



## **Breakfast Habits and Family Structure Associated with Overweight and Obesity in General Basic Students, Ecuador**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Author NRS conceived the study, wrote the protocol, initiated the manuscript and compiled the final version for submission. Authors AG, GG, AC, PS, VL and VE collected the data and participated in the analyses and editing of the manuscript. Author OF wrote the protocol and was de manager. MU and MM directed the statistical analyses and participated in editing of the manuscript. All authors have read and agreed for publication of this manuscript.*

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### **ABSTRACT**

**Aim:** This study aimed to characterise the consumption and type of breakfast associated with overweight and obesity in students of the Quito Metropolitan area in the academic year 2010-2011.

**Study Design:** Cross sectional study.

**Place and Duration of Study:** Quito municipal schools during the academic year 2010-2011.

**Methodology:** We surveyed 6964 students (3254 males, 3710 females; age range 9 -

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17 years), previously classified by their body mass index. The self-administered questionnaire, completed in class time asked about breakfast habits, physical activity, type and stage of family.

**Results:** 6939 students (99.6%) answered the question about usually eating breakfast. Of these, 5.4% (CI<sub>95%</sub> 4.87-5.94) reported not eating breakfast, this response being given by 6.8% of the girls (CI<sub>95%</sub> 6.0-7.6) and 3.7% of the boys (CI<sub>95%</sub> 3.1-4.4). Not eating breakfast was more common among the students aged 15 years (11.9% CI<sub>95%</sub> 8.2-15.7), 16 years (19.5% CI<sub>95%</sub> 12.8-26.3) and 17 years (17.9% CI<sub>95%</sub> 10.3-26.9). The crude OR for weight excess and not breakfasting 1.44 (CI<sub>95%</sub> 1.16-1.80) was strengthened after adjustment by age, sex, family type, family stage, sedentarism and health zone: OR 1.54 (CI<sub>95%</sub> 1.16-2.05). There was no significant association between eating a non-recommended breakfast and weight excess when adjusted by the mentioned variables.

**Conclusion:** Not eating breakfast is associated with overweight and obesity, this problem being enhanced in girls who skipped breakfast twice as much as boys. Also, students living in launch pad families eat breakfast more often and suffer less from excess weight.

*Keywords: Breakfast; overweight; obesity; students; family; Ecuador.*

## 1. INTRODUCTION

Childhood and adolescence are characterised by rapid changes and is a crucial phase for biological modifications such as increase in stature, weight, body fat, appearance of secondary sexual traits, and the beginning of puberty in both sexes [1]. Food is one of the main exogenous factors which influence growth and development in this stage of life [2]. Breakfast provides 20 to 25% of daily energy needs [3, 4], and it is recommended to consume milk and milk products, cereals and fruit, and recommended that it should be eaten with the family [5].

Breakfast is the first meal of the day, taken before starting daily activities, in the first two hours after waking up, usually before 10 AM [6]. Several studies have issued recommendations to encourage eating breakfast since it is associated with diet quality and proper body weight [7]. The World Health Organization (WHO) estimates that around 10% of children aged 5 to 17 years in the world are overweight or obese [8], and these conditions persist into adulthood with consequences such as endothelial dysfunction and future chronic diseases such as catastrophic cardio vascular events [9, 10]. In Latin America a significant increase in overweight and obesity among children and teenagers has been described, particularly among the population living in poverty [11]. The family and school are instances of settings in which pupils can acquire or reinforce inappropriate eating habits and sedentary behaviours. Children and teenagers in school develop relationships characterized by narrow circles of friends assuming common identities even to the extent of with whom they identify and it seems that there are associations between having a high body mass index (BMI), and interacting with friends with high BMI [12].

At the end of 2010 a study was conducted in 21 municipal schools of the metropolitan area of Quito in order to determine the prevalence, based on WHO criteria, of overweight (BMI>P<sub>85</sub> <P<sub>97</sub>) and obesity (BMI>P<sub>97</sub>) [13]. The prevalence of overweight found in the 6964 participants aged from 9 to 17 years was 18.7%, (CI<sub>95%</sub> = 17.8 -19.6) and of obesity was

7.9% (CI<sub>95%</sub> = 7.3 – 8.5); in most ages overweight and obesity was more common in boys than in girls. 62.3% of students reported living in a family nuclear (consisting of parents and children) and 60.5% said that their families were in the "teenager" stage (families whose first born child was now a teenager) [14].

These results were the subject of a preliminary report submitted to the local government in order to take into account the data reflected so far [15, 16]. In the same study, we examined possible factors for weight excess: breakfast, sedentarism and family structure, always considering the setting of the project's development and intervention: school health and family medicine. The objective of this work was to characterise the consumption patterns and type of breakfast associated with overweight and obesity in these students. Other associated factors such as family, physical activity and sedentarism were also considered.

## **2. MATERIALS AND METHODS**

### **2.1 Study Design and Setting**

Between October and December 2010 a cross-sectional, census-style study was conducted in all municipal schools of Quito Metropolitan District. The schools which participated included the nine schools traditionally offering general basic education (EGB) which are located in the urban area and accounts for 82% of the city's population and 12 schools which in the academic year 2010-2011 switched to offering EGB instead of the simpler, more artisanal style of education which is mainly found in the rural part of Quito, an area with a weaker territorial structure due to its socioeconomic characteristics [17]. These 21 schools all teach both boys and girls. Medical care is provided to the schools through primary health care teams, coordinated by municipal health units corresponding to the health zones: South (4 schools), Central (two schools) and North (three schools); for the purposes of the present study the schools which have recently incorporated EGB have been grouped in the so-called "Transitional zone" (12 schools) and this is located in the transition area between urban and rural surroundings of Quito.

The questionnaire was self-administered and completed in class time with the presence of the teacher and two survey physicians. 6964 students were surveyed and there were no failures in returning the questionnaires. For the variables, proportions of missing data ranged from 1.1% in the variable asking with whom they lived, through 9.7% for the age of their oldest sibling, to 27.8% in the question on whether they drank coffee with breakfast.

### **2.2 Study Size**

All students present on the day of the study were included subject to compliance with the conditions of informed consent on the part of the family and the student himself/herself.

### **2.3 Variables**

Weight status: This variable had three categories following WHO criteria for each age and sex based on the 85th and 97th BMI percentiles (BMI > P97 equal Obesity, P85<BMI<P97 Overweight, the rest "normal"). In order to analyse the overall phenomenon of excess weight, we created a dichotomised variable representing "excess weight" by combining the original categories of 'overweight' and 'obese'; that is categories Obesity and Overweight equal "yes" and the rest equal "no" [14].

## 2.4 Breakfast

The students answered the question “*What do you usually have for breakfast?*” This is a multiple response question listing the possible components of a breakfast: milk and derivatives, fruit, cereal, eggs, chocolate, tea, coffee, ham or bacon, meat or fish. The possible answers are daily or very frequently / not eaten. The last component of this question is “*I never have breakfast*”. The question measures the student’s perception of the composition of his/her usual breakfast [18].

## 2.5 Recommended Breakfast

Using multiple correspondence analyses two clusters were created where each individual was grouped by proximity to the pattern that characterizes them. The first cluster was characterized by those categories that are considered daily consumption (“recommended”: milk and derivatives, fruits and cereals) and a second cluster including students distinguished by not having a frequent intake of these foods although they reported intake of other foods. Therefore this variable had two categories, yes and no. To gather this information, the survey was based on studies published in Hispanic communities. [18].

## 2.6 Physical Activity/Sedentarism

This variable was measured by means of the “*Instituto de Nutrición y Tecnología de los Alimentos*”- INTA scale ranging from 0 to 10, with 0 corresponding to an absence of physical activity. This scale has been developed to be applied in Latin-American countries especially for the countries in the Andean area. In order to classify the students this variable was categorized to form a new variable named sedentarism with three categories: sedentary, (INTA 4), active ( 5 INTA 6) and very active (INTA 7) [19].

## 2.7 Family Type

Variable with 5 categories, nuclear (parents and children), single-parent (father or mother and children), extended (parents, children and relatives), reconstituted (a family in which at least one of the partners is acting as a step-parent. This definition includes families with or without custody of children) and family-equivalent (a group of unrelated individuals living together and functioning as a family) [20].

## 2.8 Family Stage

Variable with three categories, with children at school (children aged up to 12 years old), with adolescent members and launch pad (the first born child has left home). This classification was defined based on the age of the first born child at the time of the survey. [21].

## 2.9 Health Zone

We included this variable as a possible confounding factor representing social and economic level: south, central, north and transitional (the poorest zone).

## 2.10 Statistical Methods

All categorical variables were expressed in terms of percentages, and comparisons between groups were made using prevalence ratios (PR) and odds ratio (OR). Median contrasts were performed by Mann-Whitney U and Kruskal-Wallis tests. Bivariate associations were described using contingency tables ( $D^2$ , p value), showing prevalence or odds ratios and their confidence intervals only in those cases where the null hypothesis was rejected. To achieve a description of consumption patterns in the minimum possible number of categories Multiple Correspondence Analysis [22, 23] was performed with the SPAD program [24], which allows using the large number of variables needed to define types of breakfast, while avoiding the global alpha risk associated to multiple bivariate tests, creating a new space of variables as a linear combination of the previous categories and defining a cluster analyses of cases with the minimum of independent groups.

In order to detect possible confounders in the associations of interest for the objectives of the present study, two types of analysis were conducted. First a stratified analysis in which OR values are compared with the crude OR values obtained, checking whether their confidence intervals overlap. Second, using logistic regression modelling by the ENTER method, we again analyzed the OR relating excess weight with the fact of eating breakfast or not, adjusted for age, sex, health zone, recommended breakfast, family type and stage, physical activity, in this case only for those subjects who declared they usually ate breakfast. The data were analysed using the SPSS v18 statistical package [25].

## 3. RESULTS

### 3.1 Demographic Details and Family Characteristics

Ages ranged from 9 to 17 years, the largest group being that aged 13 years (22.8%) while the smallest corresponded to those aged 17(1.1%). There were 3254 males (46.7%). 60.5% of children declared living in families where the eldest child was now an adolescent, and 62.3% that they lived in a nuclear family.

### 3.2 Breakfast

6939 students (99.6%) answered the question regarding what they typically consumed for breakfast. Of these responses, 5.4% (CI<sub>95%</sub> 4.87-5.94) reported not eating breakfast, this response being given by 6.8% of the girls (CI<sub>95%</sub> 6.0-7.6) and 3.7% of the boys (CI<sub>95%</sub> 3.1-4.4). Not eating breakfast was more common in students among the cohorts aged 15 years (11.9% CI<sub>95%</sub> 8.2-15.7), 16 years (19.5% CI<sub>95%</sub> 12.8-26.3) and 17 years (17.9% CI<sub>95%</sub> 10.3-26.9) compared to the cohorts aged nine (3.9% CI<sub>95%</sub> 0.8-7.8), 10 (2.3% CI<sub>95%</sub> 1.4-3.2), 11 (1.2% CI<sub>95%</sub> 0.6-1.9), 12 (4.5% CI<sub>95%</sub> 3.4-5.7) and 13 (5.8% CI<sub>95%</sub> 4.7-7.0) years, with differences being significant. Among the students who reported breakfasting, 71.8% (CI<sub>95%</sub> 70.7-72.9) indicated that their breakfast included cereals, 71.0% (CI<sub>95%</sub> 70.7-72.9) that it included milk and derivatives and 66.9% (CI<sub>95%</sub> 65.8-68.0) that it included fruit.

In terms of the classification by health zones, differences were clearly significant ( $\chi^2 = 108$ , d.f. = 3,  $p < 0.001$ ). 11.2% (CI<sub>95%</sub> 9.5-13.0) of students who attended schools in the transitional zone reported not eating breakfast compared to 5.4% (CI<sub>95%</sub> 4.3-6.5) in the northern zone and 3.6% (CI<sub>95%</sub> 2.9-4.4) in the central zone or to 3.5% (CI<sub>95%</sub> 2.7-4.3) of the south zone. In terms of gender, frequency of not consuming breakfast was more severe in

the transitional zone where 13.8% (CI<sub>95%</sub> 11.5-16.2) of girls did not eat breakfast versus 6.1% (CI<sub>95%</sub> 5.3-6.9) for boys.

### **3.2.1 Breakfasting and type and stage of family**

Whether students ate breakfast or not was significantly associated with both family stage ( $\chi^2 = 25.8$ , d.f. = 3,  $p < 0.001$ ) and family type ( $\chi^2 = 28$ , d.f. = 4,  $p < 0.001$ ). The proportion of children who did not usually eat breakfast varied with family characteristics, with non-breakfast consumption occurring in 5.4% (CI<sub>95%</sub> 3.2-8.0) of children living in families where the eldest child was now an adolescent compared to 7.9% of children living in launch pad families (CI<sub>95%</sub> 5.2-10.9), 4.4% of children living in nuclear families (CI<sub>95%</sub> 2.4-6.5), 7.1% of children living in single-parent families (CI<sub>95%</sub> 4.6-9.8), and 5.5% of children living in extended families (CI<sub>95%</sub> 3.3-7.9).

### **3.2.2 Breakfasting and overweight - obesity**

Among those children who did not have regularly breakfast, 24.5% (CI<sub>95%</sub> 20.2-29.0) were classified as overweight and 9.4% (CI<sub>95%</sub> 6.5-12.4) as obese. Taking children below the 85<sup>th</sup> percentile as the reference category and comparing those who did not usually have breakfast with those who did, yielded a PR for overweight of 1.33 (CI<sub>95%</sub> 1.12-1.57) (OR 1.5 CI<sub>95%</sub> 1.2-1.9) and 1.21 (CI<sub>95%</sub> 1.08-1.35) (OR 1.4 CI<sub>95%</sub> 0.9-1.9) in the case of obesity, the latter not being significant. When these two weight categories were combined into one category, 'excess weight', the resulting PR was 1.29 (CI<sub>95%</sub> 1.11-1.50) (OR 1.4 CI<sub>95%</sub> 1.2-1.8), implying that there were 29% more cases of excess weight among the children who did not usually have breakfast compared to those who did.

### **3.2.3 Recommended breakfast and overweight - obesity**

Using multiple correspondence analyses two clusters were identified allowing each individual to be assigned by proximity to the pattern characterising them. This analysis was carried out in those children who declared breakfasting, and the first of the clusters obtained corresponded to those who ate those foods recommended for breakfast, namely milk and derivatives, fruit and cereals (59.0%); the other group corresponded to those children who did not often eat these foods although they did eat other kinds of food such as eggs, ham, fish, etc. (41.0%) The association between the two categories and excess weight led to an OR 1.05 (CI<sub>95%</sub> 0.93-1.19).

### **3.2.4 Physical activity/sedentarism (test INTA) and breakfast**

The median of physical activity variable was 4, range 0 to 9. Girls had a median of 4 and boys of 5 ( $p < 0.001$ ). Also, the sedentarism variable shows that 57.9% of the students were sedentary, 34% active and 8.1% very active. There were differences in terms of gender: 67.0% of girls were sedentary, 27.8% were active and 5.2% were very active, while the corresponding figures for boys were 47.3%, 41.2% and 11.5%, respectively.

There were no differences in INTA score between students declaring they usually had breakfast and those who didn't (median 4). With respect to the classification of sedentarism there was no significant association with breakfasting ( $D^2 = 2.05$ ,  $p = 0.359$ ).

### **3.2.5 Physical activity/sedentarism (Test INTA) and weight status**

There were non-statistical differences between INTA medians and weight status ( $p=0.07$ ). When this variable was recorded in terms of sedentarism, no significant association with the variable weight excess.

### **3.3 Stratified Analysis**

The association between overweight, obesity and excess weight and not eating breakfast is described by strata defined for each variable and category in Table 1. Results are presented as the PR and OR with the corresponding confidence intervals by strata.

### **3.4 Multivariate logistic regression models**

The crude OR between whether breakfast was eaten or not and excess weight was 1.44 ( $CI_{95\%}$  1.16-1.80) with usually consumption of breakfast serving as the reference. Adjustment by age, sex, family type, family stage and health zone yielded: OR 1.82 ( $CI_{95\%}$  1.43-2.31). When the variable sedentarism was considered as a possible confounding factor in the previous model, the value of the OR changed to 1.54 ( $CI_{95\%}$  1.16-2.05).

In the case of students who usually have breakfast, the association between excess weight and non-recommended breakfast had a non-significant crude OR of 1.05 ( $CI_{95\%}$  0.91-1.26). Nevertheless this association became significant after adjusting for the previously mentioned variables, adjusted OR 1.27 ( $CI_{95\%}$  1.13-1.44). Including physical activity yielded an OR of 1.01 ( $CI_{95\%}$  0.88-1.14).

## **4. DISCUSSION**

The percentage of students in this study reporting not regularly eating breakfast is less, and its confidence interval smaller, than that found by other authors in a review of 47 studies reporting associations between eating breakfast and adequate nutritional status, body weight and academic performance in children and adolescents, highlighting the fact that skipping breakfast is highly prevalent in other continents, ranging from 10% to 30% depending on age, sex, population, and definition [26]. Unfortunately comparisons between countries may run the risk of committing ecological fallacies.

The presentation of this non-recommended habit was more common among girls than boys. Students in our cohorts aged 15, 16 and 17 years declared not eating breakfast in greater proportions than the other cohorts. We have also observed that not eating breakfast increases the risk of overweight, obesity and excess weight, and also that the association was stronger in girls than boys. Breakfast consumption has been described as a protective factor associated with obesity [27]. The consequences of skipping breakfast have been studied by other groups which analysed the relationships of eating breakfast with visceral fat and insulin indices, concluding that skipping breakfast was associated with an increase in visceral fat independently of age, sex, Tanner Scale stage, body fat, and daily energy intake [28].

**Table 1. Stratified prevalence ratios\* and OR of overweight, obesity and excess weight associated with eating breakfast**

Variables	N	Overweight	Obesity	Excess weight	Stratified OR (CI <sub>95%</sub> )
		PR (CI <sub>95%</sub> )	PR (CI <sub>95%</sub> )	PR (CI <sub>95%</sub> )	
<b>Sex</b>					
Male	3253	1.07	1.43	1.20	1.30 (0.89-1.91)
Female	3708	1.50(1.21-1.86)	1.26(1.11-1.42)	1.44(1.18-1.75)	1.66 (1.26-2.19)
<b>Age</b>					
9	129		1.83	0.97	0.95 (0.15-5.91)
10	990	1.67(1.10-2.53)	1.85(1.12-3.04)	1.74(1.11-2.72)	1.41 (1.17-6.21)
11	1122	1.91	0.79	1.55	2.02 (0.67-6.06)
12	1326	1.27(1.06-1.52)	2.01(1.20-3.37)	1.50(1.07-2.11)	1.86 (1.09-3.16)
13	1585	1.62(1.44-2.29)	1.18(1.05-1.33)	1.49(1.10-2.02)	1.78 (1.14-2.77)
14	1303	1.52(1.06-2.19)	1.20(1.41-1.02)	1.46(1.04-2.04)	1.64 (1.05-2.56)
15	295	1.40	0.83	1.29	1.37(0.59-3.21)
16	136	1.86	0.81	1.54	1.70 (0.59-4.90)
17	79		6.90(1.93-24.69)	0.91	0.89 (0.22-3.62)
<b>Family stage</b>					
With children at school	1129	1.38	1.62	1.47	1.87 (0.97-3.61)
With adolescent members	3803	1.44(1.17-1.78)	1.43(1.16-1.76)	1.43(1.16-1.76)	1.66 (1.23-2.23)
Launch pad	1355	1.21	0.93	1.13	1.18 (0.78-1.82)
<b>Family type</b>					
Nuclear	4289	1.46(1.15-1.85)	1.16(1.06-1.27)	1.38(1.12-1.71)	1.58(1.17-2.15)
Single-parent	1237	1.13	1.60	1.26	1.40(0.88-2.22)
Extended	926	1.22	1.13	1.19	1.29(0.71-2.35)
Reconstituted	287	0.78	-	0.57	0.51(0.15-1.75)
Family-equivalent	148	1.54	1.77	1.61	2.02(0.67-6.10)
<b>Health zone</b>					
Central	2168	1.41	1.08	1.31	1.50(0.94-2.39)
North	1642	1.23	1.25	1.23	1.34(0.85-2.12)
South	1894	1.29	1.59	1.38	1.58(0.94-2.64)
Transitional	1260	1.52(1.12-2.05)	1.34(1.09-1.65)	1.47(1.11-1.94)	1.69(1.15-2.49)

\*Confidence intervals are not given for prevalence ratios not significantly different from 1.

Stratified OR: association between excess weight and not eating breakfast, by strata.



Children living in nuclear families and families with adolescent members ate breakfast less often and had more excess weight according to the crude OR by strata but this effect disappeared after adjustment for sex, age and health zone. The family stage and type may be a risk factor, probably acting through the development of more behaviour reinforced by the whole group of the same life cycle. On the other hand, however, adapting existing weight management programs to include a focus on family engagement in the early stages of treatment may help to improve participation in family-based obesity interventions [29].

With respect to health zones, students living in the central zone whose family type was 'family-equivalent' had more excess weight, in contrast to reconstituted families in the northern zone and families with adolescent members in the southern zone, where a protective effect was observed, i.e. that they breakfasted more often and had less excess weight, in terms of both crude and adjusted OR values.

The pattern of breakfasting mainly consists in the usual consumption of all those foods forming part of the recommended basic breakfast. Not eating breakfast was associated with overweight and obesity. Among students who usually ate breakfast, whether it was of a recommended type or not was not associated with these variables.

Families with adolescent members and nuclear families have significant association, although at the time it is done the multivariate model these actions on the act of presenting weight excess and skipping breakfast are no longer significant. This study was done in a context of family medicine and is necessary to consider the family involvement and the community characteristics for planning intervention actions [30, 31].

#### **4.1 Limitations**

The reason why we find overweight and obesity among students who not eat breakfast could be due to other factors not analysed in the present study, among which the following may be highlighted: genetic factors, co-morbidity and levels of food intake, among others. Other limitations, such as the questionnaire having been self-administered and lack of any information provided by the family which would permit contrasting it, as well as the fact that respecting the confidentiality of the information and children's identities meant we did not have sufficient information to correct for the effect of siblings being present in the study.

#### **5. CONCLUSION**

The results therefore, and despite the limitations mentioned, provide evidence for the importance of breakfast among students, a gender phenomenon and family stage effect being present. The fact of whether their breakfast was of the recommended type or not did not show any association with regard to excesses of weight.

#### **CONSENT**

All authors declare that 'written informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images.

## **ETHICAL APPROVAL**

The baseline work was approved by a team formed for this purpose. Delegates from the Secretaries of Health and Education of the Municipality of Quito and the Academy participated. The protocol was submitted and approved in General Assembly of representatives of parents, students and teachers. Furthermore, prior to the implementation of the survey, a document explaining the objectives of the study was delivered to the families of the students and they returned it signed and with the explicit statement of participation for parents and students completed.

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## **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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