Characteristics of a Group of Obese Tunisian People and Results of a Weight Management Intervention

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ABSTRACT

Background and aims: Overweight and obesity are increasing worldwide. The aim of this study was to determine the characteristics of a group of obese and overweight Tunisian adults and the results of a weight management intervention.

Methods: this is a prospective study that included 58 Tunisian adults, at baseline, they undertook dietary intake assessment, arthrometric measurements and biological tests, then after 3 weeks of healthy diet and physical activity.

Results: this study included 8 men and 50 women. The mean age was 44 years ±10.68. The mean BMI for men and women was respectively 37.86kg/m²±7.6 and 34.77kg/m²±4.77. Abdominal obesity affected all but one participant. Hyperglycemia affected 20.7% of participants, 43.1% had hypercholesterolaemia and 19% had hypertriglyceridemia. vitamin B1, folate and vitamin C intake was insufficient respectively in 82.8%, 75.9% and 89.7% of participants. More than 80% were not consuming enough calcium. An insufficiency in iron intake was observed in half participants. The body weight and BMI after 3 weeks were significantly lower than baseline, P<0.00. There was a nonsignificant beneficial effect on glycemia and lipidic profile.

Conclusion: Overweight and obese people are subjects to obesity-related diseases and deficiencies in micronutrients. A persistent healthy lifestyle can reduce weight and related morbidities.

Keywords: nutrition, macronutrients, micronutrients, obesity, overweight, weight management.

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I. BACKGROUNDD

Nutritional disorders have become a worldwide health problem over several decades due to lifestyle and diet changes. Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health according to the WHO. Worldwide obesity is increasing at an alarming rate. It has nearly tripled since 1975. In 2016, more than 1.9 billion adults, 18 years and older, were overweight. Of these over 650 million were obese [1]. Obesity is a major risk factor for mortality and morbidity from cardiovascular diseases, diabetes, cancers, and musculoskeletal disorders [2], [3]. It is no longer a function of income or wealth. The prevalence of high BMI is increasing due to the availability of energy dense foods and the hole food systems and environment [3]. Besides the reduced physical activity that came along with the urbanization, North African countries are no exception to this issue. Developing countries such as Tunisia are also at high risk because of the recent urban industrial lifestyle [4], [5].

II. METHODS

A. Study Population

This study has been conducted over 3 weeks at the nutrition ward C at the National institute of nutrition. 58 Tunisian adults (18 years and older) were volunteers to undergo the study. The study population consisted of overweight and obese people (BMI over 25Kg/m²). They were interviewed about medical history, weight history and obesity-related diseases. The Marshall score was used to evaluate the physical activity. The subject was considered sufficiently active when the score was ≥4 (at least three times a week). The physical activity was considered insufficient when the score was 0 to 3.

B. Assessment of Anthropometric Measurements

Body weight was measured using a calibrated scale. Stature was measured with a fixed stadio meter. Body mass index (BMI) was calculated by dividing the body weight (Kg) by the height squared (meter²). Weight and stature were measured at the second medical visit, 3 weeks after the lifestyle modification. Waist circumference (WC) was measured using a non-elastic metric tape.
C. Body Composition

All subjects have had a bioelectrical impedance analysis to calculate the body fat. The results were used to estimate the lean mass.

D. Biochemical Analysis

All subjects undertook blood tests at the baseline for the measurement of fasting glycemia, total plasma cholesterol, triglyceride, phosphocalcic profile and uricemia concentrations. All these tests were reconduted 21 days after lifestyle changes.

E. Assessment of Dietary Intake

Dietary intake was assessed through a single 24 hours recall. Dietary recalls were analyzed for nutrient composition using Bilnut nutrient files.

F. Lifestyle Changes

All participants received advice on weight control lifestyle modification. The dietary intervention encouraged decreasing calories intake and changing unhealthy eating behavior. They were encouraged to increase the consumption of fruits, vegetables, and whole grains to increase the fibres intake to 25% of total protein intake. They were encouraged to decrease saturated fat intake to 8% of total calories intake and to prefer monounsaturated fat and polyunsaturated fat. Physical activity intervention consisted in increasing exercise up to 30 minutes at least three times a week. Walking was the most advised activity.

G. Statistical Methods

SPSS program was used to analyze the collected data. Continuous variables are presented as mean ± standard errors and categorical variables are presented as numbers and percentages. The Paired Samples Test was used to compare the anthropometric and biological data at baseline and after 3 weeks.

III. RESULTS

A. Before Weight Management Intervention

1. Population characteristics

The study included 58 adults, 8 males (13.8%) and 50 females (86.2%). The mean age was 44.47 ±10.68 years [27 to 65 years]. All had a BMI over 25 kg/m². The overweight or obesity history started about 14.48±11.30 years ago [1-50 years]

2. Anthropometric measurements

The mean body weight was 95.02 ±19.87 [63.8-162.4 kg]. The mean BMI for men and women was respectively 37.86 kg/m²±7.6 and 34.77 kg/m²±4.77. Ten participants (17.2%) including one male and 9 females were overweight identified by a BMI≥25 and<30 kg/m². Using BMI ≥30 kg/m² as a surrogate for obesity, we found that 48 participants were obese representing 82.7% of subjects including 7 males and 41 females. Among these obese participants, 36.2% had a class 1 obesity defined by 30≤BMI <35 kg/m², 29.3% had a class 2 obesity with a 35≤ BMI <40 kg/m² and 17.2% had a BMI≥40 kg/m² defining a class 3 obesity. The mean BMI was 35.2±5.27 kg/m². The minimum BMI found was 26.9 and the maximum was 50.10 kg/m². the mean waist circumference for males and females was 122.19 cm±20.29 and 103.86 cm±10.02.

B. Changes in lifestyle factors

Obesity class 1 (%)

BMI (kg/m²)

Sex ratio (M/F)

Age (years)

Weight (kg)

Height (cm)

BMI (kg/m²)

Overweight (%)

Obesity class 1 (%)

Obesity class 2 (%)

Obesity class 3 (%)

Waist circumference (cm)

Male

Female

Overweight or obesity history (years)

Mean results

0.16

44.47±10.68

95.02±19.87

163.83±9.18

35.2±5.27

17.2

36.2

29.3

17.2

122.19±20.29

103.86±4.77

14.48±11.30

3. Body composition

The bioelectrical impedance analysis showed that the mean body fat percentage was 33.32%±6.38 in men and 44.08%±4.63 in women. Using fat mass as reference (25% for men and 35% for women as the most used in literature), the percentage of subjects affected with obesity was 87.5% and 100% of men and women, respectively.

4. Obesity related diseases

Among our study population, 81% had at least one obesity-related health issue. Metabolic diseases (diabetes, hypertension, dyslipidemia) were reported in 21.1% of cases, respiratory problems in 19% of participant and 14% had obesity related liver issues. Osteoarticular problems were found in more than half participants (51.7%).

5. Biological anomalies

The blood samples taken at baseline, before making any lifestyle changes or any specific diet showed that 20.7% of participants had hyperglycemia, 43.1% had hypercholesterolaemia and 19% had hypertriglyceridemia. Hyperuricemia was found in 21.6% of subjects.

6. Dietary intake

The daily mean calories intake was 2509 Kcal±754.97 with a minimal intake of 729 Kcal and a maximum intake of 4612 kcal per day. The mean protein intake was 83.88 ±26.01 [27-166] corresponding to 13.65±2.92 of total energy intake. The mean Animal protein/vegetable protein ratio was 0.94±0.45 and 56% of participants had a PA/PV ratio ≥1. The mean protein intake was 0.89±0.23 g/kg/day. It was insufficient in 34.5% subjects defined by an intake <0.8 g/kg/day. The mean fat intake was 90.27 g±36.74 [30.5-212.5], the mean carbohydrate intake was 340.39 g±104.71. The fat and carbohydrate intake represented respectively 32.23%±6.5 and 54.11%±8 of the total energy intake. The fat intake was composed of...
saturated fat (29.02%±7.21), monounsaturated fat (45.02%±14.77) and polyunsaturated fat (25.95%±15.13). It represented respectively 9.28%, 14.4% and 8% of total energy intake. Regarding food patterns, 70.7% of participants take at least one snack a day. The dietary intake of micronutrients showed that vitamin B1 intake was insufficient in 82.8% of cases. The mean folate intake was 251.08±106.3 µg/day and was insufficient in 75.9% of cases. The ¼ of subjects (24.1%) had an insufficient vitamin C intake and 89.7% of participants had a vitamin E intake deficiency. When it comes to minerals, 81% of participants were not consuming enough calcium and the mean calcium intake was 668.29±277.6 mg/day. An insufficiency in iron intake was observed in half participants (48.3%). Sodium intake was excess if in 36.2% of cases. The phosphorus, magnesium and zinc intake were insufficient respectively in 19.3%, 91.4%, and 31% participants. The fiber intake was insufficient in 87.3% of participants.

7. Physical activity

Only 21 participants (36.8%) had a sufficient physical activity according to the physical activity score used. The other 37 participants were judged as inactive with a physical activity score <4.

B. After Weight Management Intervention

1. Anthropometric measurements and body composition

The body weight and BMI after 3 weeks were significantly lower than measurements at baseline, P=0.00 for both variables. The mean weight loss was 1.29±1.39 kg and the mean BMI decrease was 0.51±0.52 kg/m². There was a mean lean mass lowering of 0.98±2.45 kg. The difference between the lean mass at baseline and after the lifestyle changes was statistically significant p=0.007. There was no significant difference between the fat mass at the first and second medical visit, p=0.31, neither for the waist circumference p=0.08.

2. Biological tests

After 3 weeks of lifestyle and diet changes, the participants undertook a second blood test. The anomalies detected were hyperglycemia in 15.7% of subjects, hypercholesterolaemia in 39.2% of cases and 23.5% of participants had hypertriglyceridemia. Hyperuricemia was found in 12.5% of cases. There was a nonsignificant beneficial effect on glycemia, total cholesterololaemia, LDL cholesterololaemia and triglyceridemia at baseline and after 3 weeks (Table II). The mean HDL cholesterololaemia was significantly lower at the second medical visit, p=0.00.

TABLE II: BIOCHEMICAL VARIABLES COMPARISON AT BASELINE AND AFTER 3 WEEKS

| Biochemical variables | Baseline | 3 weeks | P   |
|-----------------------|----------|---------|-----|
| glucose (mmol/L)      | 5.5±1.85 | 5.6±1.99 | 0.32|
| Total cholesterol (mmol/L) | 5±1.01  | 4.97±0.98 | 0.23|
| HDL cholesterol (mmol/L) | 1.26±0.31 | 1.22±0.28 | 0.00|
| LDL cholesterol (mmol/L) | 1.21±0.34 | 1.21±0.33 | 0.94|
| Triglycerides (mmol/L)  | 1.33±0.78 | 1.29±0.62 | 0.23|
| Uricemia (mmol/L)      | 301±84.07 | 289±81.31 | 0.36|

Values are means _ SD; HDL, high-density lipoproteins; LDL, low-density lipoproteins.

IV. DISCUSSION

The aim of this study was to assess the characteristics of an overweight and obese population in Tunisia, to show the substantial clinical burden associated with excess bodyweight and demonstrate if the adequate lifestyle changes are effective and promising practices for obesity management for adults. Despite being a major health issue in north Africa countries including Tunisia, there is no national program to prevent obesity yet [4]. Prevalence of obesity in our country is high. It affects 37% of women and 13.3% of men according to Atek M. et al. [5]. Our study included more females, and the sampling method did not allow to determine if overweight and obesity affects a specific gender more than the other in north Africa. The prevalence of overweight and obesity is higher in females and urban people [4]. In fact, studies showed that women are more obesity-prone than men [4]-[6]. The estimation of obesity using the body fat percentage cutoffs mostly used in literature [7], [8] increased the number of obese women in our study. The results are similar to those found on different studies [7], [9], [10]. In fact, obesity is underdiagnosed using the current BMI references. The daily energy intake was over the recommended levels in the majority of cases. However, the percentages of the macronutrient energy intake were in the range of the recommended percentages. The distribution of saturated fat, monounsaturated fat and polyunsaturated fat intake was respecting the recommendation. These results were similar to those of Mokhtar N. et al. [5]. Regarding micronutrients, several insufficient intakes were noted. Iron and calcium inadequate intake were largely observed in obese and overweight adults [11]-[13]. In fact, with increasing weight there was a trend towards a decrease in vitamin and mineral intake [14]. The physical inactivity was approaching the 2/3 of participants which reflects the general population inactivity in our country. Leisure time is spent mostly on sedentary media and more households are using motorized vehicles [15]. This inactivity trend is one of the main determinants of overweight and obesity all over the world [15], [16]. An energy deficit is the key for achieving a weight loss. Different studies showed that Physical activity combined with diet modification is more efficient in reducing weight than diet restriction alone [17]-[19]. In fact, the most effective weight loss intervention is the one where calories are reduced, physical activity is increased in association with behavior strategies to allow a good adherence for long term results [20]-[22]. All these factors make the obese population vulnerable to obesity-related diseases and even mortality [16]. The diseases associated with increased fat mass are psychological dysfunction, sleep apnea [23] and osteoarthritis. The latter is particularly frequent in our participants reaching 51%. Our study did not focus on psychological dysfunction, but all the other diseases were reported by our participants. The diseases due to increased fat cell size and their secretions are type 2 diabetes, insulin resistance and metabolic syndrome including hypertension [23]. There are also liver diseases comprising Nonalcoholic fatty liver disease (NAFLD), nonalcoholic steatohepatitis (NASH) and Cholelithiasis [24], [25]. Liver issues were reported in 14% of
participants. In addition to the morbidity that impacts the society’s health and economy, the BMI is a great predictor for overall mortality mainly related with cardiovascular diseases [26]. On the biological level, studies have shown that overweight and obesity tend to increase serum glucose. The lipid profile shows a major trend towards hypertriglyceridemia, an elevation in total and LDL cholesterol concentration and a decrease in the HDL cholesterol levels [27]. Uric acid concentration is higher with an increased BMI and the level of risk for hyperuricemia is greater if there is a metabolic syndrome [28]. We found a significant weight loss in our study which was in conformity with the results of MJ Franz and al meta-analysis [29]. However, the weight loss was mainly due to fat free mass loss in our participants. These results might be due to the shortness of the study period or the low intensity physical activity. In fact, an intends physical activity is more effective to maintain muscle mass [29]. The nonsignificant decrease in TC, LDL cholesterol and TG compared to the baseline in our study also aligns with the results of the same meta-analysis [30]. There are multiple strategies for weight management using different diets and physical activity intensity, but the best strategy is the personalized one [31]. the Mediterranean diet seems to be slightly more effective than other diets in reducing body weight and BMI [32] or at least it is the healthiest diet for weight control [33].

V. CONCLUSIONS

Overweight and obese people are subjects to multiple deficiencies in vitamins and micronutrients. In our study, a deficiency in vitamin B1, folate, vitamin C and E intake were frequent among obese adults. These deficiencies should be particularly sought in this population. Obesity related diseases were dominated by osteoarticular and metabolic diseases such as hyperglycemia, and hypertriglyceridemia. There is no doubt that lifestyle interventions using a healthy diet and a physical activity increasing is effective in reducing the BMI and obesity related diseases in the long term. Our study was conducted for three weeks, a short period that showed a significant decrease in BMI. The weight loss at this point concerned the fat free mass in spite of a well-balanced diet. However, it was not long enough to intervene in improving the biological tests. The healthcare system in Tunisia should include these lifestyle interventions in national programs to reduce obesity and obesity related diseases especially that one of the healthiest diets for weight loss and its maintenance is the Mediterranean diet which is the traditional Tunisian diet.

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