Nutritional status and dietary behaviours of Northern Algeria university students

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Abstract. The present study tries to assess the nutritional status and dietary behaviours in a group of undergraduate students in order to characterize their food habits and assess the quality of their diet. A cross-sectional study was conducted with 220 undergraduate university students (110 male and 110 female) aged between 19 and 24 years from the Food Department of Saad Dahlab Blida 1 University (Algeria). The data collection and nutritional evaluation were carried out using DIAL nutritional software. Male participants had significantly ($P < 0.005$) higher body mass index (BMI) when compared to females. Significantly higher percentages of female students ($P < 0.005$) had tried a low-fat diet ($P = 0.0075$) and a low-carbohydrate diet ($P < 0.005$). The prevalence of overweight was higher among males compared to females. In contrast, a greater percentage of underweight students were observed in the group of female subjects. Related to micronutrient intake, a significant difference by sex was observed for vitamin A, C, folic acid, iron, calcium, and sodium intakes. However, females consumed more food containing vitamins C and A, whereas males' intake of calcium, sodium, folic acid, and iron was higher than the corresponding values observed in females. To conclude, these students reported a diet characterized by a high variety of cereal products and a moderate amount of vegetables, milk and dairy products, meat, fish and eggs, dietary fats and beverages, whereas the consumption of fruits was highly infrequent.

Keywords and phrases: food intake, diet, university students, macro- and micronutrients

1. Introduction

Obesity has become a serious epidemic health problem, and it is considered the fifth leading cause of mortality at the global level (*James et al.*, 2004). Overweight and obesity are major risk factors for several of the chronic diseases, including diabetes, hypertension, cardiovascular diseases (metabolic syndrome), and cancer. Some of the major causes of obesity are those changes in people's diet, in terms of quantity and quality, which have become more "Westernized" (*Gasbarrini & Piscaglia*, 2005). Consequently, the government regularly gives healthy eating recommendations and publishes national dietary guidelines to improve healthier dietary intakes (*NCM*, 2012; *USDA*, 2015).

In the recent decades, most of these populations have rapidly changed this ancient lifestyle towards more globalized behaviours – particularly young people (*Garcia-Closas et al.*, 2006). This new lifestyle involves several risks for health, especially increased prevalence of obesity and non-communicable chronic diseases associated with obesity and diet (*Schmidhuber & Traill*, 2006). In Algeria in 2018, the death cases (% of all deaths, all ages, both sexes) are associated in a proportion of 36% with cardiovascular diseases, 13% with cancers, 4% with diabetes, and with 3% chronic respiratory diseases. The obesity of adults aged over 18 years presented a major risk factor for these diseases with a mortality rate of 27% (19% males and 34% females) (*WHO*, 2018). The dietary record (DR) is highlighted among the prospective methods (*Ortega et al.*, 2009; *Thompson & Byers*, 1994). A DR is a prospective open-ended assessment method where the subject records all the foods and beverages consumed over a specific period of time (*Ortega et al.*, 2015).

In this study, a sample of undergraduates was requested to record information about food ingredients of recipes and preparation methods of consumed foods. Then, data were collected after food consumption. In order to obtain consistent data, students were trained how to use the DIAL software before participating in this survey. Academic years are a critical period regarding unhealthy changes in eating behaviours in students because most of them live far from their family, at the university campus (*Ugartemendia et al.*, 2020).

Nutritional deficiencies are very significant to the overall health of humans at all ages and for both genders; these deficiencies can seriously affect growth and development. The present work aimed to assess the food behaviour of students in order to characterize their food habits and assess the quality of diet in a sample of Algerian university students.

2. Materials and methods

Participants

The present cross-sectional study was carried out in a group of undergraduates, which comprised a total of 220 university undergraduate students living in Blida city, which is located 50 km south of Algiers (Algeria). Volunteers were chosen randomly from the Biology Department of Blida 1 University during the fall of academic year 2016/2017. Participants were excluded if they were aged under 18 or over 25 years. Approval to perform the study was obtained from the scientific board of the Faculty of Sciences, M'Hamed Bougara University of Boumerdes. All the procedures performed in this study were in accordance with the ethical standards of the Helsinki declaration.

Data collection and dietary assessment

Students were asked to fill out a self-reported quantitative questionnaire that included questions on their eating, drinking, and physical activity. Also, their weight, height, and body mass index were measured. Body mass index (BMI) was used to assess students' weight status. BMI values were categorized according to the World Health Organization (WHO) criteria as follows: < 18.5 kg/m² as underweight, 18.5–24.9 kg/m² as normal weight, 25–29.9 kg/m² as overweight, and ≥ 30 kg/m² as obese (*WHO*, 1997). Participants were asked to record in detail the daily food and beverage intake (type, quantity, and mealtimes) throughout twenty-one consecutive days (*Aidoud et al.*, 2019). The students from the Food Department were recruited from Blida 1 University; they received training related to dietary behaviours and how to use the DIAL® software. The DIAL® software has been developed to calculate, program, and modify any kind of diet fast and easily. It contains a nutritional table with more than 800 foodstuffs and a wide variety of information about their composition (up to ~140 different components in the most frequent foodstuffs). Information about foodstuffs contains not only their most common names but also the less frequent ones. In addition, this software allows to calculate diets depending on age, body composition, and basal metabolic rate, among other variables. Therefore, this software provides a very useful environment for teaching about dietetics in higher education but also for research purposes.

Data were computer-processed for the nutritional assessment using the DIAL software (Alce Ingeniería S.L., Spain). The variables provided by the software were: body mass index (BMI), dietary content of nutrients (macro- and micronutrients), energy intake, lipid content, and percentage of energy consumed according to food groups. For each subject, BMI was calculated with the DIAL® software as weight

(kg)/height^2 (m^2). All food groups' diets are compared to recommended daily allowance (*NCM*, 2012; *USDA*, 2015) considering the self-reported weekly physical activity. The nutritional composition of the diets was analysed by students trained in the DIAL® software, which contains information about energy and nutrient content in terms of foods and recipes (*Ortega et al.*, 2010).

Statistical analysis

Data were expressed in terms of mean ± standard deviation (SD). Therefore, this was the chosen manner to express descriptive data to determine the prevalence of overweight and obesity in the sample. In order to elucidate the differences in the variables between males and females with respect to the RDA, statistical analyses were performed with one-way analysis of variance (ANOVA), followed by Tukey's post-hoc test. The degree of significance was set at $P < 0.05$. Both descriptive and inferential statistics were performed using GraphPad Prism (version 6.01, 2012; GraphPad Software, Inc; San Diego, CA, USA).

3. Results and discussions

Characteristics of the students' sample

The descriptive statistics of the students' variables assayed by the research group are presented in *Table 1*. Students participating in this study (n = 220) included 110 females and 110 males and were enrolled in Blida 1 University (age: 21.76 ± 1.39 years). Participants' average height and weight were 168 ± 8 cm and 61.76 ± 11.32 kg respectively. The mean BMI was 21.74 ± 2.77 (kg/m^2). As described in *Table 1*, this study showed that the highest percentage of the students (75.45%) were of normal weight ($18.5 \leq BMI \leq 24.9$), this value being slightly higher in the population of female students. The prevalence of overweight ($25 \leq BMI \leq 29.9$) was more frequently reported among male students compared to females (21.82% and 5.45% respectively). No case of obesity was found among the university students. However, 15.45% of the female students and 6.36% of the male students were underweight ($BMI \leq 18.5$). Most studies recorded a low prevalence of obesity and overweight among Chinese and Japanese students (*Rie et al.*, 2004; *Ruka et al.*, 2005). In contrast, all participants were non-smokers and were in good health, without any medication.

Table 1. Characteristics of graduate students' sample and BMI categories (Mean ± SD)

Variables	Total n = 220	Males n = 110	Females n = 110
Age (year)	21.76 ± 1.39	22 ± 1.50	21.50 ± 1.23
Weight (kg)	61.76 ± 11.32	69.92 ± 9.54	53.59 ± 5.73
Height (cm)	168 ± 8	174 ± 6	162 ± 5
BMI (kg/m²)*	21.74 ± 2.77	23.10 ± 2.53	20.39 ± 2.29
– Underweight (n, %)	(24), 10.91	(7), 6.36	(17), 15.45
– Normal (n, %)	(166), 75.45	(79), 71.82	(87), 79.09
– Overweight (n, %)	(30), 13.64	(24), 21.82	(6), 5.45
– Obese (n, %)	(0), 0	(0), 0	(0), 0

* Categories according to BMI (WHO): Underweight < 18.5 kg/m²; Normal weight: 18.5–24.9 kg/m²; Overweight: 25–29.9 kg/m²; Obese: ≥ 30 kg/m².

Students' intake of the food group categories

Table 2 shows food intake in our sample, where a significant gender difference was observed. However, it was observed that the total energy intake (kJ) of female students was significantly ($P < 0.05$) lower in comparison with male students (6979 kJ/day and 9357 kJ/day respectively). Female students in average consumed 25% fewer calories than male students. The contribution of the different food groups to the total diet energy intake and macronutrients are presented in *Table 2*. This table shows the variables about students' behaviour regarding consumption in foodstuffs throughout three weeks. Generally, the most important amount of energy provided by the food group of cereals and its products (4731 ± 942 kJ/day for males and 3270 ± 1138 kJ/day for females) represents 51% and 47% of the total energy dietary intake respectively. This is in good agreement with a study conducted on Mediterranean students, which showed that Italian students consumed generally more cereals and vegetables in their diet (*Baldini et al.*, 2009).

Most students consumed moderately vegetables, milk and dairy products, meats, fish and eggs, dietary fats, and beverages – about 6–15% of the total dietary intake –, whereas the consumption of fruits was highly infrequent (3% and 2% of the diet total energy intake for male and female students respectively).

Table 2. The total energy dietary intake of the different food groups
(Mean ± SD)

| Food groups		Males n = 110	Females n = 110
Cereals	kJ/day	4731 ± 941.61	3270 ± 1138.35
	% energy	50.56 ± 10.06	46.85 ± 16.31
Vegetables	kJ/day	888 ± 258.03	502 ± 211.06
	% energy	9.49 ± 2.76	7.20 ± 3.02
Fruits	kJ/day	272 ± 128.12	167 ± 90.02
	% energy	2.91 ± 1.37	2.40 ± 1.29
Milk and dairy products	kJ/day	850 ± 268.16	1043 ± 314.26
	% energy	9.08 ± 2.87	14.94 ± 4.50
Meat, fish, and eggs	kJ/day	1135 ± 341.01	850 ± 297.77
	% energy	12.13 ± 3.64	12.18 ± 4.27
Oils and dietary fats	kJ/day	846 ± 237.77	716 ± 324.06
	% energy	9.04 ± 2.54	10.26 ± 4.64
Beverages	kJ/day	636 ± 196.53	431 ± 179.82
	% energy	6.80 ± 2.10	6.18 ± 2.58

Students' nutrient intake

In our study, a significant difference was observed between the sexes in terms of the frequency of macronutrient intake ($P < 0.05$). Furthermore, the authors noticed that male students consumed more macronutrients than female students (*Figures 1B–D*). Thus, the protein, carbohydrate, and fat content in male students' intake represented 15.71%, 51.15%, and 29.91% of the total energy intake respectively. However, the female students ingest an approximately equal amount of macronutrients (14.44%, 48.70%, and 28.48% respectively) as males.

As for micronutrients, a significant difference by gender was observed for vitamins A, C, folic acid, iron, calcium, and sodium intakes (*Figure 2*). However, female students consumed more foods containing vitamin C and A than male students, as demonstrated in *figures 2E–F* in the district of Blida. On the other hand, male students' intake of calcium, sodium, folic acid, and iron (*Figures 2A–D*) was more significant than female students' intake of these micronutrients. The sodium intake of both sexes was significantly ($P < 0.05$) increased compared with the RDA value of sodium.
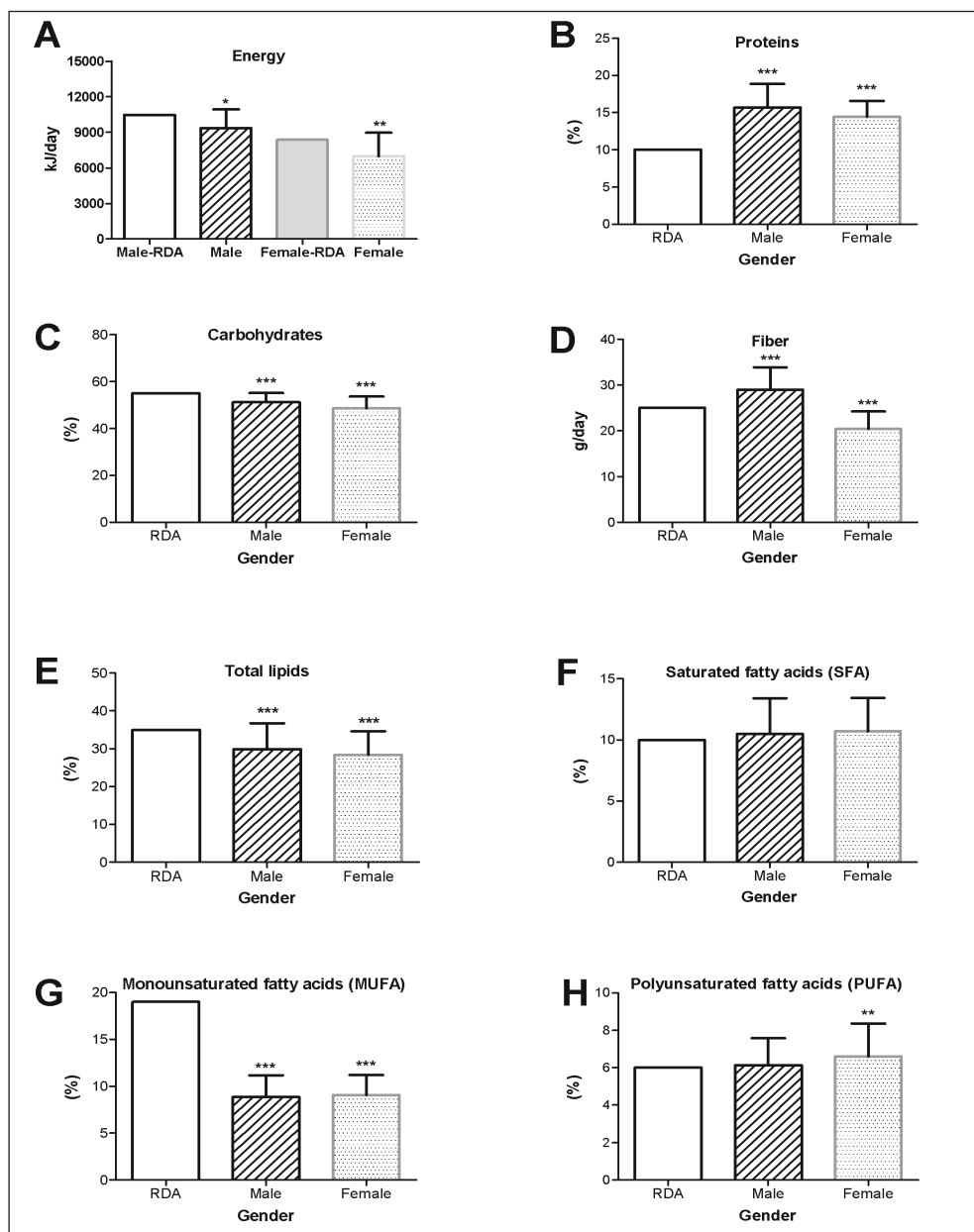
Note: Values represent mean ± SD. *P < 0.05 between students with respect to the RDA.

Figure 1. Macronutrient intake of university students: (A) Energy intake, (B) Protein intake, (C) Carbohydrate intake, (D) Fibre intake, (E) Total lipids intake, (F) SFA intake, (G) MUFA intake, (H) PUFA intake.
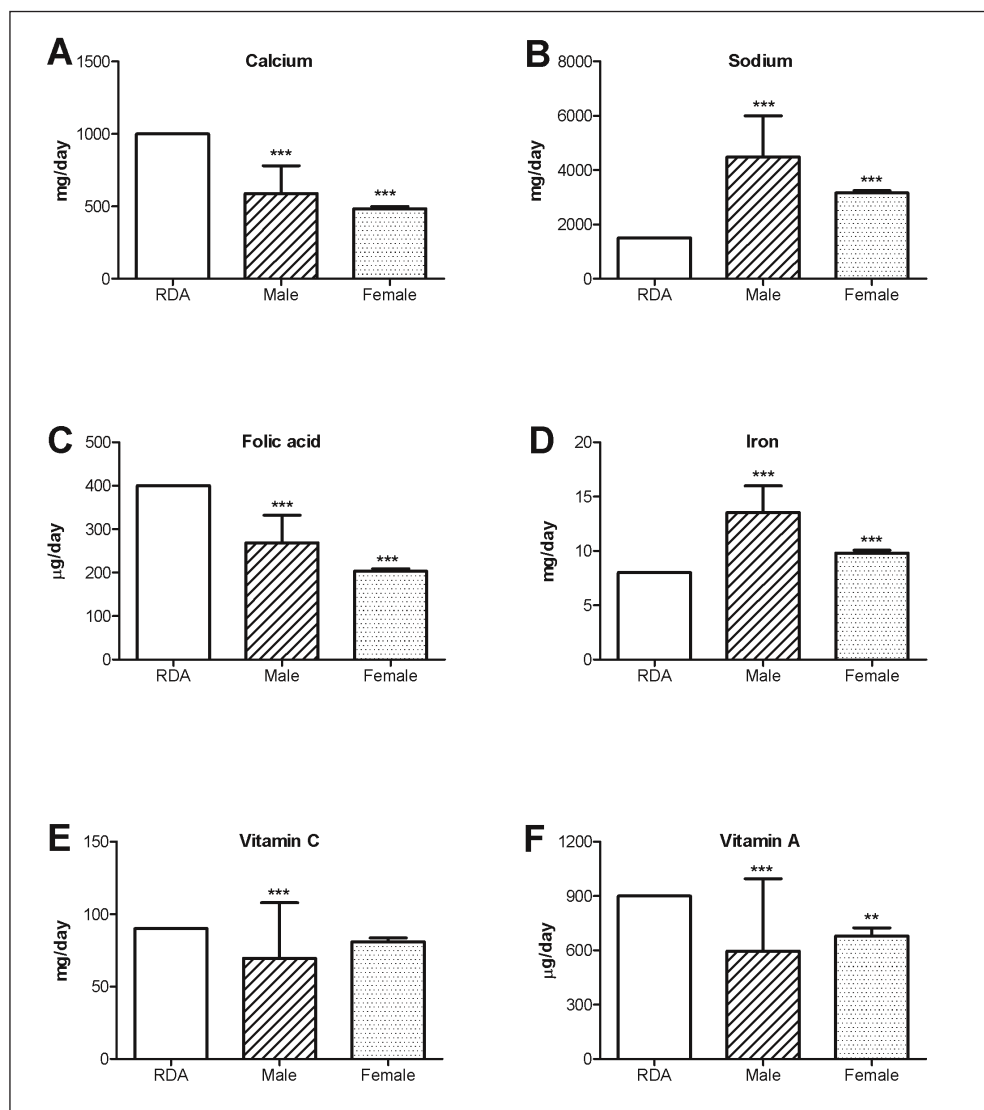
Note: Values represent mean ± SD. *P < 0.05 between males and females with respect to RDA.

Figure 2. Micronutrient intake of university students: (A) Calcium intake, (B) Sodium intake, (C) Folic acid intake, (D) Iron intake, (E) Vitamin C intake, (F) Vitamin A intake.

The population of the countries around the Mediterranean Sea has traditionally a characteristic dietary pattern: the Mediterranean Diet. This is a diet characterized by a high consumption of plant-based foods (i.e. whole-grain cereals, vegetables,

fruits, nuts, and seeds), a moderate intake of fish, seafood, eggs and dairy products, a moderate intake of wine and beer at meals, and, finally, by an occasional consumption of processed foods, ready-to-eat meat, and sweets. Also, olive oil is the primary oil in the diet (*Durá & Castroviejo*, 2011). In the last few decades, the Mediterranean diet has been recognized as one of the most effective dietary patterns in the prevention of several chronic diseases (*Koloverou et al.*, 2004; *Estruch et al.*, 2013; *Widmer et al.*, 2015). This may be due to the fact that this diet is rich in key nutrients and also provides an adequate balance of them. Among them, we would like to highlight the following: monounsaturated fatty acids present in olive oil, polyunsaturated fatty acids in nuts, dietary fibre in plant-based foods, and polyphenols in fruits as well as vitamins (vitamin A, vitamin D, vitamin E, folic acid, vitamin B12) and minerals (iron, calcium, magnesium, potassium).

However, the majority of these regions, which include developed, middle-income, and emerging societies, have rapidly changed this healthy lifestyle, leading to different kinds of risks for health (*Belahsen & Rguibi*, 2006). While researchers are still learning about the interplay among the combination of biological, psychological, interpersonal, and social factors, we know that eating disorders often begin in adolescence and young adulthood, a life stage associated with stressful events such as leaving home for college (*Allen et al.*, 2013; *FAO*, 2012). However, economic growth in developing countries and the globalization of the food sector is leading to 165 increasingly similar food consumption patterns worldwide. In addition, the prevalence of obesity and 166 several non-communicable chronic diseases associated with obesity and diet has increased (*FAO*, 2012; *Schmidhuber & Traill*, 2006). The period necessary for undergraduates to obtain their degrees constitutes a critical stage that may entail consequences for the quality of lifestyle and eating habits (*Lupi et al.*, 2015). Current findings also coincide with previous research suggesting that unhealthy food intake is a common coping mechanism implemented in response to stress in undergraduate students (*Wichianson et al.*, 2009). Nowadays, it is generally accepted that modern diet is energy-dense but nutrient-poor (*Nikolaou et al.*, 2015). Accordingly, we observed our sample population did not take in enough amounts of vitamin A (both sexes) or vitamin C (only male) compared with vitamin recommendations (*Troesch et al.*, 2012). The amount of energy supplied by proteins and carbohydrates was in line with the current international recommendations. In contrast, the energy provided by fats was slightly lower than the recommended value (30–35%) (*NCM*, 2012; *USDA*, 2015). A possible explanation may be that female students tend to have increased exposure to unhealthy eating habits or unbalanced diets such as low intake of fruits, vegetables, and cereals and slightly higher intake of milk and dairy products, oils, dietary fats, and beverages.

4. Conclusions

We conclude that the students of Blida 1 University reported a high variety of cereal products, which represent almost half of the energy input in their diet. Most students consumed moderately the food group of vegetables, milk and dairy products, meat, fish and eggs, dietary fats, and beverages, whereas the consumption of fruits was very limited. We recommend more nutritional education for young people, especially encouraging a higher intake of vegetables, olive oil, dairy products, fish and a lower intake of sodium so as to return to the Mediterranean diet and fight against CVD and obesity with a view to achieving an improved health in the future.

Conflict of interest

The authors declare that there are no conflicts of interest.

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