Nutritional Status and Sugary Drinks Consumption of in Children from 6 to 9 years

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ABSTRACT

Introduction: Obesity is considered one of the most serious public health problems today. It has been linked to increased consumption of sugar from food and in particular from sugary drinks. However, the contribution of its consumption to the increased prevalence of overweight in children is still controversial.

Objective: To relate the nutritional status with the frequency of consumption of sugary drinks in children from 6 to 9 years.

Methods: Cross-sectional observational study in 267 children aged 6 to 9 years from four primary schools in Barcarena. Socioeconomic data were obtained by a questionnaire applied to carers. Nutritional status was assessed by BMI according to WHO and CDC criteria. The frequency of consumption of sugary drinks was assessed by a qualitative food frequency questionnaire. The association between nutritional status and the frequency of consumption of sugary drinks was assessed by logistic regression. Statistical significance was considered when p < 0.05.

Results: According to WHO criteria, 58% had normal weight, 24% pre-obesity and 18% obesity. The results obtained according to the CDC indicated 61.8% normal weight, 19.5% pre-obesity and 17.3% obesity. The prevalence of overweight was higher in boys. Belonging to the consumption class of iced tea, nectar and fruit juice “up to once a week” seems to favor the risk of obesity (OR = 1.95; p = 0.098).

Conclusion: There is a tendency to associate the frequency of consumption of sugary drinks with nutritional status of children, being more likely that they are overweight when they belong to the consumption class of iced tea, nectar and fruit juice “until once a week”.

KEYWORDS: Children; Obesity; Sugary drinks

INTRODUCTION

Obesity is considered one of the most serious public health problems today. The World Health Organization (WHO) has considered it as the 21st century epidemic Currie et al. [1]. The WHO defines obesity as a disease in which excess body fat accumulates to affect health. However, the amount, body distribution and health consequences vary among obese individuals. Their classification...
in children is difficult as height and body composition change constantly and occur at different times in each child's development. Childhood obesity is estimated to be the predominant pediatric disease worldwide. The main reasons for raising so many concerns in the medical and scientific community are due to its association with the development of other diseases, as well as the strong link between childhood and adolescent obesity and its persistence into adulthood (WHO). Ding [2] report that in the first decade of this century, about 28% of school age children and 12% of preschool age children had pre-obesity or obesity in most developed countries. At the beginning of the 21st century, Portugal was one of the countries where overweight was among the highest in Europe, with about 31.5% of Portuguese children either pre-obese or obese Padez et al. [3].

When compared with other European countries, the same can be observed in the considered countries of southern Europe, Italy, Spain and Greece Rito et al. [4]. More recent data point to a decrease in the prevalence of obesity in Portugal when compared to previous years Oliveira et al. [5]; Graça [6]. These results are in line with those obtained in other European countries, such as Denmark and England, where there were trends for decreasing pre-obesity and obesity Morgen et al. [7]; Van Jaarsveld [8]. Several studies relate childhood obesity to the growth in dietary sugar consumption, particularly sugary beverages (BA) DeBoer [9]. The WHO admits that the consumption of BA may contribute to the epidemic Johnson et al. [10], since the consumption of these beverages increases the total energy intake Slining [11]. There is no consensual definition of the term sugary drinks. The general term includes, in this range of beverages, soft drinks (carbonated or non-carbonated soft drinks), fruit juices, lemonades and added sugar tea Malik [12]. Some authors also include energy and sports drinks in this definition Bleich et al. [13]; Schulze [14]; Popkin [15]. Beverages like 100% fruit juices, lemonades and added sugar tea Malik [12]. Some authors also include energy and sports drinks in this definition Bleich et al. [13]; Schulze [14]; Popkin [15]. Beverages like 100% juice are not included in soft drinks definition and may be part of a healthy diet but their consumption should be limit. There are also other drinks that are not recommended as part of a healthy diet in early childhood (plant milks/non-dairy beverages, flavoured milk, toddler milk, sugar-sweetened beverages, beverages with LCS, and caffeinated beverages) Lott et al. [16]. Although milk and alternative milk drinks have other nutrients that differentiate them from other sugary drinks, the addition of sugar increases their energy value without obtaining nutritional benefits CDC [17].

A 2012 study in nine European countries assessed adolescent drinking as drinking water, followed by sugary drinks and fruit juices Duffey et al. [18]. In the pediatric population, the increase in the intake of these drinks has been predominant in children aged 6 to 11 years, which puts them at greater risk for the future development of metabolic or cardiovascular diseases Kosova [19]. Thus, there is no consensus on the contribution of the consumption of sugary drinks to increase the prevalence of pre-obesity and obesity in children. Studies suggest a correlation between consumption of these drinks and long-term weight gain Pan et al. [20], while others find no association Hasnain et al. [21]. Although the prevalence of overweight children in Portugal has been decreasing Graça [6], obesity remains a public health problem that needs to be addressed. Information on the consumption of sugary drinks in school-age children remains inadequate and its relationship with nutritional status needs to be more explored in Portugal Katzmanzyk et al. [22]; Machado-Rodrigues et al. [23]. In this sense, the present work aims to relate the nutritional status with the frequency of consumption of sugary drinks in children from 6 to 9 years.

METHODOLOGY

Study Design

A cross-sectional observational epidemiological study of 267 children aged 6 to 9 years attending one of the four primary schools (Leceia, Queluz de Baixo, Tercena and Velejas) in the parish from Barcarena.

Ethical Considerations

All research work has been developed in accordance with the considerations contained in the Declaration of Helsinki WMA [24]. Initially, the principals of the various school groupings were contacted by letter explaining the study and requesting permission to conduct it. Subsequently, upon their consent, the school coordinators were contacted through which all the caretakers of the randomly selected pupils were sent detailed information of the project and informed consent to allow their children participation. Data collection was performed only after confirming the signature of informed and informed consent of the child’s guardians and the child’s consent at the time of the anthropometric assessment.

Socioeconomic Data

They were obtained through the development and application of a closed response self-completion questionnaire sent to the caregivers of the participating children. With the application of this questionnaire it was possible to obtain information regarding parents’ education, as well as the monthly income of the household.

Anthropometric Data

Anthropometric measurements were performed according to international standard procedures WHO and calibrated equipment. The anthropometric data measured included weight and height. Weight was measured in kilograms to an accuracy of 100 g. Height was recorded to an accuracy of 1 mm using a stadiometer. To assess nutritional status, BMI was calculated according to WHO criteria. BMI was assessed using the WHO growth curves for children aged 5 to 19 years (WHO, 2007). The WHO criterion defining pre-obesity was used when the BMI to age ratio z + 1 standard deviation (SD) and <= 2 SD from the baseline median, which is a percentile value of at least 85 and a BMI ≥ 25kg/m² in adulthood. Using the same criterion, obesity was defined as BMI ratio values for age ≥ 2D of the reference median, equivalent to a percentile value of at least 97 and a BMI of ≥ 30kg/m² at 19 years. In turn, underweight was defined for BMI ratio values for age ≤ -2D of the reference median WHO. The assessment of nutritional status was also performed by calculating BMI according to the CDC criteria, using the growth curves for age and the corresponding percentiles. Pre-obesity was defined when the percentile value was equivalent to the 85th percentile to below the 95th percentile; obesity was defined when the percentile value was at least 95; and low weight was defined when the percentile value was lower than the 5th percentile CDC [25].

Food Data

The collection of data on the frequency of consumption of sugary drinks was performed by applying a self-filling non-quantitative food frequency questionnaire. The questionnaire was sent to the parents of the participating children. In order to prepare the questionnaire, information was collected on all sugary drinks available for sale in four large areas in the municipality of Oeiras. Subsequently, the information was grouped to include sugary drinks with similar characteristics. The frequency of consumption
The children’s nutritional status, assessed according to the WHO and CDC criteria, is described in Table 2. According to the WHO criteria, no child was underweight, 58% had normal weight, 24% pre-obesity and 18% obesity, with the prevalence of pre-obesity and obesity being higher in boys than in girls. As for the CDC criteria, 1.5% of children were underweight, 61.8% normal weight, 19.5% pre-obesity and 17.3% obesity; it was observed that the prevalence of pre-obesity and obesity were higher in boys and that, in relation to low weight, they were mostly girls. Although there are differences between the two sexes, they are not statistically relevant (p = 0.05). The Table 3 shows the socioeconomic data of the children by school attended. There is a relative balance with regard to factors of educational qualifications of parents and household income in Queluz, Tercena and Valejas. The school in Leceia has the lowest values in terms of educational qualifications of parents and also in monthly income. As for the mother’s educational level, the school in Tercena has the highest percentage with regard to higher education (55%), while the school with the lowest percentage is Leceia (18.9%). The same happens when we look at the father’s education level; the highest percentage belongs to the school of Tercena (42.6%) and the lowest to Leceia (15.2%). An analysis of family income shows that the Queluz school stands out as the one in which parents have higher incomes, which contradicts the data regarding the level of education of parents who have higher values both in Tercena and in Valejas. As for the houses with the lowest income, Leceia has the lowest values. The first two levels reach 58.8%. A much higher percentage than Queluz (19.6%), Tercena (28.8%) and Valejas (28.0%). Despite the differences observed between schools in relation to these factors, only in the monthly income was a statistically significant difference (p = 0.001).

Table 2: Assessment of children’s nutritional status.

| Nutritional status | Children          |
|--------------------|-------------------|
|                    | Girls (n=120)     | Boys (n=147) | Total (n = 267) |
| Low weight         |                   |              |                |
| CDC                | 3 (1.1)           | 1 (0.4)      | 4 (1.5)        |
| WHO                | 0 (0.0)           | 0 (0.0)      | 0 (0.0)        |
| Normal weight      |                   |              |                |
| CDC                | 71 (26.6)         | 94 (35.2)    | 165 (61.8)     |
| WHO                | 70 (26.2)         | 85 (31.8)    | 155 (58.0)     |
| Pre-obesity        |                   |              |                |
| CDC                | 25 (9.4)          | 27 (10.1)    | 52 (19.5)      |
| WHO                | 29 (10.9)         | 35 (13.1)    | 64 (24.0)      |
| Obesity            |                   |              |                |
| CDC                | 21 (7.9)          | 25 (9.4)     | 46 (17.3)      |
| WHO                | 21 (7.9)          | 27 (10.1)    | 48 (18.0)      |

Note: The results are expressed in number of individuals (percentage). CDC, Center for Disease and Control Prevention; WHO, World Health Organization.
Table 3: Socio-economic data of the children according to the school attended.

| Socio-Economic Data       | School          |          |          |          |          |
|---------------------------|-----------------|----------|----------|----------|----------|
|                           | Leceia          | Queluz   | Tercena  | Valejas  | Total    |
| Mother's Educational Qualifications |         |          |          |          |          |
| 1st Cycle EB              | 0 (0.0)         | 1 (1.0)  | 1 (1.5)  | 0 (0.0)  | 2 (0.77) |
| 2nd EB Cycle              | 4 (10.8)        | 7 (7.1)  | 1 (1.5)  | 3 (5.3)  | 15 (5.83)|
| 3rd EB Cycle              | 10 (27.0)       | 9 (9.1)  | 11 (16.9)| 9 (16.1) | 39 (15.2)|
| High School               | 16 (43.3)       | 42 (42.4)| 19 (29.3)| 21 (37.5)| 98 (38.1)|
| University education      | 7 (18.9)        | 40 (40.4)| 33 (50.8)| 23 (41.1)| 103 (40.1)|
| Total                     | 37 (12.2)       | 99 (38.5)| 65 (25.5)| 56 (21.8)| 257      |

| Literary Qualifications of the Father |          |          |          |          |          |
|---------------------------------------|----------|----------|----------|----------|----------|
| 1st Cycle EB                          | 1 (3.0)  | 2 (2.0)  | 2 (3.3)  | 0 (0.0)  | 5 (2.10) |
| 2nd EB Cycle                          | 4 (12.1) | 8 (8.1)  | 3 (4.9)  | 2 (3.9)  | 17 (6.90)|
| 3rd EB Cycle                          | 11 (33.3)| 22 (22.2)| 13 (21.3)| 11 (21.1)| 57 (23.3)|
| High School                           | 12 (36.4)| 41 (41.4)| 17 (27.9)| 20 (38.5)| 90 (36.7)|
| University education                  | 5 (15.2) | 26 (26.3)| 26 (42.6)| 19 (36.5)| 76 (31.0)|
| Total                                  | 33 (13.5)| 99 (40.4)| 61 (24.9)| 52 (21.2)| 245      |

| Monthly Income                       |          |          |          |          |          |
|--------------------------------------|----------|----------|----------|----------|----------|
| <500€                                 | 4 (11.8) | 0 (0.0)  | 7 (11.9) | 2 (4.0)  | 13 (5.60)|
| 500-1000€                             | 16 (47.0)| 18 (19.6)| 10 (16.9)| 12 (24.0)| 56 (23.8)|
| 1000-2000€                            | 6 (17.7) | 43 (46.7)| 25 (42.4)| 20 (40.0)| 94 (40.0)|
| >2000€                                | 8 (23.5) | 31 (33.7)| 17 (28.8)| 16 (32.0)| 72 (30.6)|
| Total                                 | 34 (14.5)| 92 (39.1)| 59 (25.1)| 50 (21.3)| 235      |

Note: The results are expressed in number of individuals (percentage). EB, Basic Education.

Table 4: Association between nutritional status and socioeconomic data.

| Socio-Economic Data       | Nutritional Status |          |          |          |          |
|---------------------------|--------------------|----------|----------|----------|----------|
|                           | Normal Weight      | Over Weight|         |          |          |
| Mother's Educational Qualifications |         |          |          |          |          |
| Basic education           | 34 (13.2)          | 22 (8.6)  |           |          |          |
| High school               | 56 (21.8)          | 42 (16.3) |           |          |          |
| University education      | 62 (24.1)          | 41 (16.0) |           |          |          |
| Total                     | 152 (59.1)         | 105 (40.9)|           |          |          |

| Father's Educational Qualifications |         |          |          |          |          |
|-------------------------------------|----------|----------|----------|----------|----------|
| Basic education                     | 43 (17.6)| 36 (14.7)|           |          |          |
| High school                         | 51 (20.8)| 39 (15.9)|           |          |          |
| University education                | 52 (21.2)| 24 (9.80)|           |          |          |
| Total                               | 146 (59.6)| 99 (40.4)|           |          |          |

| Monthly Income |          |          |          |          |          |
|----------------|----------|----------|----------|----------|----------|
| <1000€         | 38 (16.2)| 31 (13.2)|           |          |          |
| 1000-2000€     | 54 (23.0)| 40 (17.0)|           |          |          |
| >2000€         | 47 (20.0)| 25 (10.6)|           |          |          |
| Total          | 139 (59.2)| 96 (40.8)|           |          |          |

Note: The results are expressed in number of individuals (percentage). Overweight (includes pre-obesity and obesity).
Table 5: Frequency of consumption of sugary drinks.

| Sugary Drinks         | Consumption Frequency |
|-----------------------|-----------------------|
|                       | Never or <1 time per Month | Up to 1 time per Week | More than once a Week |
| Coke or Pepsi         | 175 (65.5)             | 70 (26.2)              | 11 (4.1)              |
| Iced Tea              | 85 (31.8)              | 102 (38.2)             | 71 (26.6)             |
| Gaseous               | 230 (86.1)             | 17 (6.4)               | 3 (1.1)               |
| Soda with gas         | 210 (78.7)             | 36 (13.5)              | 7 (2.6)               |
| Refrigerant without gas | 166 (62.2)           | 50 (18.7)              | 36 (13.5)             |
| Energetic             | 247 (92.5)             | -                      | -                     |
| Sporty                | 238 (89.1)             | -                      | 1 (0.4)               |
| Fruit concentrate     | 198 (74.2)             | 35 (13.1)              | 12 (4.5)              |
| Fruit nectar          | 79 (29.6)              | 116 (43.5)             | 54 (20.2)             |
| Fruit juice           | 86 (32.2)              | 115 (43.1)             | 48 (18.0)             |
| Powdered refreshment  | 226 (84.6)             | 8 (3.0)                | 9 (3.4)               |
| Milk with chocolate   | 55 (20.6)              | 59 (22.1)              | 141 (52.8)            |
| Alternative to milk   | 223 (83.5)             | 10 (3.8)               | 6 (2.3)               |

Note: The results are expressed as number of individuals (percentage).

The Table 5, referring to the frequency of consumption of sugary drinks, reveals a very high frequency of consumption of chocolate milk and iced tea. With regard to the consumption of energy or sports drinks, the value is residual with only one child admitting consumption. The figures for nectars and fruit juices show similar numbers in terms of frequency, recognizing that “up to 1 time a week” and “more than 1 time a week” are practiced by more than 60% of children. As for drinks such as carbonated, carbonated or non-carbonated soft drinks, Coca-Cola or Pepsi, fruit concentrate, powdered soft drinks and drinks alternative to milk, the frequency appears as low. In relation to drinks such as iced tea and chocolate milk, they are evenly distributed in terms of frequency of consumption in the three groups presented. The big difference is that iced tea has a percentage of 26.6% of consumption “more than once a week”, compared with the chocolate milk with 52.8% for the same frequency of consumption. To associate each sugary drink with a specific consumption frequency, a hierarchical group analysis was carried out (Table 6), where the number of classes was three and where the aggregation method was the connection between groups and the measure used was the Euclidean distance squared. Drinks were grouped into classes taking into account children’s drinking behavior, with “never less than once a month” in class 1, “up to once a week” in class 2 and “more than once a week” in class 3. It was found that the drinks referring to class 1 were Coca-cola or Pepsi, carbonated, soft drinks (with and without gas), energy and sports drinks, fruit concentrate, powdered soft drinks and drinks alternative to milk. Those that were part of class 2 were iced tea, nectar and fruit juice. Finally, only chocolate milk belonged to class 3. After the association between each drink and the children’s consumption behaviour was made according to frequency, an association was made between their nutritional status and the classes through a binary logistic regression. Although the results are not statistically significant (p > 0.005), a trend can be observed between belonging to one of the classes and being overweight. As shown in Table 6, belonging to class 1 is associated with a protective effect against excess weight (OR = 0.40) whereas belonging to class 2 has the opposite effect (OR = 1.95). In relation to class 3, belonging to this class has a non-significant result.

Table 6: Association of excess weight with the frequency of consumption of sugary drinks.

| Variable | Odds Ratio | p      |
|----------|------------|--------|
| Class 1* | 0.4        | 0.347  |
| Class 2**| 1.95       | 0.098  |
| Class 3***| 0.91       | 0.815  |

Note: *Frequency of consumption “Never or less than once a month” associated with Coca-Cola or Pepsi, carbonated, soft drinks (with and without gas), energy drink, sports drink, fruit concentrate, powdered drink and drinks alternative to milk.

**Frequency of consumption “Up to once a week” associated with iced tea, nectar and fruit juice.

***Frequency of consumption “More than once a week” associated with chocolate milk.

**DISCUSSION**

The primary school phase is a time of growth in the emotional, cognitive and social areas. In this phase, children gain greater autonomy, become more responsible, acquire new routines and habits. In addition, it is a period of growth prior to puberty, which is essential to predict overweight in adulthood Whitaker et al. [26]; Williams [27]. The prevalence of overweight in children is an alarming public health problem that has been highlighted in recent decades. It is increasingly common to have children with pre-obesity and obesity, which causes an increased risk of complications related to nutritional status in adulthood Dietz [28]. The percentage of overweight in children varies greatly between countries and regions. In Europe, countries such as Greece, Italy, Spain, Malta and Portugal are those with the highest levels of overweight Wijnhoven et al. [29]. The prevalence of overweight (including obesity) observed in the children in this sample was worrying, making a total of 42%, a number much higher than the last results made at the national level (31.6%) Rito & Graça [6]. As for differences between boys and girls,
both the prevalence of pre-obesity and obesity were higher in boys, which can also be seen in other studies Bracale et al. [30]; Mocanu [31]; Pizarro [32]. Several studies have attributed this worsening in the prevalence of overweight to the increased consumption of sugary drinks Grimes et al. [33]; Pan et al. [34]; Papandreu et al. [35], although others have not found a connection Johnson et al. [10]. Due to the lack of a consensual definition of the term sugary drinks, there are disparities between studies regarding the drinks that are evaluated, which can influence the results.

A study carried out in 187 countries describes the countries of Central and Latin America as the biggest consumers of sugary drinks, while Asian countries, namely China, North Korea and Azerbaijan, have the lowest consumption levels. Despite the target population being adults, an age gradient was found, with younger adults being the biggest consumers of sugary drinks. The authors justify these results with the advertising and marketing behind the business of this product Singh et al. [36], aimed mainly at younger populations, in which children with very young ages, such as those in the present study, can also be inserted. Furthermore, it was reported that in Portugal, adolescents aged about 15 years old consumed soft drinks less frequently than children aged 11 Currie et al. [1]. Although the results of this study are not statistically significant, there was a trend with regard to consumption behaviour related to certain drinks, and the prevalence of overweight. It was found that beverages such as soft drinks, among others, belonged to class 1, with a lower frequency of consumption, which provided a protective effect on children being overweight. On the other hand, iced tea and fruit juices and nectars are associated with a frequency of weekly consumption (class 2), which seems to be associated with the group of children who are overweight. This consumption trend is not in agreement with the results observed in a study carried out in Canada, where the highest prevalence of overweight was associated with the group of drinks in which soft drinks (with and without gas), Coca-cola or Pepsi and soda were included Danyluk et al. [37]. However, our results are similar to a study carried out in 2013, in which children also consumed greater quantities of fruit juices compared to soft drinks Han [38], as well as other study carried out with children aged 2 to 5 years O'Connor [39].

A possible explanation for the frequency of fruit and fruit consumption, such as iced tea, is higher than the frequency of drinks (with the exception of chocolate milk) is information regarding the effects of excessive consumption of carbonated drinks (such as carbonated, Coca-cola or Pepsi and gas sodas) is widely publicized by the scientific community in the population, while information is displayed in drinks as sums and nectars of less affected fruits. According to our knowledge, only another study was carried out in Portugal with the aim of verifying an association between the high consumption of sugary drinks and the prevalence of overweight in children. No association was found, which can be explained by the inclusion of all different types of sugary drinks in a group and the fact that portions of each drink ingested were not used to show any effect on the child’s weight Valente et al. [40]. The present study has some limitations: a) application of the questionnaire using the self-filling method; b) lack of information about the participants’ eating habits and lifestyles; c) geographic location of schools, as they are located in one of the municipalities with the greatest purchasing power in Portugal and where a large part of the inhabitants have a high degree of literacy. Thus, it is important that further studies are carried out in different regions of Portugal so that it is possible to better understand and characterize the possible relationship between the consumption of sugary and non-recommended beverages and the prevalence of excess weight in Portuguese children. The increase in the consumption of these drinks in children aged 6 to 9 years has been described worldwide Dereia et al. [41], but the results are not yet conclusive, perhaps due to the different types of drinks included in this concept and/or the use of different criteria used To assess nutritional status and consumption of sugary drinks [42-43].

CONCLUSION

The prevalence of overweight (pre-obesity and obesity) was high in the sample studied. Although there were no statistically significant differences, it was possible to observe a trend regarding the consumption of sugary drinks and the nutritional status of children, with a greater probability of being overweight when they belong to the consumption class of iced tea, nectars and juice. Fruit up to once a week. The results of this study are contrary to the beliefs of the majority of the population that only considers carbonated non-alcoholic drinks, namely soft drinks, carbonated and Coca-cola or Pepsi, among others, as sugary drinks that carry a greater risk for the prevalence of excess of weight. This study highlights the importance of assessing the nutritional status of school-age children and the need to develop programs and strategies for the prevention and treatment of overweight in children, as well as food education programs that inform parents and children about the effects excessive consumption of sugary drinks.

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