Anthropometric Profile and Nutritional Intake in a Tunisian Population of Medical Students

Eya Safi, Yosra Htira, Zohra Hadj Ali, Imene Hedfi, Chaima Jemai, and Faika Ben Mami

ABSTRACT

Young students, in particular those in the medical field, seem to have poor eating habits and therefore inadequate nutritional intake.

We aimed to study the anthropometric and nutritional profile of a Tunisian population of medical students.

We conducted a descriptive cross-sectional study at the Medical University of Tunis between November 2019 and May 2020. It included 250 students. Each student benefited from a dietary survey and anthropometric measurements.

A female predominance was noted in 71.2% of cases. The mean BMI was 23.28 [16.01-35.67] kg/m². Abdominal obesity was present in 30% of cases.

More than a third of the students had a hypocaloric (38.4%) or hypogluteric (41.2%) intake. The majority (82.4%) had a high protein intake and 51.6% had a high fat intake.

Regarding micronutrients, iron deficiency was noted in more than half of the cases (55.8%). Insufficient vitamin D intake was found in two-thirds of the cases (68.8%). Dietary fiber intake was insufficient in most students (84.4%).

These results justify the need for providing nutritional education among medical students in order to preserve the physical and mental health of future caregivers.

Keywords: BMI, caloric intake, medical students, micronutrients.

I. INTRODUCTION

A healthy diet helps prevent the onset of chronic diseases, especially cardiovascular and metabolic pathologies and contributes to the optimal functioning of the body. Eating habits are mainly established during late adolescence and early adulthood [1]. Nowadays, young adults, especially students, tend to have poor dietary practices [2], even the most aware subjects, namely medical students.

In this perspective, we propose to conduct a cross-sectional survey on a representative sample of students at the Medical University of Tunis.

Our objective was to study the anthropometric profile as well as the nutritional intake in this population.

II. METHODS

A. Study Population

This was a descriptive cross-sectional study conducted in the Tunisian medical Faculty over a period of 7 months.

We collected 250 students, 50 per year of study. Those who refused to complete the questionnaire and those who were absent at the time of recruitment were not included. We excluded students who partially responded to the questionnaires.

The study was approved by the university ethics committee and each student gave consent to participate in the survey.

B. Data Collection

Recruitment was conducted randomly, using posters, within the faculty.

1) Anthropometric measurements

Weight was measured for each student, after the removal of shoes, using a scale. Height was determined using a measuring rod. The Body Mass Index (BMI) was calculated. It corresponds to the ratio Weight/height² expressed in kg/m² (the weight being expressed in kg and the height in meter).

We referred to the BMI classification proposed by the WHO to divide our students into the 4 categories of

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considered carbohydrate and fat intakes excess the recommended fat intake of 1 g/kg ideal weight/day. We interpreted according to WHO [10] with a recommended carbohydrate intake of 5 g/kg ideal weight/day and a formula [9].

Abdominal obesity was defined according to the IDF (International Diabetes Federation) 2005 criteria by a WC ≥ 94 cm in men and ≥ 80 cm in women [5].

2) Dietary survey

Each participant received a dietary survey based on the food history method with a 24-hour recall. This technique allows the participant to recall and report all food and beverages consumed during the previous 24 hours.

For the quantification of portions, we used the manual established by the Zouhair el Kallel Institute [6].

The foods consumed were converted into nutrients by referring to the nutritional composition tables of foods proposed by the Ciquel table. The exploitation of the results of this survey was carried out thanks to the computer software available online "Nutrilog" in order to obtain nutritional balance. The latter provides information on total spontaneous energy intake, macronutrient, and micronutrient intake (minerals, vitamins, and trace elements), saturated fatty acid (SFA), monounsaturated fatty acid (MUFA), polyunsaturated fatty acid (PUFA) and cholesterol intake, as well as dietary fiber intake.

We considered the energy balance at equilibrium when the global energy intake is equivalent to the total energy expenditure (TEE). This expenditure corresponds to the energy spent on average over 24 hours. It varies from one individual to another and depends on several factors, essentially the basal metabolic rate (BMR), estimated in our study by the formula of Black and AI [7], thermogenesis, and the energy dedicated to physical activity. Given the inter-individual variability of the intensity and duration of physical activity, the TEE can be estimated by multiplying the resting energy expenditure (corresponding to the BMR) by the PAL (physical activity level), a factor determined for many activities of daily living and reflecting the intensity of a person's physical activity.

The PAL values are used to classify individuals according to their activities as sedentary or slightly active (between 1.4 and 1.69), active or moderately active (between 1.7 and 1.99), or vigorously active (between 2 and 2.4) [8].

Thus, we calculated for each student the minimum and maximum TEE by multiplying the BMR by the minimum and maximum PAL, respectively. We considered spontaneous caloric intake hypocaloric if it was less than the calculated minimum TEE, normocaloric if it was between the minimum and maximum TEE, and hypercaloric if it was greater than the calculated maximum TEE.

To calculate the nutritional requirement indices for each student, we used the ideal weight, determined by the Lorentz formula [9].

The carbohydrate and fat nutritional indices were interpreted according to WHO [10] with a recommended carbohydrate intake of 5 g/kg ideal weight/day and a recommended fat intake of 1 g/kg ideal weight/day. We considered carbohydrate and fat intakes excessive if they exceeded the recommended intakes and insufficient if they were less than 5 and 1 g/kg ideal weight/day, respectively.

For protein nutrient indices, we chose the EFSA 2017 [7] for our population of young adults, i.e., 0.83 g/kg ideal weight/day.

We referred to the recommendations of Anses 2016 and those of EFSA 2017 for the interpretation of cholesterol and saturated, monounsaturated and polyunsaturated fatty acid intakes [7].

For fiber, we considered intakes to be inadequate if they were below the recommended intake of 30 g/day [7].

For the different classes of micronutrients, we considered that at the individual level, spontaneous intakes were satisfactory if they were between 70 and 100% of the Recommended Dietary Allowance (RDA). They were considered inadequate below 70% of the RDA [11].

III. Results

The mean age of the participants was 21.6 years with extremes ranging from 18 to 29 years. A female predominance was noted, with a sex ratio of 0.4.

The mean BMI was 23.28 kg/m² with extremes ranging from 16.01 to 35.67 kg/m². It was significantly higher in the male population (p=0.002).

Two thirds of our sample had a normal weight. Only one student was class II obese. There were no cases of morbid obesity or severe underweight.

Abdominal obesity was found in 30% of the students, with a female predominance (women N=54 versus men N=21).

The average spontaneous caloric intake was 2388.5 [538–6187] kcal/day. It was insufficient in more than a third of the cases (38.4%), normal in 34%, and excessive in 28%.

Table 1 summarizes the average intake of macronutrients, fatty acids, and cholesterol.

Carbohydrate intake was insufficient in more than one-third of the cases.

Table I: Average Intakes of Macronutrients, Fatty Acids and Cholesterol

<table>
<thead>
<tr>
<th>I N TAKES</th>
<th>M ACRONUTRIENT</th>
<th>A VERAGE</th>
<th>S TANDARD D EVIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates (g/kg/day)</td>
<td>4.46</td>
<td>1.68</td>
<td></td>
</tr>
<tr>
<td>Protein (g/kg/day)</td>
<td>1.44</td>
<td>0.57</td>
<td></td>
</tr>
<tr>
<td>Fat (g/kg/day)</td>
<td>1.51</td>
<td>0.61</td>
<td></td>
</tr>
<tr>
<td>SFA (%) TEI</td>
<td>10.96</td>
<td>3.57</td>
<td></td>
</tr>
<tr>
<td>MUFA (%)TEI</td>
<td>14.29</td>
<td>3.52</td>
<td></td>
</tr>
<tr>
<td>PUFA (%)TEI</td>
<td>6.19</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td>Cholesterol (mg/day)</td>
<td>348.98</td>
<td>277.19</td>
<td></td>
</tr>
<tr>
<td>AP/VP</td>
<td>1.89</td>
<td>1.51</td>
<td></td>
</tr>
</tbody>
</table>

TEI: Total Energy Intake.

Table II: Insufficient and Excessive Macronutrient Intakes

<table>
<thead>
<tr>
<th>I NSUFFICIENCY</th>
<th>S AMPLE (N=250)</th>
<th>E XCESS</th>
<th>S AMPLE (N=250)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate intake</td>
<td>103 (41.2)</td>
<td>78 (31.2)</td>
<td></td>
</tr>
<tr>
<td>Protein intake</td>
<td>15 (6)</td>
<td>206 (82.4)</td>
<td></td>
</tr>
<tr>
<td>Fat intake</td>
<td>8 (3.2)</td>
<td>129 (51.6)</td>
<td></td>
</tr>
<tr>
<td>SFA intake</td>
<td>148 (59.2)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>MUFA intake</td>
<td>67 (26.8)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Cholesterol intake</td>
<td>-</td>
<td>115 (46)</td>
<td></td>
</tr>
</tbody>
</table>

AP/VP | - | 246 (98.4) |
The majority of students (82.4%) had a hyperprotein intake with a predominance of animal protein (AP) over vegetable protein (VP) (AP/VP > 0.33) and more than half (51.6%) had a hyperlipid intake. The insufficiency and excess of macronutrients are represented in Table II.

Table III shows the mean micronutrient intakes. The mean dietary fiber intake was 22.01 ± 9.48 g/day. The mean water intake was 2408.96 ± 872.65 ml/day.

Micronutrient deficits are summarized in Table IV.

Dietary fiber intake was insufficient in most students (84.4%) and more than a third of our sample (38.8%) had a water deficit.

### Table III: Average Micronutrient Intake

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Average mg/day</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>1019.06</td>
<td>410.13</td>
</tr>
<tr>
<td>Magnesium</td>
<td>387.91</td>
<td>146.42</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>1335.68</td>
<td>547.83</td>
</tr>
<tr>
<td>Iron</td>
<td>12.66 ± 9.75</td>
<td>6.19 / 4.25</td>
</tr>
<tr>
<td>Sodium</td>
<td>5816.36</td>
<td>1424.28</td>
</tr>
<tr>
<td>Potassium</td>
<td>2760.84</td>
<td>1055.81</td>
</tr>
</tbody>
</table>

#### B Vitamins

- B1 (mg/day): 1.08 ± 0.46
- B2 (mg/day): 1.61 ± 0.72
- B3 (mg/day): 22.26 ± 12.57
- B6 (mg/day): 1.72 ± 0.87
- B9 (µg/day): 332.17 ± 143.77
- B12 (µg/day): 3.87 ± 4.33

#### Vitamins

- A (µg/day): 784.54 ± 637.99
- C (mg/day): 135.91 ± 115.54
- D (µg/day): 10.20 ± 2.17
- E (mg/day): 18.63 ± 9.66

#### Trace elements

- Iodine (µg/day): 219.9 ± 108.3
- Zinc (mg/day): 9.08 ± 3.96
- Copper (mg/day): 1.43 ± 0.67
- Selenium (µg/day): 230.53 ± 90.78
- Manganese (mg/day): 3.43 ± 3.34

### Table IV: Micronutrient Deficiencies

<table>
<thead>
<tr>
<th>Micronutrient deficiency</th>
<th>% of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>18</td>
</tr>
<tr>
<td>Magnesium</td>
<td>16</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.8</td>
</tr>
<tr>
<td>Iron</td>
<td>55.8</td>
</tr>
<tr>
<td>Potassium</td>
<td>43.6</td>
</tr>
<tr>
<td>Sodium</td>
<td>-</td>
</tr>
</tbody>
</table>

#### B Vitamins

- B1: 35.2
- B2: 20.8
- B3: 10.4
- B6: 20.4
- B9: 24
- B12: 46.4

#### Vitamins

- A: 33.6
- C: 37.6
- D: 68.8
- E: 6

#### Trace elements

- Iodine: 8.4
- Zinc: 20.8
- Copper: 7.6
- Selenium: -
- Manganese: 8

### IV. Discussion

The average BMI of our students was 23.28 kg/m² [16.10–35.67] and 2/3 of the population were of normal weight. Reference [12–15] found similar results with a majority of participants being of normal weight (58.9%, 66%, 72.4%, and 73.1%, respectively).

BMI in our study was significantly higher in the male population (p<0.002). Concordant results were found in other surveys, such as [16], where female students had a mean BMI of 21.4 kg/m² and male students had a BMI of 22.7 kg/m² (p<0.001). Similarly for surveys by [14] and [17] surveys, p<0.01 and p<0.001, respectively. The one by [18] also showed that the mean BMI of Iranian students was 22.76±3.09 kg/m² in male students and 21.5±2.77 kg/m² in female students with a statistically significant difference (p<0.001).

This could be explained, in part, by the fact that women are more preoccupied with their weight and show a greater desire to be slim, hence their lower BMI [17]. Regarding the nutritional profile of our population, the average daily caloric intake was 2388.5 kcal/day [538–6187 kcal/day]. This intake was insufficient in more than a third of the students (38.4%) and excessive in 28% of the cases.

In the study by [19], conducted in 2012 among 194 medical students at Taibah University in Saudi Arabia, the mean spontaneous caloric intake was 2314.2 kcal/day, close to that found in our survey. Caloric intakes below the recommendations were noted in the studies of [20] and [21]. However, the intake was hypercaloric with an excess of 215 kcal/day in men and 119.5 kcal/day in women in a population of medical and pharmacy students in Budapest [22]. In this same population, an excess of protein intake was found, which is consistent with our result where the majority (82.4%) of students had a hyperprotein intake with a predominance of AP.

However, the intake was normoprotein in many studies such as [19] and [23]. A hypoprotein intake was reported by [21].

As for carbohydrate intake, in our sample, it was deficient in more than one-third of cases (41.2%) and excessive in 31.2% of cases.

Divergent results have been found in the literature. [19] showed that the carbohydrate intake of Saudi students was significantly higher than the recommended daily allowance (RDA) (162.9% of the RDA), whereas in the study by [23], the majority of Swedish medical students had a carbohydrate intake in line with recommendations. Reference [21], on the other hand, found that carbohydrate intake was decreased compared to the RDA.

Furthermore, we noted that more than half (51.6%) of the medical students had a hyperlipidic intake with an excess of SFA in more than a third of the cases (38.8%). This excess in saturated and total fats has also been found in another previous research [20–22], [24]. In this same context, the average SFA intake was 14% in the 13-year study of Greek medical students [25] and was over 12% in the survey [23], exceeding the average intake of our students (10.96%).

This high fat intake could be explained, according to a study carried out in Peru with 523 first-year medical students, by a high level of stress (p<0.001). Indeed, there is evidence...
that high-stress levels increase cortisol secretion, which in turn increases fat intake [26, 27].

Cholesterol intake was excessive in almost half of the cases (46%). This excess was also highlighted in the studies of [22] and [25] in both sexes, as well as in those of [19] and [20], essentially in the male population.

In contrast, dietary fiber intake was inadequate in most students (84.4%). This result is consistent with several nutritional surveys of future physicians where dietary fiber deficiency was evident [19], [20], [24], [25].

Regarding micronutrients, deficiencies were highlighted in our population such as the deficiency in iron (55.8%), potassium (43.6%), vitamins, especially vitamin D (68.8%), B1 (35.2%), B2 (20.8%), B12 (46.4%), A (33.6%), C (37.6%), as well as zinc (20.8%) and calcium (18%).

Vitamin D deficiency has been frequently reported in previous dietary surveys [19], [21]-[23]. Other deficiencies have been found in the diets of medical students around the world to varying degrees. These deficiencies are mainly related to iron, potassium, zinc, and calcium [19], [20], [22], [25], as well as vitamin intakes such as B vitamins, A and C [19], [21], [22].

Indeed, fruits and vegetables are known to be rich in dietary fiber, minerals, and vitamins. Therefore, the low combined intake of these nutrients described in our study and in the literature could be explained by low intakes of these foods. This has been highlighted in many studies that have investigated the dietary habits of students, particularly those in the medical field [1], [2], [28]-[30].

V. CONCLUSION

The dietary profile of the students was characterized by deficiencies and excesses affecting all nutrients to varying degrees. This underlines the importance of providing adequate nutritional education for all students in order to improve their diets and consequently their physical and mental well-being.

CONFLICT OF INTEREST

Authors declare that they do not have any conflict of interest.

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