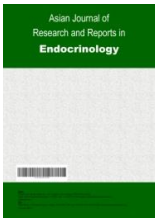

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Eating Habits and Dietetic Management of Obesity in Children and Adolescent

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Authors' contributions

This work was carried out in collaboration between all authors. Author MES designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors BSD and EM managed the analyses of the study. Author MAMA managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: dietary management is the most important step in the childhood obesity care.The aim of this study is to analyze dietary habits in a pediatric population who are obese and to evaluate the effectiveness and adherence of patients to the prescribed diet at 6 months of follow-up.
Methods: We carried out a cross-sectional study, which concerns obese children who are referred to the endocrinology department in Hédi Chaker hospital in Sfax. Then we have assessed the weight status after 6 months under regime. A sample of 84 children who are overweight and obese were recruited into the study. All the children included in our study were put under diet adapted according to the age during 6 months.
Results: 84 children, 44 boys and 40 girls. The average age was 11.83 years. The average BMI was 31.55kg/m² (21-47), average BMI Z score was 7,9SD (2,7-16). The daily calorie intake was 2484kcal/day. This weight loss was not statistically significant.

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After 6 months of Fallow up: good adherence was observed in 23%. The average BMI was 29,6 kg/m², the average BMI Z score was 7,5 SD. The half of our patients have decreased their BMI Z-score. The prescribed diet was more effective in boys than in girls, in patients without a family history of obesity, in patients who were physically active, in patients who are overweight without obesity and in those who were more adherent. But this efficiency remains statistically insignificant.
Conclusions: This study showed that there is a positive impact of dietary management on weight reduction in children. Other studies have shown the value of dietetic management on childhood obesity care particularly through multidisciplinary interventions.

Keywords: Overweight; childhood obesity; eating habits; daily calorie intake; dietary management.

1. INTRODUCTION

Childhood obesity is one of the major public health problems, particularly in developed countries [1]. Its prevalence has increased rapidly in recent years as a result of lifestyle changes and modernization [2]. This increase is spreading to developing countries [3]. Universally it is estimated that 10% of school-age children are overweight, a quarter of them are obese. The prevalence of obesity varies from one country to another. It is higher in developed countries than in developing ones. It's about eight percent in the United States, three percent in Europe, and less than one percent in Africa and Asia [4]. Tunisia is not an exception for this epidemic phenomenon. As national surveys have shown, the prevalence of childhood obesity is constantly increasing. In a study conducted by Boukthir et al. noted that, in including tunisian schoolchildren aged 6 to12 years, the prevalence of overweight was 19.7% and that of obesity was 5.7% [5]. Persistent obesity is a risk factor in the occurrence of several chronic diseases such as cardiovascular, metabolic, and respiratory diseases, as well as certain types of cancer [6]. Despite that following a weight-loss diet is difficult, and its effectiveness may be inconstant particularly in children, dietetics and physical activity have a major influence on the energy balance and these are the main modifiable factors in the management of obesity [7].

The Aim of this study is to analyze dietary habits in obese pediatric patients and to evaluate the adherence and the effectiveness of diet at 6 months of follow-up.

2. METHODS

We carried out a cross-sectional and analytical study, which examined the records of children admitted to the endocrinology department in Hédi Chaker University Hospital in Sfax between January 2015 and December 2019 for obesity explorations.

Overweight and obesity were defined using age- and sex-specific BMI thresholds proposed by the International Obesity Task Force (IOTF). The thresholds correspond to the most widely used adult thresholds of 25 and 30 kg/m2 respectively for overweight and obesity [8].

2.1 According to WHO

2.1.1 For children under 5 years of age

overweight is weight-for-height greater than 2 standard deviations above WHO Child Growth Standards median; and obesity is weight-for-height greater than 3 standard deviations above the WHO Child Growth Standards median.

2.2 Between 5–19 Years

overweight is BMI-for-age greater than 1 standard deviation above the WHO Growth Reference median; and obesity is greater than 2 standard deviations above the WHO Growth Reference median [9].

It should be noted that the IOTF-25 curve (overweight threshold) is close to the 97th percentile curve of the French references (Table 1) [10].

We used the French corpulence curves of the National Nutrition Health Program 2010 (NNHP2010); these thresholds of these curves are derived from both French references and IOTF references.

2.3 Patients Were Included

- overweight children (BMI > IOTF-25 or ≥ 97th percentile): with or without obesity.
- children who had a regular follow-up to assess the effectiveness of dietetic management.

Were excluded the children who stopped their follow-up before 6 months whatever the reason.

Impedancemetry data (weight, Body Mass Index (BMI), Fat Mass Percent (FMP), Fat Mass (FM), Lean Mass (LM), and Water Mass (WM)) were recorded.

We have analyzed the initial dietary survey conducted by the dietician. A diet was prescribed, with a 33% decrease for children with a calorie intake above normal for age and sex. For the normal calorie intake by age and sex, we have referred to the Recommended Daily Calorie Intake (RDCI) 2011 [11].

After 6 months we have checked the effectiveness of the prescribed diet by measuring the different Impedancemetry parameters.

To account for age- and sex-dependent changes in BMI, the corpulence evolution between first visit and 6 months was evaluated by the Δ BMIZ score calculated as follows:

BMI Z score = (BMI median−BMI observed)/Standard deviation.

ΔBMI Z score = initial BMI Z score - BMI Z score at 6 months. The prescribed dietary regime was considered effective if Δ BMI Z score is positive.

Data were analyzed using SPSS statistical. The testes were considered statistically significant when the p value was < 0.05.

3. RESULTS

3.1 Socio-Demographic Characteristics

The study population included 84 children, 44 boys and 40 girls. The average age was 11.83 years (2-17). More than half of patients have an age between 10 and 15 (Fig.1) Urban area was noted for 71.4% and 28.6% live in rural. The most of the children in our series were students (92%) while 8% were manual workers. A history of obesity in the family was reported in 84.5% of cases, Average birth weight was 3200 grams (1700-4950 G), 13.5% had a birth weight less than 2500 G, 76.9% between 2500 and 4000G, and 9.6% were above 4000G.

3.2 Initial Weight Status

At the first visit the average weight was 72.68 kg (20-125 kg). The average weight was 68,97 kg (35-108) in boys and 78,78 kg (30-125) in girls. The average BMI was 31.55 kg/m² (21-47). The Average BMI was 29,6 kg/m² (23-39,6) in boys and 30,6 (21-47) in girls. The average BMI Z score was 7,9 SD (2,7-16). It was 7,8 (4,5-13,2) in boys and 7,7 (3,6-16,8) in girls. Most of our patients (78.6%) presented an obesity with BMI above IOTF-30 and 21,4% were overweight without obesity (between IOTF-25 and IOTF-30) (Table 2).

Table 1. Recommended thresholds to define overweight and obesity according to NNHP2010 curves

French references(33)	
BMI <3rd percentile	Underweight
3rd ≤ BMI <97th percentile	Normal Corpulence
BMI ≥ 97th percentile	Overweight
The international obesity task force (IOTF) (8)	
BMI ≥ threshold IOTF-25	Overweight (including obesity)
threshold IOTF-25 < BMI < threshold IOTF-30	Overweight (obesity excluded)
BMI ≥ threshold IOTF-30	Obesity

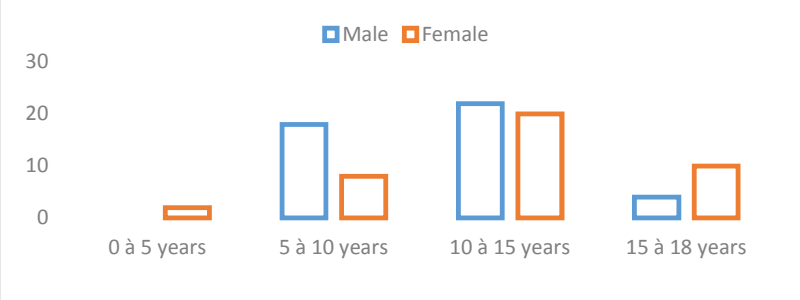

Fig. 1. Age group by sex

3.3 Characteristics of Obesity

The average age of onset of obesity was 7 years and the evolution was progressive in 97.6% of cases. The obesity was of primary etiology in 96.4% of cases, and syndromic in 3.6% of cases (two cases of Bardet-Biedl syndrome, and one case of Prader-Willi syndrome). It was without aggravating factors in 92.9%, in 2.4% aggravated by a hypothyroidism, and in 4.8% aggravated by a taking medication.

A corticoid take was recorded in one case (1.2%) and 4 children (4.47%) were under neuroleptic.

3.4 Impact of Obesity

The obesity complications were cardiovascular in 3.6%, (3 hypertensive patients) mechanical in 4.8% of cases (knees pain), respiratory 7.1% of cases (6 patients with SAS including 2 with apparatus), and metabolic in 15% of cases (prediabetes in 10 patients with dyslipidemia in 7 patients). Polycystic ovary syndrome was objected in 7 of 21 pubertal girls (33%).7% of cases had a growth retardation.

3.5 Biological Parameters

The average plasma glucose level was 5.58 mmol/l (3.4-6.83 mmol/l), average total cholesterol was 3.97 mmol/l (2.25-6 mmol/l), average triglyceride was 1.08 mmol/l (0.4-2.7 mmol/l), and average HDL was 1.1 2 mmol/l (0.35-2.04 mmo/l) (Table 3).

3.6 Initial Impedancemetry

3.6.1 The initial impedancemetry parameters were as follows

Average basic metabolism was 1683 kcal (780-2869). Average body fat mass percentage was 42.45%. Average fat mass was 30.2 kg. Average lean mass was 41.5 kg, and average water mass was 30.5 kg.

3.7 Dietary Survey

The average daily calorie intake in our series was 2484 kcal/day (1500-5300 kcal/day).

Two-point seven percent had daily calorie intake below 1500 kcal, 62.6% between 1500 and 2500 kcal, 26.7% between 2500 and 3500 kcal, and 8% had daily caloric intake above 3500 kcal (Fig. 2).

The daily calorie intake was distributed over the day as follows: 53%, 35%, and 12% for carbohydrates intake, fat intake and Protein intake respectively. The simple carbohydrates represented an average of 4.7%, saturated fatty acids 8.6%, monounsaturated fatty acids 13.8%, and polyunsaturated fatty acids 12.9%. An animal protein ratio to vegetable protein at 0,9. The average daily intake of calcium was 541.5 mg, cholesterol was 214 mg, iron was 8.4 mg and fiber was 10 g.

3.7.1 The distribution of daily calorie intake was as follows

Breakfast 15.5%, lunch 36.2%, dinner 30.3%, mid-morning snack, 8.28% taste and 4.25% in the evening. A meal skipping was found in 35% of our patients, 15.3% drink sweet tea, 41.1% drink sweet coffee, 61% drink sodas and 41.1% drink fruit juice. No alcohol intake was found in our series (Table 4).

Breakfast was taken with family, in 88.3%, and in 11.7% alone. Lunch was with family in 82%, in 15.3% at school, and 2.7% alone. The majority of children (97.2%) were having dinner with their families. Snacking was reported in 56.3%.

3.8 Evaluation after 6 Months

After 6 months of follow-up, good adherence was observed in 23% of cases. The average weight in our patient was 68.88 kg, (average weight loss of 3.8 kg), the average MBI was 29,6 kg/m² (decreased in 1,95), and the average BMI Z score was 7,5 SD (decreased in 0,4).

Table 2. Initial weight status

	Boys			Girls		
	Mean	Min-Max	SD	Mean	Min-Max	SD
Weight (Kg)	68,97	35-108	22,8	78,78	30-125	25,65
BMI (kg/m²)	29,6	23-39,6	4,9	30,6	21-47	6,06
BMI Z score (SD)	7,8	4,5-13,2	2,38	7,7	3,6-16,8	2,39

BMI: Body Mass Index

Table 3. Biological parameters

	Mean	min	max	SD
PGL mmol/l	4,8631	3,40	6,83	0,76425
TC mmol/l	3,9775	2,25	6,00	0,71279
TG mmol/l	1,0890	0,40	2,70	0,53055
HDL	1,1204	0,35	2,04	0,33383

PGL: Plasma Glucose Level; TC: Total Cholesterol; TG: Triglyceride; HDL: Hight Density Lipoprotein; Min: Minimum; Max: Maximum; SD: Standard Deviation

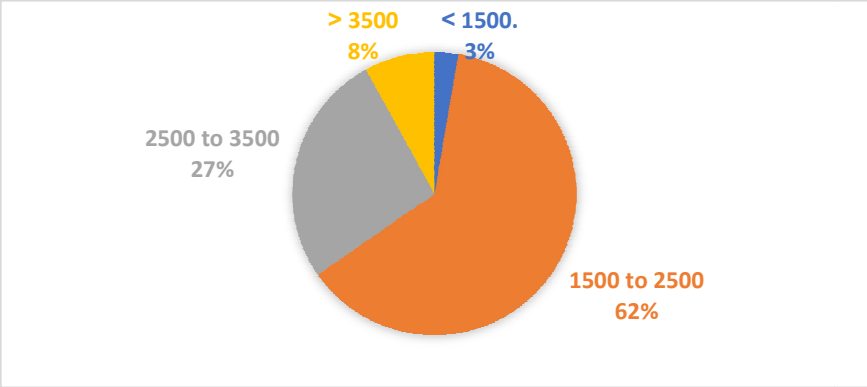

Fig. 2. Distribution by caloric intakes

Table 4. Dietary survey data

	Mean	SD
DCI (kcal)	2484	863
carbohydrates intake	53,1%	6,7
Fat intake	35%	5,9
Protein intake	11,9%	2,5
simple carbohydrates	4,74%	4,7
SFA	8,67%	2,45
MUFA	13,8%	4,8
PUFA	12,9%	10,44
cholesterol (mg)	214	135,7
AP/VP	0,9	0,4
Calcium (mg)	541	291
Iron (mg)	8,24	3
fiber (g)	16,8	7,1

DCI: Daily Calorie Intake; SFA: Saturated Fatty Acids; MUFA: Mono Unsaturated Fatty Acids; PUFA: Poly Unsaturated Fatty Acids; AP: Animal Proteins; VA: Vegetal Proteins

3.8.1 Impedancemtry parameters after 6 months were

Average basic metabolism was 1725 kcal, increased in 42 kcal, an average body fat mass percentage was 40.5%, decreased in 1.95%, an average fat mass was 25.2 kg, decreased in 5.4, an average lean mass was 43.5 kg, increased in 2 kg, and an average water mass was 30.06 kg decreased in 0.06 kg.

To look for the predictive factors of good response to the prescribed diet, we tested the efficacy according to the different characteristics of the Studied population. We objected that boys decreased more their BMI Z score (54,5%) compared to girls (45%). Patients who were physically active decreased more their BMI Z score (87,5%) compared to those who were physically inactive 40%. Children under 10 years decreased more their BMI Z score (70%) compared to children above 10 years. Patients without have decreased more their BMI Z score (71%) compared to patients with family history of obesity (45,7%). adhering more to the diet have decreased more their BMI Z score (77%)

compared to those with poor adherence 40,6%. Patients who were overweight without obesity decreased more their BMI Z score (75%) compared to children who were obese 44%. But this efficiency remains statistically insignificant.

4. DISCUSSION

All studies in both industrialized and developing countries indicate a rapid increase in the number of overweight and obese children.

According to WHO ,in 2016, more than 340 million children and adolescents aged 5-19 were overweight or obese [12]. In 2019, 38 million children under the age of 5 were overweight or obese.

Our study concerned a group of overweight and obese children of which a majority (78.6%) was obese (above IOTF-30). There were a little more boys than girls in our series. The similar outcomes were found in many studies.

In recent Chinese studies, there was no significant difference between the rates of boys and girls [13–15]. Contrary to a study published in 2018 by Hayyah Clairman who found that boys represented 45% [16].

Table 5. Impedencemetry parameters initial and after 6 months

	Initial Mean	Mean after 6 months	Variation	p
Weight (kg)	72.68	68.88	−3,8	0,01
BMI kg/m²	31.55	29,6	−1,95	0,034
BMI Z score (SD)	7,9	7,5	−0,4	0,177
BM (kcal)	1683	1725	+ 42	0,195
BFMP (%)	42,45	40,5	−1,95	0,041
FM(kg)	30,2	25,2	−5,4	0,881
LM (kg)	43,5	41,5	+ 2	0,250
WM (kg)	30,06	30,5	−0,44	0,997

BMI: Mass Body Index; BM: Basic Metabolism; BFMP: Body Fat Mass Percent; FM: Fat Mass; LM: Lean Mass; Water Mass

Table 6. Comparison of individual characters with the effectiveness of diet

	Inefficace	Efficace	P
Sex			
Male	45,5%	54,5%	0,537
Female	55%	45%	
Age catagories			
Age < 10 years	28,8%	71,4%	0,145
Age 10 to 15years	61,1%	39,9%	
Age > 15 years	60%	40%	
Provenance			
Rural	45,5%	54,5%	0,726
Urbain	51,6%	48,4%	
Low social level			
Low social economic level	48,5%	51,5%	0,707
Medium social economic level	55,6%	44,4%	
Family history of obesity			
With family history of obesity	54,3%	45,7%	0,214
Without family history of obesity	28,6%	71,4%	
Weight status			
Overweight withtout obesity	25%	75%	0,116
Obesity	56%	44%	
Physical activity			
Low physical activity	61,3%	39,7%	0,069
Moderate physical activity	12,5%	87,5%	
adherence			
Good adherence	22,2%	77,8%	0,086
Poor adherence	59,4%	40,6%	

The different age categories were represented in our series with a majority between 10 and 15 years.Similar results have found in a recent Moroccan study done by Karima Azekour et al. [17].

Eighty percent of our children are from urban areas, and 20% of children from rural areas. This rate is higher than the one found by Danladi I et al. in Nigeria (58%) [18].

That can be explained by the sedentary way of life in urban areas rather than in rural.

Family history of obesity was noted in 84.5% of cases in our study.

The family history of obesity is known as a risk factor obesity in descendants [19]. This correlation is explained by the sharing of genetic and environmental factors in the same family [20,21].

In an Algerian study by Salima Taleb et al. parental obesity was a significant risk factor, and more significant when both parents were obese [22]. In a study carried out in our service by Sofien Regaieg et al. it was shown that there is a positive correlation between parental excess weight and the risk of childhood obesity [23].

Our study shows that most obese children had a high daily caloric intake and an inadequate distribution of these caloric intakes during the day with poor eating habits such as nibbling and consumption of sweet tea and coffee, soda and juice.

The daily calorie intake in our series was high with average at 2484 kcal/. It was above 3500 kcal/day in 8% of patients.

This rate is higher than that observed by Jaak Jürimäe et al. found an average at 1798 kcal/day [24].

It should be noted that few studies have been conducted in children to find a correlation between disorders, eating habits, and childhood obesity [8,25] Behavioral changes through healthy eating and regular physical activity are the main strategies for preventing and reducing obesity according to the guidelines of learned societies [26–28]. Ruopeng An found a positive impact of healthy eating and regular physical activity in childhood obesity [29].

23% of our patients have correctly followed the prescribed diet.

In reality the assessment of the adherence level to prescribed diet remains subjective and difficult to precise.

Kyla L et al. found a rate of adherence around 60% [30].

In our study we showed that the dietary management during 6 months allowed a decrease of the BMI Z-score in 0,4 SD with a decrease of the average fat mass in 5,4 kg in favor to the lean mass which increased in 2 kg, and consequently an improvement in the weight status. 50% of our patients have decreased their BMI Z-score.

Caroline CARRIERE et al. found a decrease of the Z-score BMI in 0.3 SD as well as a decrease rate at 73% after 2 years of follow-up [31].

However, this improvement shown in our study remains unsatisfactory for several reasons, the most important of which is the difficulty of these children to change their lifestyle, indeed several studies have shown that only multidisciplinary interventions involving parents with a well-established nutritional education program have been able to produce significantly the weight [31,32,33].

Our study has certain limitations, particularly its retrospective character, as well as the existence of certain missing data and especially the difficulty in assessing physical activity and adhesion to diet in these children.

5. CONCLUSION

Through this work, we have studied the socio-demographic, clinical and paraclinical characteristics as well as eating habits of a pediatric population followed in our department for overweight. We evaluated the effectiveness after 6 months under the regime prescribed by the dietician.

Our results show that there is a positive impact of dietary management on weight reduction. It casts the lights on the difficulty of managing childhood obesity; hence the need for multidisciplinary interventions in order to make it easier for obese children to join the proposed diet program.

CONSENT

As per international standard, parental written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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