times month | 0.93 (0.55-1.55) | 1.01 (0.36-1.62) | 0.97 (0.36-2.64) |
| **Hambúrguer** | | | |
| < once a month | 1 | 1 | 1 |
| 1 – 2 times month | 0.84 (0.56-1.25) | 0.821(0.567-1.188) | 1.34 (0.61-2.94) |
| > 2 times month | 0.79 (0.48-1.30) | 0.89 (0.57-1.38) | 0.86 (0.36-2.05) |

[a] OR adjusted to sex, school and Parent's BMI.

## 6.2 – Daily energy intake and meal distribution on obesity and body dissatisfaction in 13 years old adolescents.

**DAILY ENERGY INTAKE AND MEAL DISTRIBUTION ON OBESITY AND BODY DISSATISFACTION IN 13-YEASR OLD ADOLESCENTS**

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**ABSTRACT**

**Aims:** to compare energy intake between two periods of the day and the association of that distribution with obesity and body dissatisfaction in 13-year-old Portuguese adolescents.

**Methods**: a part of the cohort of adolescents born in the year 1990 (13 years old, 57% girls). Evaluation included extensive data collection, comprising two self-administered questionnaires (one completed at home, another at school), and a physical examination performed at school by health professionals that included weight and height measurements to calculate BMI which was define by CDC references. School questionnaires included two questions about body images (Stunkard's silhouettes). Hundred and fifteen students filled a self-administered of 3-non-consecutive-days dietary record – one weekend day and two weekdays.

**Results:** Twenty percent of adolescents were overweight/pre-obese and 10.4% were obese. Forty two percent of adolescents were satisfied with their body image. Concerning eating habits, adolescents' total mean energy intake (TEI) was 2391 (691) calories and they ate more calories after lunch (1328 kcal vs. 1231 kcal, $p$ = 0.055). There were no significant differences between the two periods of the day (before and after lunch) in macro and micronutrients' intake, either in obesity classes, body fat percentage or body image dissatisfaction.

**Conclusion:** we did not find any differences in energy intake in the two periods of the day and obesity in adolescents as well in body dissatisfaction.

## 1 | Introduction

The importance of food in health promotion and disease prevention is well known and will increase the ability to meet nutrient requirements and promote a feeling of wellbeing [1].

Human eating behavior depends on biological, genetic, psychological, social and cultural aspects [2,3,4]. Eating behavior differ from one culture to another, which leads to a various ways of preparing food, different norms of food consumption, time and quantity of meals, food availability influenced their food choices [5] and amount of total energy intake 30.

All over the years many studies tried to explain the regulation of food intake [6], which focus on homeostasis-type models and behavioral factors that influence intake (stomach content and hunger and diurnal rhythms, social facilitation and palatability) [7].

Eating between meals has become part of our culture. Certain aspects of eating behavior, such as the time of day that a meal take place, may have important consequences for weight control [8], so energy intake must be balanced with energy expenditure to maintain body weight since obesity became a major concern.

Adolescence is often considered a critical period and nutritional status has a particular concern [9], as overweight and obesity at this period of life is associated with adult mortality and morbidity.

In Europe [10] 13-year-old boys' BMI was 19.0kg/$m^2$ and 15 years old boys was 20.6 kg/$m^2$, and 13 and 15 years old girls' BMI was 19.4 kg/$m^2$ and 20.5 kg/$m^2$ respectively, so obesity is increasing widely. In Portugal, 29.5% of 7-years old children are overweight and obese and 32.5% are overweight/ obese at 9,5 years [11], 10.2% of 13 years old adolescents are overweight and 16.5% are at risk of overweight [12].

In Portugal, 90.8% students considered themselves as average and 4.6% considered themselves as obese [13]; the obese and overweight adolescents reported a negative attitude toward appearance and wish to change.

In this century, family structure change because women start working out of home and the meal pattern have undefined hours, meals are less elaborated, fast to eat and sometimes people eat alone [14]. Adolescents' eating habits are first influenced by family, friends and mass media. In this phase the body still in development and

the search for the perfect body, sometimes leads to inadequate intake which leads to nutritional unbalances that interfere with normal growth and health condition 6.

Bellisle et al [15] have suggested a possible contribution of daily rhythms of food intake in the development of overweight in children. Some studies describe a "night eating syndrome" which occurs in patients with a "diet depression", in which people have an evening hyperphagia and morning anorexia, suggesting a disturbance in the diurnal pattern of food intake. In his study with children, obese and fat children ate less at breakfast and more at dinner than leaner peers 39.

Halberg et al 33 has suggested that the metabolic efficiency of energy utilization from macronutrients may show circadian variability. Energy intake in the morning after awakening was found to lead to higher weight loss relative to when the same intake occurred in the evening. Bellisle et al [16] reviewed several epidemiological studies about people's usual frequency of eating and body weight loss, but they concluded that there is no evidence that weight loss on hypoenergetic regimens is altered by meal frequency.

During adolescence young people are easily influenced by their peers, TV advertisements, fashion and all kind of changes that occur in the society. Adolescents are often dissatisfied with their body image [17,18,19]. It is common to see adolescents consuming low quality foods and many of them dieting because they want to lose weight.

Our aim is to compare energy intake between two periods of the day: until lunch and after lunch, and the association of that distribution with obesity and body dissatisfaction, in Portuguese adolescents born in the year of 1990.

## 2 | Participants and Methods

Our sample included 115 adolescents, 13-year-old, 66 girls (57.4%), members of the Epidemiological Health Investigation of Teenagers in Porto (EPITeen) [20] cohort. During the assembling of the cohort, the executive boards of Porto schools (27 public and 24 private) were approached and asked to provide students' addresses, as previously reported 66.

The initial evaluation included extensive data collection, comprising two self-administered questionnaires (one completed at home, another at school), and a

physical examination performed at school, between 8 a.m. and 10a.m. by a team of experienced nurses, nutritionists and physicians.

The home questionnaire inquired about demographic, social, behavioral and clinical characteristics of the children and the family. We also sent a food frequency and a physical activity questionnaire. At school, during the research team visit, children answered an additional questionnaire comprising further information on physical activity, smoking, alcohol intake and included questions about body dissatisfaction choosing body images with Stunkard's silhouettes [21]. Body image dissatisfaction was calculated as the difference between current image and desired size.

Anthropometrics measures were obtained with the subject in light indoor clothes and no shoes. Weight was measured using a digital scale – Tanita ® (in kilograms, to the nearest tenth), and height was measured (in centimeters, to the nearest tenth) using a portable stadiometer; adolescents were classified according to the reference percentiles developed by the United States Centers for Disease Control and Prevention [22] to classify obesity classes (normal if < 85$^{th}$ percentile risk o overweight if BMI was between 85$^{Th}$ and 95$^{th}$ percentile, and obese/overweight if BMI > 95$^{th}$ percentile). Parental Body Mass Index (BMI) was calculated as weight (kg) divide by squared height (m$^2$) using self-reported weight and height and classified according to World Health Organization (WHO) [23].

Leisure time activities were classified according to answers to a multiple choice question proposing four subjective intensity categories (mainly sitting, mainly standing, active or very active). Average weekend time spent watching TV, playing computer and reading was recorded and added to compute total time spent in sedentary activities.

The present analyses included 115 adolescents who filled a three non-consecutive days diet record with one weekend day and two week days. We use Food Processor Plus SQL® software to convert foods in nutrients adapted for Portuguese population [24,25]. Participants were asked to write the time of the day at which food and beverage were consumed, quantities of which food or beverage (glasses, cups, spoons) and food preparation (recipes, commercial brands). All the questionnaires were sent to adolescents' home with information of how to fill the questionnaires. The total energy and nutrients intake were calculated by the average of the individual items contribution in three days.

Six meals a day were identified (breakfast, morning snack, lunch, afternoon snack, dinner and evening snack). We divided these meals in two periods – before lunch (included all adolescents that eat more calories until lunch) and after lunch (included all adolescents that eat more calories after lunch). Adolescents with incomplete information for key variables were excluded.

Statistical analysis was performed using the SPSS® version 17.0. Proportions were compared using the Chi-square test. Non parametric tests were applied to compare quantitative variables and a significant level of 0.05 was assumed. To estimate the magnitude of the association of eating snacks and obesity, body dissatisfaction and fat percentage, odds ratios (OR) and 95% confidence intervals were computed using logistic regression.

## 3 | Results

Our sample included 66 girls (57.4%), 81 (70.4%) frequent public school. Around 21.5% of parents had superior education, 15.7% had twelve years of education, 10.4% of parents had nine years of education and 8.7% only frequent primary school. When we analyze parent's BMI we found that 46.1% were pre-obese and 23.5% were obese.

Seventy percent of adolescents were normal weight, 20.0% were overweight/pre-obese and 10% were obese.

Concerning physical activity outside school we found out that 54.8% of our adolescents practice extra physical activity. From adolescents who practice physical activity outside school, 68.3% were normal weight, 20.6% were overweight adolescents and 11.1% were obese. There were no significant differences ($p$ = 0.327) between those who practice physical activity and those did not practice.

The analysis of the 3-non-consecutive-days dietary record, adolescents' total energy mean (sd) intake (TEI) was 2391(91) calories. Protein accounts with 17.4% of kcal, fat intake was 33.8% and carbohydrates were 47.1% of kcal.

Table 1 shows that adolescents' intake between two periods of the day by meal. Mean energy intake was 1231 calories before lunch and 1328 calories after lunch, $p$ = 0.055 which is in the limit of significance. There were not any significant

differences in the two periods of day concerning protein, fat and carbohydrates intake.

Concerning meal contribution to TEI, breakfast accounts with 13% (13.0% normal weight *vs*. 13.2% overweight/obese), 22.4% morning snack (21.2% normal weight *vs*. 25.3% overweight/obese), 31.4% for lunch (30.5% normal weight *vs*. 33.5% overweight/obese), 20.9% afternoon snack (19.9% normal weight *vs*. 23.0% overweight/obese), 29.5% for dinner (28.9% normal weight *vs*. 30.9% overweight/ obese) and 23.6 for evening snack (24.0% normal weight *vs*. 22.9% overweight/obese).

Table 2 shows adolescents' sociodemographic and behavioral characteristics, and there were not any significant differences in the two periods of intake. Boys ate more calories after lunch and girls ate more before lunch; adolescents that frequent public school ate more calories before lunch and adolescents that frequent private schools ate more after lunch ($p$= 0.657). Obese adolescents (34.4%) ate more after lunch and non-obese adolescents ate more before lunch but there are no significant differences ($p$ = 0.304). From those who are satisfied with their body image, 61.4% eat more after lunch.

There were significant differences, p=0.030 in energy intake before and after lunch. Concerning macro and micronutrients intake we did not find any significant differences before and after lunch as shown in table 3.

A higher percentage of overweight adolescents ate more calories after than before lunch (34.4% vs. 25.5%), although non significant differences were found. Also no significant differences were found in intake distribution according to body fat percentage or body dissatisfaction.

Concerning eating habits, 100% adolescents consumed at least 3 meals (breakfast, lunch and dinner), 14.8% ate 4 meals (one snack besides three principal meals), 40.0% ate 5 meals (three principal meals and two more snacks (morning and afternoon snack, or morning and evening snack or afternoon and evening snack) and 45.2% adolescents ate all six meals.

There were no significant differences in normal weight and overweight adolescents concerning frequency of snacks intake (p= 0.506) and body fat percentage as shown in table 4. Adolescents that were dissatisfied with their body image ate 2 or 3 snacks a day than satisfied adolescents (56.5% vs. 43.5%).

## 4 | Discussion

The diurnal distribution of intake has a cultural-specific pattern**:** American students showed a pattern of increasing meal sizes over the day; Dutch students eat small meals during the day and larger meals in the evening; French students eat large meals in the early afternoon [26]. Traditionally, in the American population, as the day progresses average meal size increases [27], eating a large proportion of food energy in the morning could lead to a decrease overall intake and the short-term intake is controlled on the basis of its weight and volume as opposed to its food energy content. Recent data form Australia, United States and Europe show increased self-reported energy intake associated with obesity [28].

Studies using the food dietary technique described that there are substantial and important changes in eating behavior that occur over the course of the day 31. Lennernäs et al suppose that the disinterest of some investigators in circadian energy intake and its effect on metabolism and the lack criterions that define eating episodes as well the few strategies to analyze data, be one of the reasons of the existence of few studies in this area [29].

We want to determine whether meal eating pattern – large morning meals vs. large evening meals – affects changes in body weight but did not find significant differences between the two periods of intake and obesity, body dissatisfaction or fat percent.

In the present study all adolescents ate breakfast so it was not possible to test if there were differences in energy intake through out the day. Different results were found by Castro 31 thus American population ate a large amount in the morning which resulted in lower total energy intake and eating a large amount in the evening result in a higher total intake. He did not found differences between weekdays and weekend days 31. Benton et al [30] found that people that eat breakfast and a small snack in the middle morning reported feeling less hungry at lunch, the larger the caloric intake the less subjects reported hunger. Cho et al [31] found that population from the NHANES III study that skip breakfast have higher mean BMI. Many studies have demonstrated that missing breakfast or other meal has consequences in cognitive performance, mood all through the day [32]. Kant el al [33] in the US found that adolescents had a larger energy intake before 5p.m. in USA. Some studies found that a grater intake in the morning leads to a better weight reduction than the larger intake in the evening 40,[34]. Keim et al 41 conclude

that the meal eating pattern affected body weight and composition changes during weight reduction. These observations suggest that the distribution of daily energy intake may affect energy expenditure, energy storage and therefore body weight.

Even scientific evidence is lacking, reducing nocturnal eating is a weight loss strategy often recommended 41. Loss of fat mass was affected by the order in which subjects received their meal as they found that more weight was lost with the large morning meal pattern compared to the large afternoon meal pattern. In a recent study with normal weight women, BMI and underestimation of food intake are inversely correlated and there were not found associations between food underestimation and percent of body fat. In obese people underestimation of food intake is associated with psychological factors [35]. Another study also demonstrated that there were not positive correlations between BMI and energy intake distribution [36]. Lahti-Koskib et al [37] verified that the intake of complex carbohydrates and weight are inversely correlated. Marti-Henneberg et al [38] have positive correlations between BMI and energy density in all ages men and women did not have any correlations between BMI and energy density.

Bellisle et at 39 found that the traditional large meals of the day (lunch and dinner) represented larger proportions of daily energy intake in fat and obese children and the smaller meals were inversely related to corpulence. In that study overweight children tended to eat less at breakfast and more at dinner than normal and underweight peers. The more caloric meals were lunch an dinner in overweight children and smaller meals were less caloric than in control children. Rolland-Cachera et al [39] also find that there is no significant correlation between food intake and corpulence of children. The obese group had a percent of protein higher in the daily caloric intake than the non-obese . Baecke et al [40] found that thinner adolescents ate more calories than fatter adolescents.

In the present study the more caloric meals were lunch and dinner. Overweight adolescents ate more calories after lunch than before lunch and also ate more calories at morning and afternoon snacks, but normal weight adolescents ate more calories at evening snack.

In our study, 13% of total daily intake is form breakfast, 22% from morning snack, 31% from lunch, 21% from afternoon snack, 29% from dinner and 24% from evening snack. Kearney et al [41] found that dinner had a major contribute to total daily energy intake (35%), follow by lunch (22%), evening snack (14%), breakfast

(13%), afternoon snack (9%) and morning snack (7%). On Winkler et al [42] study dinner accounts with 33% TEI, lunch 29% of TEI, breakfast 17%, morning and afternoon snacks 7% each and 6% at evening snack.

Eating between meals, snacking, has become part of the culture of the industrialized countries. Keim et al 41 studied a 4 meals-day with energy distribution 15% breakfast, 35% lunch and 35% at dinner and 15% evening snack in the AM group and the PM group with a distribution of 15% breakfast, 15% lunch, 35% dinner and 35% evening snack. In Brazil [43] majority of adolescents ate 3 or more times as day, 36.7% had 4 meals a day, 28.8% had 5 meals a day, 21.8% ate 6 times a day and only 9.9% ate 3 times a day.

We found that 52 (45.2%) students eat six times a day, only one eat breakfast, lunch and dinner and 17 students (14.8%) eat three principal meals and one snack, 46 (40%) eat two snacks and 52 (45.2%) eat three snacks a day.

Several studies report that 20% of children skipped breakfast and that was compensated for during the rest of day by snacking. Adolescents of Southern Europe have three main meals (breakfast, lunch and dinner) and one to three snacks or sometimes more [44]. Snacks contribution to energy intake in adolescents varies from 20% to 39% [45]. French students reported 2.7 meals a day and 1.3 snacks (the traditional three meals and one or more snacks) [46]. Snacks differ from meals in size and nutritional content: more carbohydrates, less fat and less protein and they contribute in 18% do total daily intake. Snack occurs at times when hunger feelings are present, but meals bring more energy than snacks so they reduce hunger more . Sixty percent of French 16-17-year-old students snack and 45% children snack 57[,47]. In Denmark and Norway the students bring sandwiches from home and about 80% of students have dinner. Breakfast is skipped by 15% of adolescents; the afternoon snack is similar in energy content to breakfast. A Brazilian study with 17-19 years adolescents conclude that 96,6% of students eat three or more times a day: 36,7% of those eat 4 times/day, 28,8% eat 4 times/day and 21,8% eat 6 times/day and only 9,9% eat only 3 times/day. They also verified a little percentage of obese adolescents because 80% of the students eat at home and most of them work, dispending more energy.

Previous studies suggested that physical appearance and body image may influence perceived health, resulting of a discrepancy between an individual's perceived current body size and perceived ideal body size [48,13]. Several studies

reported that body dissatisfaction is very common and several adolescent reported that they were dieting and want to change something about their bodies [11, 13,14] . Meland et al 13 found that girls are more dissatisfied with their body image: 39% think they are fat, 68% want to change body but 57% said they were not on a current diet. In the present study only 42% adolescents were satisfied with their body image. From those that were dissatisfied with their body image 37% wanted to be thinner and 21% want to be fatter. Dissatisfied adolescents were more obese and snack more.

The limitations of this study include the reliability on self-reported food intake, as obese tend to underreported energy intake. Voss et al [49] found that energy intake is inversely correlated with obesity, but they suppose that many subjects probably underestimated their energy intake. We think that a transversal study will give more results and the little number of adolescents that participated in this study was also a limitation.

Adolescents' body image and body dissatisfaction are complex to measure precisely and result of many outside factors, such as influence of parents, peers, TV and fashion and many times lead to obesity and eating disorders.

Although we did not find significant differences in obese adolescents that eat more calories before and after lunch and did not find any relation between body dissatisfaction and eating habits, we must considered these results to future interventions in adolescence to prevent chronic diseases in adult life.

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## TABLES

**Table 1** – Total energy and macronutrients means (sd) intake by meal.

| | **Before lunch** (1231 kcal) | | | **After lunch** (1328 kcal) | | | All Day |
|---|---|---|---|---|---|---|---|
| | B | MS | L | AS | D | ES | (kcal) |
| Total calories (kcal) | 300 (147) | 191 (174) | 739 (325) | 473 (306) | 692 (251) | 164 (242) | 2391 (691) |
| Protein % | 15 (5) | 7 (7) | 21 (5) | 12 (5) | 21 (6) | 9 (10) | 406 (117) |
| Fat % | 23 (9) | 21 (19) | 36 (7) | 28 (10) | 35 (8) | 14 (16) | 809 (266) |
| Carbohydrates % | 59 (11) | 43 (33) | 41 (10) | 56 (14) | 42 (11) | 37 (33) | 1139 (399) |

B - breakfast, MS – morning snack, L – lunch, AS – afternoon snack, D – dinner, ES – evening snack

**Table 2** – Adolescents' characteristics according to the two defined groups: more calories before or after lunch.

| | **More calories before lunch** | **More calories after lunch** | ***p*** |
|---|---|---|---|
| n (%) | 51 (44.3%) | 64 (55.7%) | |
| **Sex** | | | |
| Female (n = 66) | 33 (64.7%) | 33 (51.6%) | 0.157 |
| Male (n = 49) | 18 (35.3%) | 31 (48.4%) | |
| **School** | | | |
| Public | 37 (72.5%) | 44 (68.8%) | 0.657 |
| Private | 14 (27.5%) | 20 (31.3%) | |
| **Parents' education** | | | |
| < 4 years | 5 (9.8%) | 5 (7.8%) | |
| 5 to 12 years | 40 (51.0%) | 26 (62.5%) | 0.462 |
| > 12 years | 19 (39.2%) | 20 (29.7%) | |
| **Parents' BMI** | | | |
| Normalweight | 19 (37.3%) | 15 (23.4%) | |
| Overweight | 23 (45.1%) | 30 (46.9%) | 0.170 |
| Obese | 9 (17.6%) | 19 (29.7%) | |
| **Sport practice** | | | |
| yes | 30 (41.2%) | 33 (46.9%) | 0.528 |
| no | 21(58.8%) | 30 (51.6%) | |
| **Obesity classes** | | | |
| Normalweight | 38 (74.5%) | 42 (65.6%) | 0.304 |
| Overweight | 13 (25.5%) | 22 (34.4%) | |

**Table 3** – Adolescents macro and micronutrients intake according to the two defined groups.

| Median (25 - 75) | **More calories before lunch** | **More calories after lunch** | ***p*** |
|---|---|---|---|
| TEI (cal) | 2142 (1838-2606) | 2427 (2095-2822) | 0.030 |
| Protein (g) | 94 (85-107) | 97 (89-117) | 0.770 |
| Fat (g) | 80 (68-100) | 93 (74-107) | 0.073 |
| Carbohydrates (g) | 256 (203-306) | 283 (235-334) | 0.073 |
| Fat sat (g) | 25 (18-31) | 27 (21-33) | 0.504 |
| Fiber (g) | 13 (9-17) | 13 (11-18) | 0.504 |
| vitA_re (g) | 879 (629-1421) | 786 (629-1344) | 0.934 |
| vit_C (g) | 59 (36-99) | 63 (42-91) | 0.770 |
| vit_D (g) | 2 (1-3) | 1 (1-3) | 0.113 |
| Folate (g) | 360 (249-589) | 300 (192-427) | 0.113 |
| Ca (g) | 875 (579-1073) | 885 (611-1109) | 0.934 |
| Mg (g) | 256 (207-300) | 264 (211-313) | 0.504 |
| Na (g) | 2127 (1599-3408) | 2389 (1842-2848) | 0.297 |

**Table 4** – Prevalence of adolescents at risk according to obesity classes, body fat percentage and body dissatisfaction, adjusted for sex.

| n (%) | **More calories before lunch** 51 (44.3%) | **More calories after lunch** 64 (55.7%) | **OR (IC 95%)** |
|---|---|---|---|
| **Obesity Classes** | | | |
| Normal weight | 38 (74.5%) | 42 (65.6%) | 1 |
| Overweight | 13 (25.5%) | 22 (34.4%) | 1.58 (0.69-3.59) |
| **Body Fat percentage** | | | |
| 1st tertile | 16 (31.4%) | 22 (34.4%) | 1 |
| 2nd tertile | 17 (33.3%) | 21 (32.8%) | 1.26 (0.45-3.53) |
| 3rd tertile | 18 (35.3%) | 21 (32.8%) | 1.38 (0.45-4.23) |
| **Body dissatisfaction** | | | |
| Satisfied | 20 (45.5%) | 22 (38.6%) | 1 |
| Dissatisfied | 34 (54.5%) | 35 (61.4%) | 1.33 (0.59-3.01) |

**Table 5 –** Number of snacks according to obesity, body dissatisfaction and body fat percentage.

| **Meals** Mean (dp) | **One snack** | **Two snacks** | **Three snacks** | ***p*** |
|---|---|---|---|---|
| **Calories (Kcal)** n (%) | 2268 (805) | 2322 (694) | 2492 (647) | 0.215 |
| **Obesity Classes** | | | | |
| Normal weight | 12 (70.6%) | 34 (73.9%) | 34 (65.4%) | 0.506 |
| Overweight | 5 (29.4%) | 12 (26.1%) | 18 (34.6%) | |
| **Body dissatisfaction** | | | | |
| Satisfied | 5 (35.7%) | 17 (41.5%) | 20 (43.5%) | 0.628 |
| Dissatisfied | 9 (64.3%) | 24 (58.5%) | 26 (56.5%) | |
| **Body Fat percentage** | | | | |
| 1st tertile | 7 (41.2%) | 15 (32.6%) | 16 (30.8%) | |
| 2 nd tertile | 4 (23.5%) | 15 (32.6%) | 19 (36.5%) | 0.787 |
| 3 rd tertile | 6 (35.3%) | 16 (34.8%) | 17 (32.7%) | |

# 7 | CONCLUSION

Adolescents' body image and body dissatisfaction are complex to measure precisely and result of many outside factors.

A high percentage of adolescents (62.7%) reported being dissatisfied with their body image and more desired to be thinner, even normal weight adolescents.

Normal weight adolescents who desired to be thinner ate less croissants and bakery, chocolate snacks, coca-cola and other sodas.

Obese adolescents who desired to be thinner drink more sodas.

Adolescents' energy intake in the two periods of the day is in the limit of significance; also no significantly differences were found in energy intake in the two periods of the day and obesity in adolescents as well in body dissatisfaction.

Besides these results, we must consider them to future interventions in a bigger population and to be more proactive in interventions with adolescents to prevent chronic diseases in adult life. School health services are a potential partner in planning, implementing and evaluating health promotion strategies within the school system.

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