

Study of Factors Associated with Overweight among Pupils Aged 6 to 18 in Bamako Commune II in 2018

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Abstract

Introduction: In sub-Saharan Africa, very little data on child overweight are available because the various actions relating to nutrition and public health have focused on default malnutrition and food security problems. The objective of this work is to study the factors associated with overweight among pupils aged 6 to 18 years in the commune II of Bamako in 2018.

Methodology: This was a cross-sectional and analytical study conducted in November 2018 among pupils aged 6 to 18 in Bamako commune II. A two-stage survey was carried out at school level and then in classes. Three questionnaires were administered (pupils, school officials and parents). Data entry was done with Epi Info 3.5.3 software and descriptive analysis and regression with R 3.4.4 software.

Results: A total of 400 pupils aged 6 to 18 were studied, 78% of whom were normal weight, 10.75% overweight and 4% obese. The pupils, 52.25% used the vehicle for the home-to-school journey; 61.75% faced a TV screen every day; 24.75% ate in front of the screen more than 3 times a week; 33% had eaten breakfast more than 3 times a week. In our sample, 31.75% consumed a sugary drink more than 3 times per week and 07.5% took fast food more than 3 times per week; 25.5% had not consumed fruits and vegetables per day; 64.5% took sandwiches as snacks; 70.2% practiced Physical Education and sports sessions and 64.75% remained seated during break times. On the family environment, only 195 files were usable, i.e. 67.70%. Thus, 20.5% of the pupils had a birth weight greater than 4 kg and 94.90% were breastfed for more than 6 months. Among parents, 48.7% of fathers were overweight and 36.9% university level; 46.1% of mothers were overweight, 05.6% uneducated, 55.4% housewives. At the school level, 50% had a canteen, playing fields/areas. In the multivariate analysis, the factors significantly associated with overweight were female gender (ORaj = 3.97 [1.03-14.97]), vehicle use for the home-to-school journey (ORaj = 2.09 [1.01-4.35]), consumption of food in front of the television and or the computer (ORaj = 3.83 [1.01-14.57]) and the irregularity of the practice of physical education and sports at school (ORaj = 4.28 [1.08-16.96]).

Conclusion: The identification of factors associated with overweight makes it possible to detect children at risk very early in childhood. It would also be interesting to include in the children's school curriculum, health education topics, which promote good lifestyle habits, especially food, from an early age.

Keywords: Associated factors; Overweight; pupils; Bamako; Mali

Introduction

The World Health Organization (WHO) defines malnutrition as deficiencies, excesses or imbalances in a person's energy and/or nutritional intake. It covers 2 major groups of conditions. The first is malnutrition and deficiencies or micronutrient deficiencies (lack of essential vitamins and minerals). The other includes overweight, obesity [1]. The frequency of overweight is increasing very rapidly, especially in children, thus becoming a major public health problem on a global scale. Being overweight is a major risk factor for cardiovascular disease, and can lead to joint, respiratory, metabolic, endocrine or even orthopedic problems. These diseases not only lead to a lower quality of life due to their chronic nature, but they also lead to serious complications and premature death. Beyond the somatic consequences, it can lead to many psychosocial disorders. Overweight in children also has a significant risk of persisting into adulthood.

According to the International Obesity Task Force (IOTF) report, one in ten children in the world is overweight, i.e. 155 million children, of whom approximately 30 to 45 million are considered obese. In Northern Europe, overweight is 10-20% while in Southern Europe it is 20-35% [2]. In sub-Saharan Africa, very little data on child

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overweight is available because the various actions relating to nutrition and public health have focused on default malnutrition and food security problems. Mali does not seem to be spared by the phenomenon of childhood overweight, the prevalence of which is on the rise. In Mali, 2% of children are overweight. It is in the regions of Ségou (4%), Mopti (3%) and Kayes (3%) that the proportions of overweight or obese children are the highest [3].

Few studies have focused on overweight and obesity in children in schools, however, in 2014 a study was carried out on overweight and obesity in the general population aged 5 to 19 in Bamako urban area [4]. Given the lack of existing epidemiological data, it appeared necessary to carry out a study whose objective is to study the factors associated with overweight in pupils aged 6 to 18 years in the commune II of Bamako in 2018.

Study framework

Mali, a Sahelian country located in the heart of West Africa, is divided into ten administrative regions. The capital Bamako was established as a district and divided into six municipalities by the ordinance of August 18, 1978 modified by the law of February 198220 headed by mayors. It extends from west to east over 22 km and from north to south over 12 km, for an area of 267 km².

Commune II of Bamako, limited to the east by the backwater of Korofina, to the west by the foot of the hill of Point G, to the north by the northern limit of the District and to the south by the bed of the Niger River, covers an area of 16.81 km² and has a population of approximately 185,000. The commune has thirteen neighborhoods and is home to 80.00% of Mali's industries.

Health coverage in commune II is provided by a Reference Health Center (RefHC), six Community Health Centers (COMHS), an Inter-Company Medical Center (ICMC), an evangelical health center and a mutual health center all held by doctors. Commune II records the highest number (56) of private health structures and 30 pharmacies in Bamako. The staff is made up of 21 general practitioners, two surgeons, an anesthetist, five gynecologists, a pediatrician, an odontostomatology surgeon, 56 midwives and 22 state nurses.

In Bamako, basic education is supervised by two teaching academies (left bank and right bank). Commune II of Bamako is located at the level of the left bank teaching academy. It has two Pedagogical Animation Centers (PAC): Bozola and Hippodrome. At the level of these two PACs, there are 235 establishments, including 46 for secondary education for a workforce of 205,700 pupils, predominantly female (52.80%). School medicine is essentially preventive with only fifty years of sports fields and canteens. The sale of food around for other schools that do not have canteens without real quality control is a problem for good food hygiene rules.

Methodology

Type and period of study: A quantitative descriptive and analytical study was carried out from November 5 to 16, 2018.

Study population: The population was made up of pupils aged 6 to 18 in Bamako Commune II, the parents of these pupils and the heads of the targeted schools.

Sampling: The sample size was calculated by the Schwartz formula ($N = Z\alpha^2 P[1-P] / i^2$) for a prevalence (**P**) of 50%, with

a reduced deviation (**Z α**) of 1.96 for $\alpha=5\%$ and a precision (**i**) of 0.05. Thus the calculated size N was 384, taking into account the refusal rate and for more power, the size was increased to a minimum of 400 individuals.

A two-stage survey was carried out. For the **first degree**, a random draw was made among all the primary, secondary, private and public educational establishments. Thus four establishments were selected, including 2 at the primary level (1 public and 1 private) and 2 at the secondary level (1 public and 1 private). For the **second degree**, a draw was made at the level of the classes of the selected establishments. The study involved 100 pupils at each selected school. For the family environment, a questionnaire was sent to the parents of each selected child.

Data collected: The information collected has been grouped by theme: For the pupils: biological characteristics; nutritional status; lifestyle habits, eating habits and sports habits. Among the parents, were asked: The birth weight and the duration of breastfeeding of the student by consulting their birth record, the profession, education and nutritional status of the parents. For the school: the condition, the availability of equipment, the existence of sports fields, canteens and the programming of Physical Education and Sports (PES) in the timetable of the pupils.

Operational definition of variables:

- ② **Body Mass Index (BMI):** is calculated by dividing the weight (kg) by the height (m) squared or Weight/Height^2 (kg/m²).
- ② To determine **overweight** two methods were used :
 - Method of the International Obesity Task Force (IOTF) in children under 18, taking into account the weight, height, sex and age of the child. We calculate the IMS of each child and we project it on the curve (on the ordinate) in relation to the age (on the abscissa) to find the corresponding point on the curve for girls (in pink) or on the curve for boys (in blue). The area where the dot is located determines the nutritional status of the child: **Thinness** (if BMI below the percentile IOTF-17); **Normal corpulence** (if BMI between the percentile IOTF-17 and the percentile IOTF-25); **Overweight** (not obese) (if BMI between the percentile IOTF-25 and the percentile IOTF-30); **Obesity** (if BMI above percentile IOTF-30)
 - WHO method, in adults (parents of pupils), by placing the IMS of each parent in a class corresponding to a type of nutritional status: **Thinness** (if BMI < 18.5); **Normal corpulence** (if BMI between 18.5 and 25); **Overweight** (if BMI between 25 and 30); **Obesity** (if BMI > 30).

Data entry and analysis: The entry and analysis was done using the Epi Info 3.5.3 software and the R software. Frequency calculations were made for the categorical variables. Means, standard deviations and extremes were calculated for quantitative variables.

Variable crossings (bivariate analysis) are carried out to illustrate certain concerns formulated in the objectives, and linked to the search for factors associated with overweight. The Khi 2 test, Fisher's test, as well as the T test were used according to their conditions with an alpha risk of 5%. The study of the normality of the distributions was done with the Shapiro Wilks test, the distribution being considered normal for a p value less than 0.05

[5]. Bartlett's test will make it possible to study the homogeneity of variances, with distributions deemed to be homogeneous for a p value greater than 0.05. The odds ratio (OR) surrounded by its confidence interval (CI) made it possible to establish and quantify the strength, direction and significance of the link.

To take into account the confounding factors, a multivariate analysis is made, using a simple logistic regression model, following a step-by-step descending strategy, taking into account in the initial model all the variables whose p-value is less than 0.25 in the bivariate analysis [6,7].

The comparison of the models was performed by the likelihood ratio test with a top-down procedure [8]. Thus the variables are removed one by one until no improvement of the model is found. The relevance of the model was studied by the test of Hosmer and Lemeshow. The measure of association was the adjusted odds ratio and its confidence interval was 95% [9].

Ethical considerations: At the level of each establishment, the objectives and the interest of the study were explained to the director with the presentation of the authorization of investigation delivered by the academy of Bamako of the left bank. The study data were confidential and kept in a secure place. Selected pupils cannot be identified in the results. Their name will not appear on any document. The informed consent of the pupil, principal or head of school was obtained before the interview. Thus, participation was completely voluntary. No form of motivation or financial or material compensation was given to the participants. All provisions have been made in compliance with law n° 2008-12 of January 25, 2008 on personal data of Senegal.

Results

Biologically, among the 400 pupils studied, 78% had a normal weight against 07.25% underweight, 10.75% overweight and 04% obese. In total, at least 14.75% of pupils (n=59) were overweight (Table I, Annex). They were 61.50% female and 46.80% were under 15 years old. The average age was 13.89 ± 2.83 with extremes of 08 and 18 years. Age and sex had no statistically significant link with overweight (Table 2, Annex).

By lifestyle: Pupils using a vehicle to get to school were 2.14 times more likely to be overweight (19.1%) than those not using a vehicle (9.9%) with BI=[1.19 - 3.84]. In addition, pupils using a screen (18.2%) had 2.21 times greater risk of being overweight than the others (9.2%) children not using a screen with a BI = [1.16 - 4.18] (Table 2, Annex).

About the **food habits:** Pupils who had breakfast had 0.49 times greater tendency to be overweight (10.1%) compared to those who did not (18.5%) with a CI= [0.27 - 0.89]. In other words, pupils who ate breakfast had 1/0.49 or 2.04 times more chance of not being overweight than those who did not eat breakfast with a CI = [1.12-3.70]. Eating breakfast was a protective factor against overweight in pupils (p=0.01 and OR= 0.49 CI= [0.27 - 0.89]). Pupils consuming snack drinks were 2.06 times more likely to be overweight (23.5%) than those who do not consume snack drinks (13%) with a CI = [1, 08-3.94]. Pupils who consumed sugary drinks were 2.49 times more likely to be overweight (20.4%) than non-consumers of sugary drinks (09.3%) with a CI= [1.38-4.48]. Pupils consuming fast foods were 2.01 times more likely to be overweight (22.8%) than those who did not (12.8%) with a CI= [1.08 -3.74].

On the other hand, food consumption in front of television/ computer, snacks intake at school, sweets purchase, fruits and vegetables consumption per day did not have a statistically significant link with overweight (Table 2, Annex).

Regarding **sports habits**, the practice of physical activity during Physical Education and Sports (PES) sessions, during break time, and outside of school have no statistically significant link with overweight (Table 2, Annex).

Concerning the school environment of the pupils, overweight was linked to the existence of sports fields and canteens within the school (p=0.03). Students with playgrounds and canteens within the school were 1.83 times more likely to be overweight (18.5%) than other pupils with no canteens within the school (11%) with a CI = [1.03 - 3.24] (Table 2, Annex).

Considering the **family environment**, 288 files were collected from parents, i.e. 72% participation rate and only 195 files were usable, i.e. 67.70%. The variables studied such as the birth weight of the pupil, the nutritional status, the education and the profession of the pupil's mother do not have a statistically significant link with overweight. Furthermore, the pupil's breastfeeding time, the nutritional status, the education and the profession of the pupil's father do not have a statistically significant link with overweight (Table 3, Annex).

NB: In the context of commune II of Bamako, the risk factors correlated with the onset of overweight, in the **bivariate analysis** were: vehicle use (p=0.009), screen use (p=0.01), failure to eat breakfast (p=0.01), consumption of snacks / drinks (p=0.02), consumption of fast foods (p=0.02) and the existence of sports grounds and school canteens at their school (p=0.03). These variables will be studied in the multivariate analysis to control for possible confounding factors.

Multivariate analysis

Significant variables and those with a p-value less than 0.25 in the bivariate analysis will be included in the multivariate analysis model to control for possible confounding factors. **After multivariate analysis**, the factors associated with overweight independently and significantly were female sex p=0.02 (ORaj = 3.97 [1.03-14.97]), vehicle use for the journey home to school p=0.04 (ORaj = 2.09 [1.01- 4.35]), the consumption of food in front of the television and/or the computer p=0.04 (ORaj = 3.83 [1.01-14.57]) and the irregularity of the practice of physical education and sports at school p=0.03 (ORaj = 4.28 [1.08-16.96]) (Table 4, annex)

In Commune II of Bamako, the profile of a pupil aged 6 to 18 likely to be overweight is that of **the female sex, using a vehicle for the journey home to school, consuming food in front of their television or their computer and being irregular in practicing physical education and sports (EPS) at school.**

Discussion

On nutritional status

Overweight seems to be on the rise in commune II of Bamako, as confirmed by the results of this study. Among the 400 pupils studied, 78% had a normal weight against 07.25% underweight, 10.75% overweight and 04% obese. In total, at least 14.75% of pupils (n=59) were overweight. The study conducted by the WHO

specifies that the phenomenon of overweight has remained stable for several years in rich countries, but is increasing in low-income countries. In South Africa, Egypt or Mexico, for example, the proportion of obese girls has risen to more than 20% in 40 years [10]. There is a wide variety of prevalence rates between regions and countries: the prevalence of overweight in Africa and Asia is on average below 5% and above 20% in America and Europe. In South Africa, the prevalence of overweight among adolescents and young adults aged 13 to 19 less than 20% in 2002 has risen to almost 26% in 2008 [8].

The result of our study is different from that of S Regaieg et al in Tunisia in Sfax in 2011 which was 6.30% for overweight and 2.40% for obesity [11]. It is also different from that of Bâ HO et al whose sample from the first survey based on the WHO STEP approach and conducted in the district of Bamako where the risk of overweight (5.50%), the overweight (2.60%) and obesity (0.30%) were found [4]. And that of Togo by K.E.Djadou et al in 2008 at the Protestant college of Lomé where the prevalence of obesity among pupils was 1.72% that of overweight 2.86% [12]. And that of the Ivory Coast in 2010 carried out by I.K.E.Kramoh et al where the prevalence of obesity was 5%, overweight 4%, thinness 39%, thin 25% and normals were 27% [13].

This result is similar to that in Oran by Mourad Raiah et al in 2011 where the prevalence of overweight including obesity was 13.1% including 10% of overweight children and 3.1% of obese children [14]; from that of Marrakech carried out by SEBBANI M et al in 2011 where the prevalence of overweight was 12.20% and obesity 5.40% [15] and that of the state of Benue in Nigeria in 2012 by Musa DI et al where the prevalence of overweight and obesity are 9.7% and 1.8% respectively [16].

This could be explained by the fact that our study was carried out among pupils living in urban areas and targeting those from 06 to 18 years old.

On Biology

The ages of the children ranged from 8 to 18 years old. Being overweight in childhood increases the risk of being obese in adulthood, since more than half of obese children at age 6 will remain so in adulthood [17].

The female sex was predominant with 61.50% with a sex ratio of 1.59 in favor of girls. This result is comparable to that of I.K.E.Kramoh et al in Ivory Coast with a female predominance of 58% and that of Bâ H.O et al in Bamako in Mali with 55.69% girls [4,13]. It is different from that of S Regaieg et al in Tunisia in Sfax where the predominance is male with 51.14% [11].

In our study, the univariate analysis showed that overweight had no statistically significant link with the sex or the age of the pupils despite a female predominance of 17.50% overweight among girls and 10.40% for boys. But in the multivariate analysis, there is a statistically significant link between overweight and female gender $p=0.02$ (ORaj = 3.97 [1.03-14.97]).

Women are much more often overweight (36%) than men (14%) [8]. The prevalence of overweight was 8% and that of obesity was 1%. Girls were significantly more affected by overweight (10.7% girls versus 5% boys) and obesity (1.5% girls versus 0.4% boys) in Lubumbashi, Democratic Republic of Congo [18].

This result is comparable to that of Musa DI et al in Nigeria where the prevalence of overweight was higher in girls (20.3%) than in boys (16.2%) [16]; with also that of Mourad Raiah et al in Oran where the prevalence of overweight including obesity was 13.1% (16.4% in girls versus 10% in boys) [14].

On lifestyle

Good lifestyle habits are enshrined in the WHO Global Strategy on diet, physical activity and health [19]. For the home-to-school journey a vehicle was used by 52.25% of the pupils in our study, the analysis showed that being overweight was linked to the use of a vehicle for the home-to-school journey ($p=0.009$ and OR=2, 14 [1.19 – 3.84]) and also in multivariate analysis ($p = 0.01$ and ORaj = 2.09 [1.16-3.77]). This result was slightly different from that of S Regaieg et al in Tunisia in Sfax where the way the children went to school, i.e. on foot or by bicycle versus by vehicle had no link to overweight ($p = 0.083$) [11].

Children were face to a screen every day in 61.75% of cases. Overweight is also linked to screen use ($p=0.01$ and OR=2.21 [1.16 – 4.18]). The prevalence of overweight and obesity were significantly higher among pupils who watched television for more than 4 hours a day on rest days (OR = 4.9 [2.68-9.1] and $p = 0.001$). Time spent on playing video games and time spent in front of the computer significantly influenced children's weight. Indeed, the frequency of overweight was higher among those who played video games or stayed in front of the computer for more than 2 hours during rest days (OR= 2.58 [1.24-5.37] and $p = 0.009$) and one hour per day on school days (OR= 3.34 [1.58-7.01] and $p = 0.001$), according to S Regaieg et al in Tunisia in Sfax [11].

In our study, the analysis showed that overweight was also linked to breakfast intake ($p=0.01$ and OR=0.49 [0.27 – 0.89]). This result is similar to that of S Regaieg et al in Tunisia in Sfax where the analysis of eating habits allowed us to deduce that taking more than two snacks per day was significantly associated with overweight (OR= 2.74 [1.53-4.92] and $p < 0.001$) [11].

It is different from that of Mourad Raiah et al in Oran where no statistically significant link is found in the eating habits of children with the exception of eating breakfast which is statistically associated with the corpulence of children. Overweight children are more likely to never eat breakfast (15.1% versus 8.9%; $p < 0.001$) [14].

Overweight is linked to the consumption of snack drinks ($p=0.02$ and OR=2.06 [1.08-3.94]). It is linked to the consumption of sugary drinks ($p=0.001$) OR=2.49 [1.38 – 4.48]. Giving infants energy-dense foods high in fats, sugars and salt is one of the major contributors to childhood overweight. The aggressive marketing of energy foods and drinks to children and families further exacerbates it [20].

Traditional diets in Africa are based on cereals, roots and tubers, few animal products, foods with a high fiber content and a low proportion of lipids. These diets, often limited in quantity and not very diversified, are gradually replaced by more abundant and varied diets when the average income rises. There is talk of a westernization of food, which is approaching the composition of the diets of industrialized countries. This phenomenon is called the "nutritional transition" [21,22].

In our study, 70.20% practiced physical education and sports sessions. Among the children 64.75% remained seated during break times, 46.20% practiced football as a sport outside of school. According to the literature, being overweight further reduces children's opportunities to participate in collective physical activities. They then become even less physically active, hence the risk of subsequent entanglement [20].

The analysis showed that the variables studied such as physical activity during Physical Education and Sports (EPS) sessions, during break time, and outside of school have no statistically significant link with the occurrence of overweight. This result is similar to that of Mourad Raiah et al in Oran concerning the practice of sports activity where the difference is not significant between overweight children and those of the reference group [14].

For the WHO, "the problem lies not only in the behavior of children but also, increasingly, in social and economic development as well as in the policies implemented in the fields of agriculture, transport, urban planning, the environment, the preparation, distribution and marketing of food, without forgetting education" [20].

On the family environment (Parents)

In our study, the analysis showed that the variables on the family environment studied (N=195) such as birth weight, breastfeeding time of the child, Body Mass Index (BMI) of the father and of the mother, the education of the mother and the father, the profession of the mother and the father have no statistically significant link to the occurrence of overweight.

Thus, 20.5% of the pupils in our study had a birth weight greater than 4 kg and 94.90% were breastfed for more than 6 months. Concerning the birth weight of the pupils, our results are similar to those of S Regaieg et al in Tunisia in Sfax where there is no significant variation between the children who had a birth weight lower than 2.5 kg or higher than 4 kg and the others (p = 0.28) [11].

However, parental obesity was positively correlated with the risk of childhood obesity (OR= 2.62 [1.44-4.78] and p < 0.001) [11]. It is also true that the risk is increased if one of the two parents, and a fortiori both, is also obese. There is also the influence of ascendants, "Like mother like daughter, like father like son". This is one of the conclusions of the study on obesity which has just been carried out by the medical school of Plymouth University [17]. It thus shows that obese women are ten times more likely to have obese daughters than those of normal weight and that the ratio is six between father and son. And above all, it adds that this relationship does not cross: an overweight father has no influence on his daughter and vice versa [23].

It is also different from that of Mourad Raiah et al in Oran where overweight is significantly associated with a birth weight > 3.8 kg (28.6% versus 19.2% with p < 0.001) [18]. On the other hand, overweight is not associated with the duration of breastfeeding and the percentage of children with a family history of overweight is significantly higher in the group of overweight children (37.6%) than in the group. baseline (20.5%) with p<0.001). There is a significant link between the level of education of the mother and the weight status of the children. Among overweight children, 14.6% had a mother with a secondary education level against 10.6% for those who were not overweight (p < 0.05).

The same observation is made for children whose mothers had vocational training (7.3% versus 3.9%; p < 10⁻³) and no significant link was found between the level of education of the father and weight status of children [14].

On the school environment

In our study, the analysis showed that overweight is linked to the existence of playgrounds and canteens within the school (p=0.03). Pupils with playgrounds and canteens within the school are 1.83 times more likely to be overweight than other pupils without canteens within the school (with a CI [1.03 – 3.24]). This result was supposed to be the opposite, but it calls into question the quality of the meals served in these canteens and the adaptation of the infrastructures and sports equipment corresponding to the needs of this 6 to 18-year-old group.

In total, after the multivariate analysis, the factors associated with overweight independently and significantly were the female sex p = 0.02 (ORaj = 3.97 [1.03-14.97]), the use of vehicle for the home-to-school journey p=0.04 (ORaj = 2.09 [1.01- 4.35]), consumption of food in front of the television and/or the computer p=0.04 (ORaj = 3.83 [1.01-14.57]) and the irregularity of the practice of physical education and sports at school p=0.03 (ORaj = 4.28 [1.08-16.96]).

N'diaye P et al found in 2015 among pupils in the 2nd cycle of public education in Dakar a statistically significant link between overweight and the practice of sport at school (ORaj = 0.2 [0.1- 0.8]), and/or the consumption of dry vegetables (p = 0.009; OR not defined), female gender (ORaj = 3.0 [1.2-7.5]) and/or the impression of being overweight (ORaj = 7.3 [2.7-19.4]) [24].

Houinato O et al found in Benin in 2016 that the risk factors associated with overweight were female sex, sedentary lifestyle, consumption of sugary and carbonated drinks. However, consumption of fruits and vegetables, regular physical activity, age over 15 years were protective factors [25].

Limitations of the study

Our study has some limitations related in particular to the mode of collection of data concerning the lifestyle of pupils, information from parents (weight, height, level of education and profession) which is essentially declarative. There is a risk of under-reporting eating behaviors known to be unfavorable or information provided by parents. However, these limitations do not detract from the quality of the results of this study.

Conclusion

The prevalence of overweight in children is increasing rapidly. The identification of overweight risk factors would make it possible to screen children at risk in order to offer them appropriate preventive measures undertaken very early in childhood. These preventive measures should include not only individual approaches but also the child's social environment by promoting healthy eating and establishing regular out-of-school physical activity. It would also be interesting to include in the children's school curriculum, health education topics, which promote good lifestyle habits, especially food, from an early age.

Conflict Of Interest

This work does not present any conflict of interest.

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APPENDICES

Table 1: Variation in the nutritional status of pupils aged 6 to 18 in Bamako commune II in 2018 (N=400)

Nutritional status according to child's BMI (IOTF)	Absolute frequency (n)	Relative frequency (%)	CI to 95 %	Nutritional status reference values (IOTF)
Thinness	29	07.25	05.00 –10.40	If BMI lower the percentile IOTF-17
Normal corpulence	312	78.00	73.60 – 81.90	If BMI between the percentile IOTF-17 and the percentile IOTF-25
Overweight	43	10.75	08.00– 14.30	if BMI between the percentile IOTF-25 and the percentile IOTF-30)
Obesity	16	04.00	02.40–06.50	if BMI above percentile IOTF-30

Table 2: Factors related to lifestyles, dietary and biological habits associated with overweight among pupils aged 6 to 18 in Bamako commune II (N=400)

Biological factors, lifestyle and eating habits, sports habits, pupils' school environment (N=400)		Presence of overweight			Univariate analysis		
		Yes	%	n	P	OR	CI to 95 %
Sex							
	Girl	43	17.50	246	0.059		
	Boy	16	10.40	154			
Age							
	< 15 years	25	13.40	187	0.46		
	≥ 15 years	34	16.00	213			
Use of vehicle for the home-to-school journey							
	Yes	40	19.10	209	0.009	2.14	[1.19 – 3.84]
	No	19	09.90	191			
Screen use, everyday							
	Yes	45	18.20	247	0.01	2.21	[1.16 – 4.18]
	No	14	09.20	153			
Food consumption in front of television/computer, every day							
	Yes	36	18.00	200	0.06		
	No	23	11.50	200			
Breakfast intake ,every day							
	Yes	18	10.10	178	0.01	0.49	0.27 – 0.89
	No	41	18.50	222			
Bring snack, every day							
	Yes	31	13.80	224	0.56		
	No	28	15.90	176			
Purchase of sweets (sweet drink), at least 3 times a week							
	Yes	31	14.20	218	0.74		
	No	28	15.40	182			
Consumption of fruits and vegetables, every day							
	Yes	44	14.80	298	0.98		
	No	15	14.70	102			
Consumption or intake of snacks (drinks, meats/ deli, biscuits, bread), every day							
	Yes	16	23.50	68	0.02	2.06	[1.08– 3.94]
	No	43	13.00	332			
Consumption or intake of sugary drinks, at least 3 times a week							
	Yes	40	20.40	196	0.001	2.49	[1.38 – 4.48]
	No	19	09.30	204			

Consumption or intake of fast foods, at least 3 times a week							
	Yes	18	22.80	79	0.02	2.01	[1.08 –3.74]
	No	41	12.80	321			
Practice of Physical Education and Sports (PES), less than 3 times a week							
	Yes	46	16.40	281	0.16		
	No	13	10.90	119			
Practice of physical activity during break							
	Yes	17	12.10	141	0.26		
	No	42	16.20	259			
Practice of Physical activity outside of school							
	Yes	12	11.30	106	0.24		
	No	47	16.00	294			
Existence of sports playgrounds and school canteens in school							
	Yes	37	18.50	200	0.03	1.83	[1.03-3.24]
	No	22	11.00	200			

Table 3: Factors related to the family environment associated with overweight among pupils aged 6 to 18 in Bamako commune II (N=195)

Pupils' home environments (N= 195)	Presence of overweight			Univariate analysis		
	Yes	%	n	P	OR	CI to 95 %
Birth weight of the pupils found in health record						
	Yes	4	10.00	40	0.42	
	No	55	14.80	155		
Overweight mother / BMC (OMS)						
	Yes	23	16.10	143	0.13	
	No	36	07.70	52		
Mother's instruction (Mother of the pupils has at least primary school level)						
	Yes	27	14.70	134	0.18	
	No	32	52.46	61		
Mother's occupation						
	Household	18	16.70	108	0.20	
	Others	41	10.30	87		
Breastfeeding time						
	Less than 6 months	10	20.00	50	0.41	
	More than 6 months	49	13.50	145		
Overweight father / BMC (OMS)						
	Yes	20	15.90	126	0.26	
	No	39	10.10	69		
Father's education (Father of the pupils has at least primary school level)						
	Yes	27	14.60	135	0.21	
	No	32	53.33	60		
Father's profession						
	Executive officers	9	14.80	61	0.80	
	Others	50	13.40	134		

Table 4: Factors associated with overweight, among pupils aged 6 to 18, after adjustment (N=400)

We performed a multivariate analysis for all variables with a $p < 0.25$

Factors	Bivariate analysis		OR adjusted	Multivariate analysis	
	OR raw	p		CI à 95 %	p
Female sex (Girl)	1.82	0.059	3.97	[1.03-14.97]	0.02*
Use of vehicle for the home-to-school journey	2.14	0.009	2.09	[1.01-4.35]	0.04*
Screen use, every day	2.21	0.01	0.73	[0.19-2.79]	0.65
Food consumption in front of television/compute , every day	1.68	0.06	3.83	[1.01-14.57]	0.04*
Intake of breakfast , every day	0.49	0.01	0.57	[0.18-1.75]	0.33
intake of snacks (drinks, meats/ deli, biscuits, bread), every day	2.06	0.02	0.95	[0.15-5.89]	0.95
Intake of sugary drinks, at least 3 times a week	2.49	0.001	2.64	[0.81-8.65]	0.10
Intake of fast foods, at least 3 times a week	2.01	0.02	0.53	[0.12-2.32]	0.40
Practice of Physical Education and Sports (PES), less than 3 times a week	1.59	0.16	4.28	[1.08-16.96]	0.03*
Practice of physical activity outside of school	0.67	0.24	0.80	[0.12-5.30]	0.82
Overweight mother	2.32	0.13	2.20	[0.50-9.72]	0.29
Mother's instruction	0.00	0.18	0.00	[0.00-0.00]	0.98
Mother housewife	1.75	0.20	2.91	[0.80-9.44]	0.07
Father's instruction	0.00	0.21	0.00	[0.00-0.00]	0.98
Presence of fields/canteens in school	1.83	0.03	0.31	[0.07-1.42]	0.13

* Statistically significant