Statistical study of the factors responsible for obesity in primary school children in the Rabat/Salé/Kenitra region

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Abstract- Obesity is a disease that can be defined by an accumulation of abnormal and excessive fat mass in the body, disease caused by an imbalance of food associated with a lack of activity, it can be of different types and degrees also obesity is considered an important public health problem in many countries, it has very heavy consequences for health. By 2025, estimates predict that obesity will affect half of all men and one third of all women. In Morocco, one in ten Moroccan children and adolescents are affected by obesity. The scourge would affect 10.3% of boys and 9.9% of girls aged 5 to 19 years. And also the rate of obesity among 5-19 year olds has increased from 4.4% in 2000 to 10% in 2015. From these worrying figures our study is conducted to identify all the factors that influence in a direct or indirect way to this pandemic using a survey intended for 200 schoolchildren aged 6 to 12 years at the level of the region of Kenitra and Khemisset and the results obtained (200 questionnaire formed by simple sentences since it is intended for children and it is by closed and open questions according to the nature of the expected response), The data are processed by SPSS software which allowed us to discover that at the level of this region, childhood obesity affects the female gender more than the male gender, also in total more than 60% of schoolchildren suffer from this pandemic, the genetic factor influences the appearance of obesity by a percentage that can reach 40%, without forgetting the relationship between obesity and the dietary factor which can be summarized by the impact of the number of meals per day (71% consumes 3 meals per day and 20, 5% consume more than 3 meals a day), the consumption of fast food (64% of the children consume fast food more than 3 times a week) and sugary drinks (69% of the children consume sugary drinks a lot) on the weight gain, the impact of the behavioral factor which is reflected in the bad snacking (92, 5% of the children snack in a bad way) and the lack of sleep (this factor influences indirectly what is noticed is that 93% of the respondents do not have a stable sleep schedule) and then the sedentary lifestyle which is the most intense cause of childhood obesity. This factor is generally translated by the hours spent in front of the Screen and the number of times of practicing sports per week (27% of the children who practice a sport 2 times per week with a percentage of 62, 5% while the time spent in front of the screen exceeds 1 hour per day with a percentage of 79%). What is concluded is that the main factors of obesity in children in the Rabat/Salé/Kenitra region are sedentary lifestyle and bad behavioral habits.

Keywords-Obesity, childhood obesity, responsible factor, statistical study, Morocco

I. INTRODUCTION

The increase in the prevalence of overweight and obesity is a major public health issue affecting both industrialized and developing countries and affecting all social classes and age groups [1]. This recent acceleration of the overweight epidemic is partly due to a sedentary lifestyle, the globalization of markets and poor eating habits [2]. According to the WHO, overweight and obesity result from an abnormal or excessive accumulation of body fat, and often from an imbalance between caloric intake (amount of calories incorporated by the diet) and energy expenditure (amount of calories expended by the basal metabolism and physical activity) leading to serious health consequences [3]. Indeed, worldwide, 5% of mortality is attributable to overweight and obesity [4]. Furthermore, according to a Framingham study, obese patients have twice the risk of heart failure and a 4.1-fold higher risk of cardiovascular disease progression than normal weight patients [5]. These physical health consequences are in addition to the psychological and social repercussions related to the change in body image caused by obesity. According to a study conducted by the British medical journal "The Lancet" and the WHO in 2016 [6], the number of obese young people (5 to 19 years) in the world has increased more than tenfold since 1975. Concerning the case of Morocco and according to the same study, one Moroccan child and adolescent out of ten are affected by obesity. The scourge affects 10.3% of boys and 9.9% of girls aged 5 to 19 years. It also affects 20.2% of men and 33.4% of women aged 20 and over. And according to the authors of the study, the rate of obesity among 5 -19 year olds has increased from 4.4% in 2000 to 10% in 2015. Moreover, overweight and obesity tend to persist into adulthood and are responsible for many life-threatening diseases in affected subjects [7]. The Body Mass Index (BMI) is now the most commonly used tool for measuring body size and studying weight independently of height. But it was not always so. The name Body Mass Index (BMI) was only recently given to

Body type	BMI
Normal weight	18,5 to 25
Overweight	25 to 30
Moderate obesity	30 to 35
Severe obesity	35 to 40
Morbid obesity	40 to 50
Massive obesity	More than 50

the ratio of weight to height squared. It was not until the early 1970s that A. Keys and his colleagues named it in this way.

This measure has since established itself as the preferred instrument for studying underweight, overweight and obesity. The use of BMI has been recommended since the 1980s in the medical field [8]. But it is the World Health Organization that, by qualifying obesity as the first non-viral world epidemic and by establishing the BMI as a diagnostic and preventive tool, has imposed its use internationally. In France, in November 2003, the Minister of Health, Jean-François Mattei, sent all general practitioners in France two BMI measurement discs, one for adults and one for children. In the letter accompanying the letter, the Minister emphasizes that the fight against obesity "requires regular monitoring of the body mass index. Its measurement during the medical consultation should become, like that of the blood pressure, systematic". The increase in concerns about obesity has contributed to the fact that BMI is a commonly used measurement tool in fields as diverse as medicine, psychology, social sciences and marketing [9].

The World Health Organization (WHO) [10] recommends this index for adults and proposes the use of the thresholds of 25 and 30 kg/m2 to define overweight and obesity respectively. These values were established from statistical data linking BMI values to mortality rates. The first curves of corpulence according to age and sex in children were published by Rolland-Cachera et al. in 1982 and concerned the French population. In 2000, the International Obesity Task Force (IOTF) proposed an international definition of overweight and obesity in children and adolescents. The thresholds are constituted by the BMI percentiles reaching the values 25 and 30 kg/m2 at 18 years of age [11]. Based on the same data, BMI thresholds defining three degrees of thinness (18.5; 17 and 16 kg/m2) have been proposed [12]. The Centres for Disease Control and Prevention (CDC) body weight curves were published in 2000 [13] and those of the WHO in 2006 for children aged 0-5 years and in 2007 for 5-19 years [14]. The use of BMI reference curves is essential in children because body weight varies with age. This variation follows the same pattern whatever the sex or the population considered: the curve increases during the first year of life, then decreases until 6 years of age and again until the end of growth [15]. This new increase is called "adiposity rebound". The age of the rebound correlates with adiposity in adulthood. The earlier it occurs, the higher the risk of becoming obese.

It is now recognized that growth is under genetic and environmental control, resulting in significant differences in size and weight between populations [16]

Child obesity is taking alarming proportions in many countries and calls for urgent action. That is why the objective of our work is to identify the factor that causes overweight/obesity in children in the region RABAT/SALE/KENITRA based on the body mass index.

II. MATERIALS AND PROCEDURES:

-This work is a statistical study of obese children in the region (Rabat/Salé/Kenitra)

-Our survey is based on a questionnaire that is formed by closed and open questions intended for children in the age range between 6 and 12 years

-The period of distribution of the questionnaires started in October 2020 and ended in May 2021.

-The data processing was carried out during the year 2022.

-The operations carried out during our study are made up of several stages indicated as follows.

Step 1: To get an authorization of access to the elementary school at the level of the delegation of education of two cities and also to have a list of the public elementary school (Khemisset and Kenitra) we worked on 10 establishments for each city.

Step 2: The questionnaire used for our survey consists of 5 pages, each page is composed of 5 to 8 questions with simple and clear sentences as it is intended for children.

This questionnaire has already been processed by a reliability test and we found that all the questions we asked are homogeneous with a random measurement error = 0.1 less than 1 so the results that will be obtained will be targeted and reliable.

Step 3: the visit of each primary school and the observation by the naked eye of the pupils of each school level and with the help of a person in charge we gather all the children who have an overweight in an empty class to take the measurements which are used for our study the weight / the height this operation lasted almost 6 months for each city studied.

Step 4: the filling of the questionnaires by myself indicating the name/age/sex and calculating the mass index of each respondent and then converting the paper version of the questionnaires to Excel which lasted almost 1 month

Step 5: The results which include 200 answers are treated by the SPSS software.

Regarding our questionnaire, it is composed of 5 pages:

-The first page: name / weight / height / age / sex / BMI

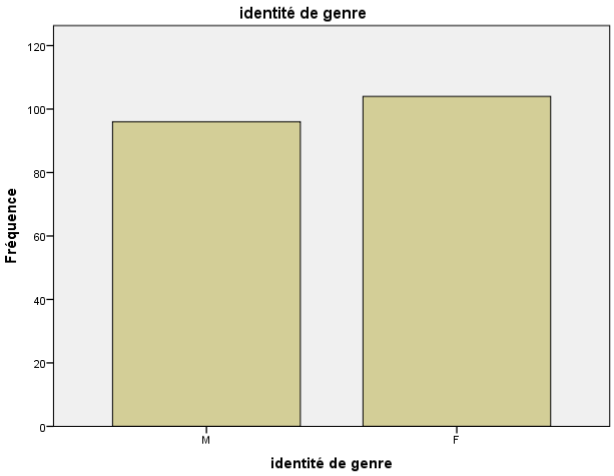
-The second page: genetic factor represented by the question (do you know obese people in your family)

-The third page : behavioral factor (snacking and sleep schedule stability)

-The fourth page : dietary factor (number of meals per day, consumption of fast food and sugary drinks)
sugary drinks)

-The fifth page : physical factor (sports practice and screen time)

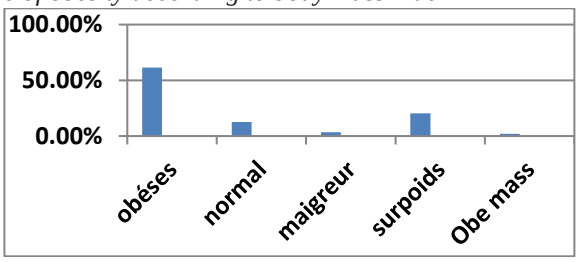
III. RESULTS AND DISCUSSION



From the graph obtained, we see that the 200 cases studied know a dominance of the female sex 104 cases with a percentage of 52% compared to the male sex which includes 96 cases with a percentage of 48%. According to a study conducted by the British medical journal "The Lancet" and the WHO in 2016 (. [17]. The number of obese young people (5 to 19 years old) in the world has increased more than tenfold since 1975. Regarding the case of Morocco and according to the same study, one out of ten Moroccan children and adolescents are affected by obesity. The scourge would affect 10.3% of boys and 9.9% of girls from 5 to 19 years old. . And according to the study authors, the rate of obesity among 5-19 year olds has risen from 4.4% in 2000 to 10% in 2015. [18].

We note that our results are inverse to the results of other studies, which may be explained by the places of study chosen. Our study is carried out at the level of primary schools which know a dominance of the female sex over the male sex, which proves the result obtained.

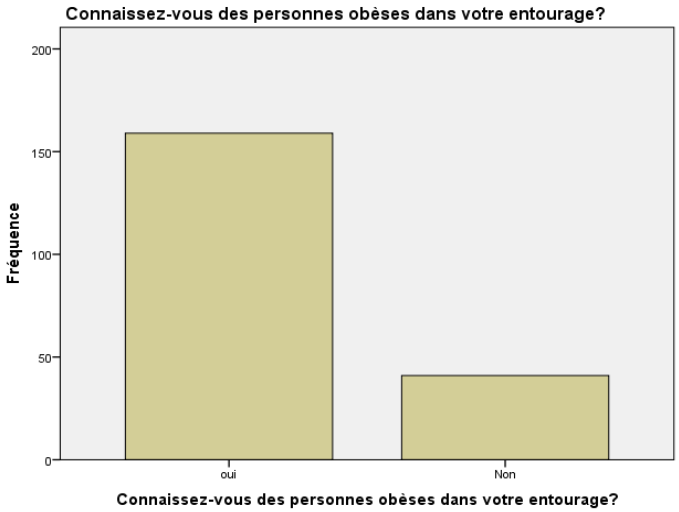
a-Type of obesity according to body mass index



According to the processed data and the graph that represents the BMI categories of the respondents, we notice that 123 of the cases are obese with the percentage of 61.5% and the rest is subdivided into 7 thin children with a percentage of 3.5%, 41 children have overweight with a percentage of 20.5%, 25 children in a normal state represents 12.5% and 4 people who suffer from massive obesity with a percentage of 2%. The WHO classification distinguishes 4 types of obesity according to BMI in terms of severity: type I or moderate obesity, for a BMI between 30.0 and 34.9 kg/m2, type II or severe obesity for a BMI between 35.0 and 39.9 kg/m2, type III or morbid obesity for a BMI greater than 40 kg/m2. And type IV obesity or massive obesity for a BMI greater than 50, it has been shown that the higher the BMI, the higher the mortality [19].

This stage of our study is very important because it showed the seriousness of the situation the classification is based on the body mass index of each child, this index which is calculated by the mass and weight ratio and as a result we obtained a massive percentage obese children which represents 61.5%.

b-The genetic factor



According to this question, we note that the majority of respondents have an obese person in their family, this segment represents 159 children and with a percentage of 79.5% while the rest which represents 41 people (20.5%) are answered by a no. It is also estimated that Genetic factors explain 15-40% obesity. But the rapid increase

of the prevalence of obesity excludes that it can be attributed to a purely genetic origin, even if the demonstration of a correlation of the BMI of adopted adults with that of their biological parents, from whom they have been separated since early childhood, clearly shows the reality – and the complexity: this BMI is also correlated, but in an inverse way , with adoptive parents and biological parents. A direct genetic relationship only exists in a few rare cases of single dominant gene mutation; in these patients, obesity, quickly morbid, is accompanied by endocrine disturbances.

In the other cases, it is rather a question of contributing factors; we thus speak of "sparing metabolism" favoring the storage of energy and the consumption of food. These metabolic conditions certainly represent a competitive advantage in the event of famine, but are not an appropriate response to our immediate affluent society. The best-described mutations

currently relate to the pathway melanocortin, in particular on the type 4 melanocortin receptor (mc4r), expressed mainly in the hypothalamus, which plays a key role in the control of food intake. This discovery helps to understand 1 to 6% of common, non-syndromic forms of obesity. Progress in this genetic field opens up the possibility of early detection of subjects at risk, which is also a source of ethical problems, since in most cases these are only contributing factors.

This question asked in our survey aims to know the impact of the genetic factor on obesity. In our results obtained by other studies, we can conclude that this factor influences obesity by a percentage that can reach up to 40%.

c-Food factor

Number of meals per day

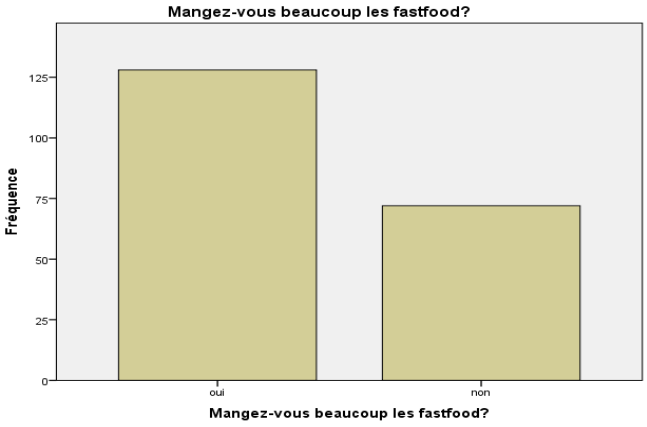
According to the graph, the children who eat 2 meals a day represent 17 cases with a percentage of 8.5%, the consumption of 3 meals a day represents a dominance with 71% of the responses (142 cases) and the children who consume more 3 meals a day represents 20.5% of responses (41 children)

27.4% of young people had lunch in the canteen. Europeans used the canteen more often than the others, the difference being statistically significant (38.6% versus 17.6%).

41.5% of them ate four meals a day: breakfast, lunch, snack, dinner [20]. 77.2% of the children took four meals a day: breakfast r , lunch r , snack , dinner (excluding snacks) [21].

Our study shows that the number of meals per day influences body condition of the person, the same results are obtained by other studies whereas most children take meals 3 to 4 times a day and especially if these meals are poorly diversified which subsequently leads to weight gain.

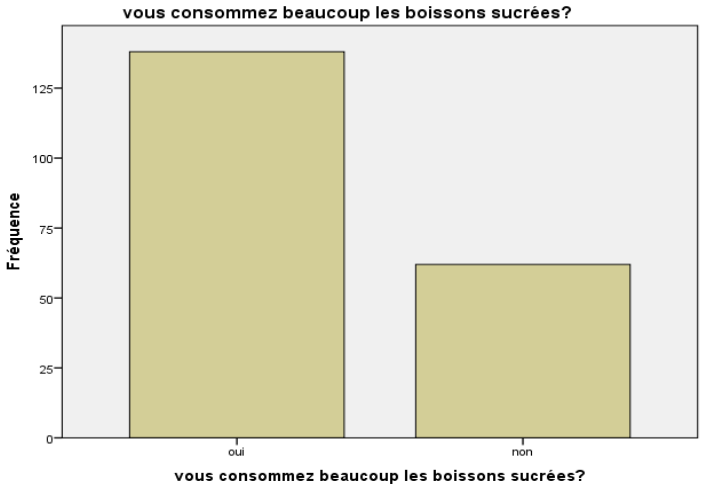
d-Eating fast food



After processing the data, we notice a dominance consumption of fast food per children with a percentage of 64% (128 yes answers) while children who do not eat fast food a lot represent 36% (72 answers with no) the percentagef children consuming hamburgers one to three times a week represents 61.8% [22].

Eating regularly in fast food promotes weight gain, since the 1990s fast food became the mode of food in Morocco people and especially children who often eat in these establishments more than twice a week have gained more than 4.5 kg on average over 15 years

e-Consumption of sugary drinks



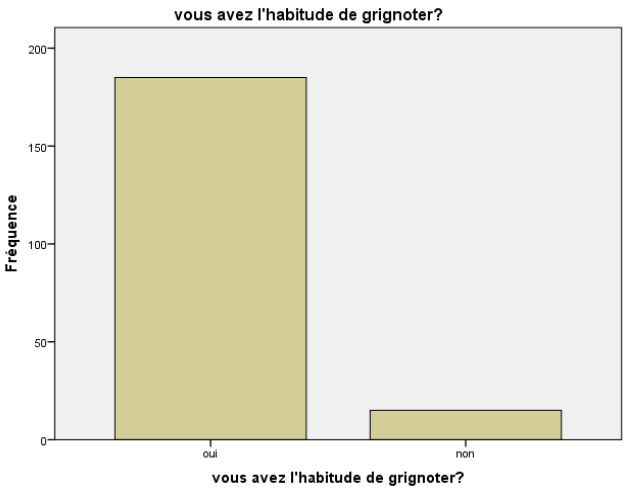
The majority of respondents consume a lot of sugary drinks 138 children who answered yes and represent 69% of the answers while the rest do not not consume them and representing a percentage of 31% with 62 answers by no. Overall, consumption sweets (cakes, sweets, chocolate, etc.) is quite high because more than 24% of students consume them more than 4 times a week [23].

Even if the causes of excess weight are numerous, the consumption of sugary drinks plays an important role in this phenomenon. Sugary drinks contain a very high amount of glucose and fructose, two simple sours that have an effect on metabolism.

- Regulation of food intake and the feeling of satiety
- An increase in visceral fat deposition
- Accumulation of hepatic lipids

f-Behavioral factor

The habit of snacking

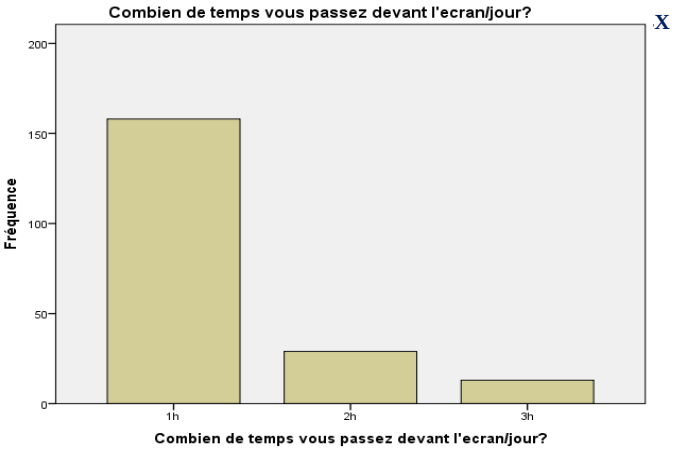


We note from the graph which deals with this phenomenon that 185 children nibble with a percentage of 92.5% while 15 responses were negative with a percentage of 7.5%. Snacking is a common eating behavior among young people. He is one of the eating behaviors that promotes the emergence of chronic diseases. Thus the fight against this risky behavior is essential and must involve targeted public health programs [24]. Dietary behavior represents a major challenge for public health because of its impact on chronic pathologies and more specifically obesity. Time preferences are psychological factors related to self-regulation abilities and may be associated with eating behaviors and obesity. The main objective of this thesis was to study the relationship between temporal preferences, food behavior and obesity in the general population. Time preferences were assessed from questionnaires measuring impulsivity and consideration of future consequences.

This work was carried out within the web-based NutriNet-Santé cohort. Impulsivity was associated with poorer diet quality, more frequent snacking and eating disorders (Association between time preferences, eating behavior and overweight [25]. Snacking is eating without hunger between meals,

snacking generally concerns foods that we like and are ready to eat, these are foods that are fatty, sweet, caloric, low in vitamins and minerals. If snacking is frequent the risk not to be hungry at the following meals and to have a healthy diet, or to consume too much calories and gain weight.

g-Screen/laptop time



We found that 158 children spend 1 hour in front of the screen (79%), 29 children spend 2 hours each day in front of the screen or the laptop (14.5%) and the rest, which represents 13 cases, exceeds 3 hours per day in front of the TV (6.5%). The increase in sedentary lifestyle related to the development of new technologies is significantly associated with obesity in both children and adults. However, it remains to be determined whether increasing physical activity leads to a proportional reduction sedentary behavior? At the house of non-obese preadolescent and obese adolescent. [26] show that the relationship between sedentary lifestyle and physical activity is not symmetrical. In fact, the increase a sedentary lifestyle leads to a significant decrease in physical activity. At the opposite, an increase in physical activity leads to only a small decrease sedentary behaviors. In other words, the decrease in physical activity caused by the increase in sedentary lifestyle is greater than the decrease in sedentary behavior caused by an increase in physical activity.

physical activity. This finding was recently confirmed by scientists. [27] who studied the relationships that may exist between sedentary indicators such as hours spent watching television and physical activity in preadolescents aged ten to 15 years.

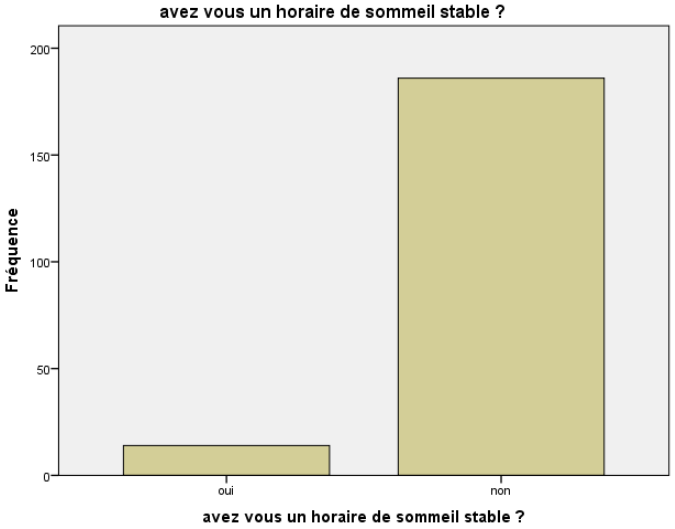
The results do not show a significant relationship between changes in sedentary behavior (reduction of hours spent in front of the television) and physical activity. So one hour less per week spent in front of the television results in only a small increase (two minutes) physical activity of moderate to high intensity

In the same vein and to go further, the importance of intervening on the reduction of sedentary behavior is demonstrated by its interest in reducing fat mass in overweight young people. The study of. [28] on the effect of the reduction sedentary behaviors and increased physical activity on fat mass (measured by impedancemetry) of obese children aged eight to 12 years reported significantly lower fat mass in subjects who reduced their sedentary behaviors (−4.8%) than in subjects who increased their physical activity (−1.2%). These results confirm that physical activity and sedentary lifestyle are indeed different concepts and that an effective strategy for both prevention and treatment requires intervention both on the decrease in sedentary behavior and on the increase in physical activity [29]. However, the fundamental question of whether inactivity is causing obesity or whether obesity leads the child to a sedentary lifestyle remains to be elucidated.

The screen reduces the practice of physical activity and encroaches on sleep, or a duration Insufficient sleep and exercise

are confirmed factors of weight gain later in childhood, and television advertising for unhealthy foods, on the other hand, seems to encourage children to consume ultra-processed foods.

h-Sleep schedule stability



After processing the data, we note that the majority of the respondents experience disturbances in the level of sleep schedule, this slice represents 186 children with a percentage of 93% while 14 children who have a stable sleep schedule with a percentage of 7%.Many cross-sectional studies conducted on different continents, in adults, adolescents or children, show an independent association between short sleep time and weight gain [30].

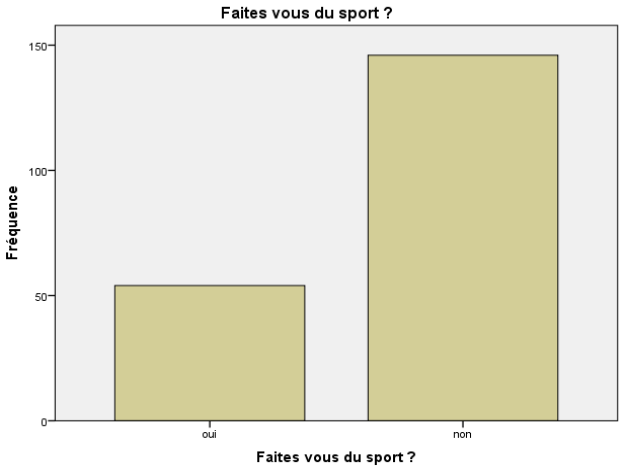
In adults, of the 25 cross-sectional studies published, only four are negative, two of them concerning subjects over 50 years of age [31] identified 696 studies, of which 30 met the required methodological criteria (12 in adults). child and 18 in adults); they included 634,511 subjects including 30,002 children

The combined odds-ratio (OR) for obesity in case of short sleep time was 1.55 in adults, with a decrease in BMI of 0.35 per hour of additional sleep. Beyond the simple association, short sleep duration predicts later weight gain, as several prospective studies have shown. The Nurses Health Study (NHS) is a study that followed middle-aged nurses. Over a 16-year period, women who slept five hours or less and those who slept between five and six hours gained, respectively, 1.14 and 0.71 kg more than those who slept seven hours [32], the risk becoming obese is increased by 15% and the risk of gaining 15 kg by 32%.

The NHANES I study showed that subjects who slept six hours or less saw their BMI increase compared to those who slept seven hours, over a period of ten years [33].

The risk of obesity doubles for each hour of sleep less in a Swiss study conducted in subjects aged 27 to 40 years [34]. Only one prospective study conducted in England was negative [35]. Cohort studies specifically devoted to sleep and including polysomnography make it possible to confirm these results with sleep time measured objectively. The Wisconsin cohort study also showed that sleep duration (objectified by polysomnography) and ghrelin level and leptin were related, independently of BMI [36]. In adolescents, comparable results have been obtained in cross-sectional studies [37]. Prospective studies are less conclusive, one is weakly positive, for boys only, while another shows that every extra hour of sleep reduces the risk of obesity by 80% [38] In children, cross-sectional studies such as cohort follow-up show a stable and robust association between sleep duration and weight gain. The meta-analysis from Capuccio et al. Shows an OR of 1.89 for obesity when sleeping short.

I-Physical factor"Doing sport'



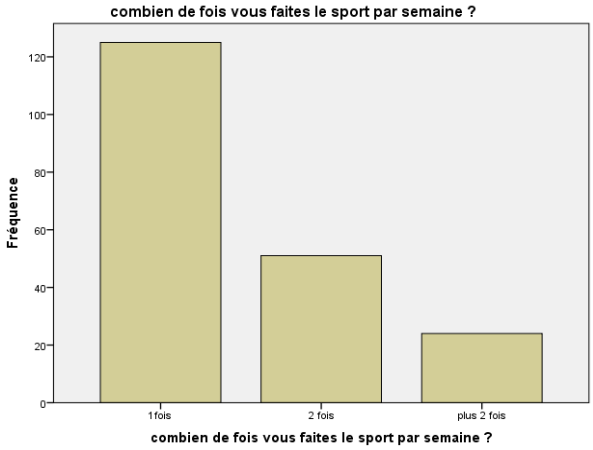
We notice that 54 children practice sport with a percentage of 27% compared to 146 who do not practice it and who represent 73%. Adult obesity is linked to processes that begin in childhood, among which physical inactivity appears to be one of the key elements [39]. There is also a significant negative association between physical activity in children and body mass index (BMI) [40]. However, in France in 2017, 39% of children aged 3 to 10 did not play any outdoor game on school days outside the school curriculum; 35% of these children play outdoors every day; 82% of them benefit from at least one physical education lesson per week. Between the ages of 6 and 12, the types of possible physical activity vary greatly [41].

The immaturity of the anaerobic glycolytic system of the child makes him reach his maximum aerobic speed (MAV) faster than the young adult. This gives him a better resistance to effort than an adult as well as a better capacity for recovery. However, 8-12 year olds are the age group for which the rate reduction or cessation of physical activity is the most important. Without physical activity, the energy balance is unbalanced and promotes fat storage at an age when adipocyte hyperplasia is major and where glycogen storage is limited. This adipocyte hyperplasia promotes subsequent development of obesity.

Physical activity burns the energy reserves stored in the form of fat in the body, these stocks consumed daily by a person reduce the risk of overweight and obesity. People who lack sleep are less likely to engage in physical activity, indirectly lack of sleep decreases energy expenditure also increasing the risk of obesity.

The number of obese young people (5 to 19 years old) in the world has increased more than tenfold since 1975. Regarding the case of Morocco and according to the same study, one out of ten Moroccan children and adolescents are affected by obesity. The scourge would affect 10.3% of boys and 9.9% of girls from 5 to 19 years old. . And according to the study authors, the rate of obesity among 5-19 year olds has risen from 4.4% in 2000 to 10% in 2015. [18].

j-How many times you exercise per week



From the graph we observe that the children who practice sport once a week are 125 with a percentage of 62.5% while for those who practice sport twice a week there are 51 children with a percentage of 25.5% and for respondents who practice sports more than twice a week are 24 people and represent 12% of the responses. The importance of introducing physical activity into weight reduction programs associated or not with energy restriction is no longer in doubt [42]. The beneficial effects in terms of body composition, physical qualities, physiological parameters and psychosocial levels no longer need to be demonstrated [43]. The explanatory mechanisms of this influence are essentially based on the effect exercise on adipose tissue and therefore on stimulation of lipolysis. The effects exercises are dependent on its characteristics in terms of intensity, duration and frequency, in relation to the stage maturation of the child [44].

If we are interested in body mass, the vast majority of studies report significant and positive results when physical activity is associated with energy restriction. Although few in number, some prospective studies find little or no effect physical activity [45] while others observe that the active child (preschool age) always has a lower fat mass than the sedentary child.

The recent meta-analysis of studies investigating the use of physical activity in the treatment of childhood obesity, shows that studies using doses of physical activity of 155 to 180 minutes per week lead to a decrease in mass fat in obese children and adolescents.

Other objectives are assigned to physical activity as an essential element in the management of obese children, such as increasing energy expenditure [46], increasing lipid oxidation (intensity of exercise where fat utilization is maximal in the obese youth: 40–50% of maximal oxygen consumption or 50–60% of maximal heart rate, maintenance of lean body mass, regulation appetite (effect which remains to be clarified), sleep (relation to be elucidated in particular on the mechanisms . Several studies have shown other beneficial effects of physical activity in obese young people, such as improved blood pressure (with energy restriction), cardiovascular risk factors (HDL-C and total cholesterol) (with energy restriction) [47] and physical and muscular aptitudes. Physical activity recommendations per week or per day. Officially Organizations such as the WHO believe that at least 150min of moderate physical activity per week should be practiced. screen 79% of children can clearly explain the impact of a sedentary lifestyle on obesity.

V CONCLUSION

Obesity or overweight is characterized by an abnormal or excessive accumulation of adipose tissue that can represent a danger to health. The body mass index is the main indicator for detecting obesity or overweight, our work has succeeded in discovering the main factors that directly or indirectly influence the onset of obesity in children of the Rabat/Salé/Kenitra region

The causes of obesity vary from one child to another, generally obesity follows the combination of several factors

- Food factor: Excessive consumption of caloric food (intense consumption of fast food 64% of children frequent these places more than 3 times a week, consumption of sugary drinks: children consume a lot of these products, which is presented by a percentage of 69% without forgetting the impact of the number of meals per day on obesity and especially if these meals are unbalanced)
- Genetic factor: influence by a percentage that can reach up to 40% on the appearance of obesity

Behavioral factor: bad nibbling which is translated by the consumption of products that are too sweet or very fatty influences in a direct way on the gain of the pea this can be explained by the large percentage of children who snack (92.5%) also the lack of sleep in children can influence in an indirect way on weight gain we found that 93% of children did not a stable sleep schedule which leads to body weakness which prevents the child from practicing physical activities and increases sedentary lifestyle and in this way the child becomes obese

- Physical factor: the low percentage of children who practice sport 27% of respondents in relation to time spent in front of the

Recommendations

- Practicing a regular sporting activity
- Have a varied and balanced diet
- Limit the consumption of saturated fats
- Limit the consumption of sugars and salt
- Consume fruits and vegetables daily
- Regularly follow the evolution of the weight curve of children
- Try to limit the time spent in front of screens

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