

ORIGINAL ARTICLE

Assessment of dietary intake in Spanish university students of health sciences



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KEYWORDS

Dietary intake;
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Abstract

Introduction: Nutritional intake during early ages has been associated to disease onset later in life. This study aimed to assess dietary intake in Spanish university students of health sciences as compared to national recommended dietary intakes (DRIs).

Methods: A cross-sectional study was conducted including 585 university students of health sciences aged 18–25 years. Dietary intake was assessed using a 72-h diet recall. A control group was selected from Spanish National Dietary Intake Survey (ENIDE) data.

Results: Intake of energy, protein, fat, fatty acids, and cholesterol was significantly lower ($p < 0.001$) in university students compared to controls, while fiber intake showed the opposite trend ($p < 0.001$). Total fat and carbohydrate intake was consistent with recommendations, but protein intake was lower than recommended. Intake of saturated fatty acids (SFAs) was markedly higher than nutrition goals, while intake of monounsaturated fatty acids (MUFAs) was lower. Both students and the reference control group did not reach the optimal dietary intake of iodine and vitamins D and E, while sodium intake was excessive in both groups.

Conclusions: Dietary habits of university students were mainly characterized by low intakes of energy, protein, fats, fatty acids, and cholesterol, and high intake of fiber as compared to the general population. Intake of iodine and vitamins D and E was low, while sodium intake was excessive in both university students and the general population. Dietary interventions should be considered to prevent nutritional deficiencies and to ensure a balanced diet.

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PALABRAS CLAVE

Ingesta dietética;
Micronutrientes;
Macronutrientes;
Estudiantes
universitarios

Evaluación de la ingesta alimentaria en estudiantes universitarios españoles de ciencias de la salud

Resumen

Introducción: La ingesta nutricional durante las edades tempranas se ha asociado con enfermedades que se inician en etapas más avanzadas de la vida. Nuestro objetivo fue evaluar la ingesta alimentaria entre los estudiantes universitarios españoles de ciencias de la salud en relación con la ingesta diaria recomendada (DRI) nacional.

Métodos: Se realizó un estudio transversal entre 585 estudiantes universitarios de ciencias de la salud, de 18 a 25 años de edad. La ingesta dietética se evaluó utilizando un recordatorio de la dieta de 72 h. Se seleccionó un grupo control de los datos de la Encuesta Nacional de Ingesta Dietética (ENIDE).

Resultados: La ingesta de energía, proteínas, grasas, ácidos grasos y colesterol fue significativamente menor ($p < 0,001$) entre los estudiantes universitarios en comparación con los controles, mientras que la ingesta de fibra mostró una tendencia opuesta ($p < 0,001$). La ingesta total de grasas y carbohidratos estuvo en consonancia con las recomendaciones, sin embargo, la ingesta de proteínas fue superior a las recomendaciones. La ingesta de ácidos grasos saturados (AGS) fue notablemente superior a los objetivos nutricionales, mientras que la ingesta de ácidos grasos monoinsaturados (AGM) fueron menores. Los estudiantes, así como el grupo de control, no alcanzaron una ingesta dietética óptima de yodo, vitaminas D y E, mientras que la ingesta de sodio fue excesiva.

Conclusiones: Los hábitos alimenticios en los estudiantes universitarios se caracterizan principalmente por una baja ingesta de energía, proteínas, grasas, ácidos grasos y colesterol, y un alto consumo de fibra en comparación con la población general. Existe una ingesta deficitaria de yodo, vitaminas D y E tanto en estudiantes universitarios como en la población general, así como un consumo de sodio superior al recomendado. Deben considerarse intervenciones dietéticas para prevenir las deficiencias nutricionales y garantizar una dieta equilibrada.

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Introduction

Unfavorable nutritional intakes have been considered as risk factor for several chronic diseases including obesity, osteoporosis or type 2 diabetes among others.^{1–3} In addition, it has been well established that nutritional intake during early ages is associated with diseases onset later in life.⁴

Young adults, and especially university students, are accepted as being a risk population for nutritional deficiencies due to unhealthy dietary habits. In fact, starting university has been related to improper intake pattern by adopting a more westernized diet characterized by a low consumption of fresh fruits and vegetables, monounsaturated fatty acids (MUFA), polyunsaturated fatty acids (PUFA) and fish and an increased intake of sugar, alcohol and fast food.^{5–8} This pattern seems to be worsened as far as the academic course goes on growing the risk of malnutrition and/or obesity, metabolic and cardiovascular diseases in this population.⁵

Previous studies conducted in different countries have identified undesirable nutritional status among university students with a diet poor in important nutrients such as dietary fiber, folate, calcium, iron and vitamin A.^{9–11} Also, some of them have reported important rates of overweight particularly in men.^{10,11} Potential causes including changes in living arrangements, cost resources, lack of experience

in the planning of meals and an increase in consumption of fast food and snacks have been identified.^{6,12}

Among university students, those who are studying health sciences deserves special attention, since are supposed to be more aware of the importance of dietary habits for health status and the relevance of dietary intake during early ages in the development of chronic diseases later in life.^{13–15} Therefore, the analysis of dietary intake among this specific group of university students is of interest. Although previous reports at Spanish national level have investigated the dietary intake across young adults, there is limited information available on energy/nutrient intake among Spanish university students^{16–18} and in particular among health science students. Thus, the purpose of this study was to investigate the dietary habits among health sciences university students.

Methods

Design and sample

A cross-sectional study was conducted among health sciences students of the University of Granada (Spain) including nurses, physiotherapists and occupational therapists. A convenience sample of five hundred and eighty-five students (68.54% females and 31.45% males) (72% nurses, 17% physiotherapist and 11% occupational therapists), aged 18–25

years participated in this study. A member of the research explained the objectives and characteristics of the study. Subject inclusion criteria included being health sciences students (Nursing, Physiotherapy or Occupational therapy degrees) during the academic year 2014–2015, not having changed the eating habits in the last six months and aged between 18 and 25 years. Subjects with any alternative diet or are on a special diet because of some major acute or chronic conditions were excluded. Written informed consent was obtained from all participants and the study was approved by the local ethics committee at the University of Granada (78/CEIH/2015) and conducted in accordance with the Declaration of Helsinki.

Anthropometric measurements

Anthropometric variables were measured by a Level 2 anthropometrist certified by the International Society for the Advancement of Kinanthropometry (ISAK) in accordance with the ISAK guidelines.¹⁹ Anthropometric measurements were performed in the morning after a 12-h fast and 24-h abstention from exercise. The same trained research assistant performed all the measurements. Body weight (kg), fat mass (g), percentage of fat mass (%) and fat-free mass (g) were measured twice (without shoes and in light clothes) to the nearest 0.11 kg using a body composition analyser (TANITA BC-418MA®). A Harpenden stadiometer (Holtain 602VR®) was used for height measurements. Height was measured twice without shoes to the nearest 0.5 cm. The averages of the two values for each measurement were used in the analysis. Nutritional status was determined by body mass index (BMI). BMI was calculated as weight over height squared (kg/m^2). Subjects were classified as underweight ($\text{BMI} < 18.5 \text{ kg}/\text{m}^2$), normal weight ($\text{BMI} 18.6\text{--}24.9 \text{ kg}/\text{m}^2$), overweight ($\text{BMI} 25\text{--}29.9 \text{ kg}/\text{m}^2$), and obese ($\text{BMI} \geq 30 \text{ kg}/\text{m}^2$), based on the World Health Organization (WHO) criteria.²⁰

Dietary intake assessment

Nutrient intake was assessed using a 72-h diet recall considering intakes on Thursday, Friday and Saturday, to capture weekly variations in weekdays and weekend. In a face-to-face interview with well-trained investigators, individuals were asked to recall all food consumed in the preceding 72 h, including methods of food preparation, foods eaten outside the home, nutrition supplements and beverages. To improve the accuracy of the food descriptions, standard household measures and pictorial food models were employed during the interviews to define amounts when requested. Completed food records were analyzed using a computerized nutrient analysis program (Nutrifier 1.1.5). Daily intakes of energy and nutrients were calculated.

Energy and nutrient intake of our study group was compared to nutritional data as reference (control group) obtained from the Spanish National Dietary Intake Survey (ENIDE) carried out in 2011.²¹ ENIDE is a representative study at national level of the food and nutrient intake in adult population. It was based on a random selection of more than 3323 individuals, providing a level of confidence of 95% and an accuracy of 1.8%.²¹ Considering that our study population

was university students between 18 and 25 years data from population aged 18 to 24 years was selected as reference (control group) to compare with our subjects.

Dietary reference intakes (DRI) for Spanish population issued by the *Spanish Societies of Nutrition Feeding and Dietetics* (FESNAD)²² and nutrition goals for the *Spanish Society of Community Nutrition* (SENC)²³ were taken as references for the interpretation of the 24 h food and beverage recall.

Statistical analysis

SPSS Statistic version 21.0 (SPSS, Chicago, IL, USA) was used for all the analyses. Numeric variables were expressed as mean and standard deviations (SD) and nominal variables were described through percentages and frequencies. Dietary intakes were compared with those obtained from ENIDE,²¹ using student's *t*-test or Mann–Whitney test, depending on the type of outcome. Dietary guidelines and nutrition goals for Spanish people were taken as references. *P*-values < 0.05 were considered to be statistically significant.

Results

Table 1 shows main characteristics of the whole study population as well as stratified by gender. The mean BMI was $22.55 (3.62) \text{ kg}/\text{m}^2$. Based on BMI classification, the majority of the subjects in this study (72.3%) were of normal-weight (67.0% of male subjects and 74.8% of females). As expected, significant differences were observed between males and females with respect to height, weight, fat mass, percentage of fat mass and fat-free mass ($p < 0.001$).

The mean dietary intake of total energy and macronutrients are shown in Table 2. The mean daily energy intake was $2157.46 (SD 719.48)$ in males and $1920.29 (SD 634.32)$ in females. Intakes of energy, protein, fat, fatty acids and cholesterol were significantly lower in health sciences university studies of both sexes compared to the reference Spanish population ($p < 0.001$). In contrast, the intake of fiber was significantly higher compared to control group ($p < 0.001$). Additionally, the intake of carbohydrates was only statistically higher compared to control group in females ($p < 0.001$).

Fig. 1 shows the energy contribution of macronutrients in health sciences university students compared to nutrition goals recommended by the SENC. Total fat and carbohydrates intake in university students represented 31.43% and 51.41%, respectively, which were in accordance with SENC recommendations. By contrast, protein intake was above the SENC recommendation (17.16% vs 12.50%). When considering energy contribution of fatty acids, saturated fat was notably higher in university students than the nutrition goals recommended by SENC, while monounsaturated fat was found to be relatively low (Fig. 2).

Regarding the intake of micronutrients, the amount of sodium, vitamin A, vitamin B1, vitamin B3, vitamin C, vitamin D and vitamin E were statistically significant lower in both in women and men university students than in the control reference group (Table 3). Conversely, selenium, vitamin B2, vitamin B6 and vitamin B12 intakes were significantly

Table 1 Descriptive and anthropometric characteristics of university students according to gender and in general.

	Females (n = 401) Mean (SD)	Males (n = 184) Mean (SD)	Total (n = 585) Mean (SD)
Age	20.11(2.23)	20.22 (2.19)	20.14 (2.21)
Height (m)	1.63 (0.06)	1.75 (0.07)**	1.67 (0.08)
Weight (kg)	59.24 (9.81)	72.86 (13.22)**	63.52 (12.68)
BMI (kg/m ²)	22.09 (3.46)	23.55 (3.76)**	22.55 (3.62)
Fat mass (kg)	15.23 (7.73)	11.59 (7.20)**	14.08 (7.75)
Percentage of fat mass (%)	24.11 (7.33)	15.15 (6.28)**	21.29 (8.15)
Fat-free mass (kg)	42.71 (17.69)	58.20 (7.36)**	47.58 (16.82)
BMI categories	N (%)	N (%)	N (%)
Underweight (<18.5 kg/m ²)	38 (9.7)	9 (4.9)	47 (8.2)
Normal (18.5–24.9 kg/m ²)	294 (74.8)	122 (67.0)	416 (72.3)
Overweight (25–29.9 kg/m ²)	48 (12.2)	41 (22.5)	89 (15.5)
Obese (≥30 kg/m ²)	13 (3.3)	10 (5.5)	23 (4.0)

BMI, body mass index.

Data are shown as mean (SD).

** $p < 0.001$.

higher than those observed in the reference Spanish population. Note that other micronutrients including calcium, magnesium and zinc were only statistically lower in males ($p < 0.001$).

Finally, Fig. 3 shows micronutrient intake adequacy in health sciences university students and in the Spanish reference population (Fig. 3). To analyze micronutrient adequacy to the RDI established by FESNAD, an 80% as cut-off point was established. According to FESNAD recommendations, university students as well as reference control group do not reach the optimal dietary intake of iodine and vitamin D. Note that the prevalence of adequacy of Vitamin E in university students was 37%. In addition, phosphorus, sodium, vitamin B3, vitamin B6, vitamin B12, vitamin C and zinc intake exceeded the daily recommendations in both populations. In university students, selenium intake was notably above FESNAD recommendation.

Discussion

The aim of this study was to assess dietary intake among health sciences university students. This is of special interest due to the relevance of dietary intake during early ages in the development of chronic diseases later in life. We found that intake of energy, protein, fat, fatty acids and cholesterol were significantly lower among university students compared to controls while the intake of fiber showed an opposite trend. In addition, total fat and carbohydrate intake were in accordance with recommendations but protein intake was above the recommendation. Saturated fatty acids (SFAs) intake was notably higher than nutrition goals, while MUFA was lower. Students as well as reference control group did not reach the optimal dietary intake of iodine, vitamin D and E, and exceeded sodium recommendations.

The vast majority of the study group was in normal ranges for BMI according to the WHO parameters which correlates with previous studies performed in Spanish regions.^{24–28} A BMI in overweight categories was more common between

males and a low prevalence of obesity was reported for the whole group, but especially among females, which can be explained by differences in body composition between genders.²⁹ Interestingly, previous studies have reported also higher overweight/obesity values between university males and higher normal/under-nutrition values between university females,¹⁵ which can be due to a major tendency to food restriction and eating disorders in these last,^{26,28} or a slight tendency to worsened food habits between university males in comparison with university females.³⁰ Considering the vast majority of our university students (68.54%) were females it was to expect the low prevalence of overweight/obesity in the whole group.

Compared to ENIDE data (Spanish age-matched population), daily energy intake is lower in our study group. Accordingly with our findings, previous studies analyzing dietary habits among Spanish university students reported that these population tends to have an energy deficit intake and often do not reach the 80% of daily recommendation.^{16,18,24,30,31}

On the other hand, the typical diet described for Spanish population tends to be rich in protein/fat (specially saturated fat) and poor in carbohydrate/fiber among all groups including university students.^{5,16,18,24,31,32} In concordance, our results revealed that health sciences university students have the same dietary pattern particularly for protein which was above and for fiber which was under the recommendations by SENC. Nevertheless, health sciences students showed a better diet quality compared to general Spanish population (ENIDE) with a significantly lower intake of protein, fat, saturated fat and cholesterol and a higher consumption of fiber, revealing that this last group have still a much more unbalanced diet. It could be hypothesized that this is maybe because our study group only included health sciences students which may pay more attention to nutrition and self-care.²⁹

SENC suggests that MUFA must contribute to 20% of total dietary energy intake. However, in our study group only 12%

Table 2 Mean dietary intake of energy and macronutrients in university students compared with Spanish population as control values.

	Female (n = 401) Mean (SD)	Spanish Population-control (ENIDE 2011) [†]	Male (n = 185) Mean (SD)	Spanish population-control (ENIDE 2011) [†]	Total (n = 585) Mean SD	Spanish population-control (ENIDE 2011) [†]
Energy intake (kcal)	1920.29 (634.32)**	2079.70 (664.65)	2157.46 (719.48)	2766.74 (964.33)**	1992.80 (699.03)**	2423.22 (814.49)
Proteins (g)	79.25 (27.81)**	87.75 (36.5)	90.00 (35.35)	117.23 (56.83)**	82.67 (30.80)**	102.49 (46.67)
Fat (g)	65.44 (32.02)**	95.29 (34.93)	71.88 (32.99)	126.65 (48.34)**	67.32 (32.28)**	110.97 (41.65)
Saturated fat (g)	25.59 (12.55)**	27.5 (11.67)	28.54 (15.12)	38.59 (17.95)**	26.52 (13.47)**	33.05 (14.81)
Monosaturated fat (g)	23.66 (15.37)**	40.09 (17.20)	25.54 (13.60)	53.31 (22.89)**	24.26 (14.85)**	46.7 (20.05)
Polyunsaturated fat (g)	9.95 (6.57)**	13.03 (6.93)	10.62 (6.09)	17.08 (8.44)**	10.17 (6.42)	15.06 (7.69)
Carbohydrates (g)	236.94 (103.18)**	208.60 (78.19)	272.02 (107.16)	275.21 (126.52)	247.72 (105.47)	241.90 (102.36)
Cholesterol (mg)	290.34 (167.90)**	330.42 (151.40)	336.66 (194.97)	457.55 (183.56)**	304.96 (178.03)**	393.99 (167.48)
Dietary fiber (g)	23.56 (22.39)**	17.05 (9.27)	22.47 (14.16)	20.53 (10.80)	23.22 (20.16)**	18.79 (10.04)

[†] Spanish Adult data (18–24 years) used as control were taken from the Spanish dietary nutritional assessment (ENIDE study representative of the adult population at national level in 2011).

* $p < 0.05$.

** $p < 0.001$.

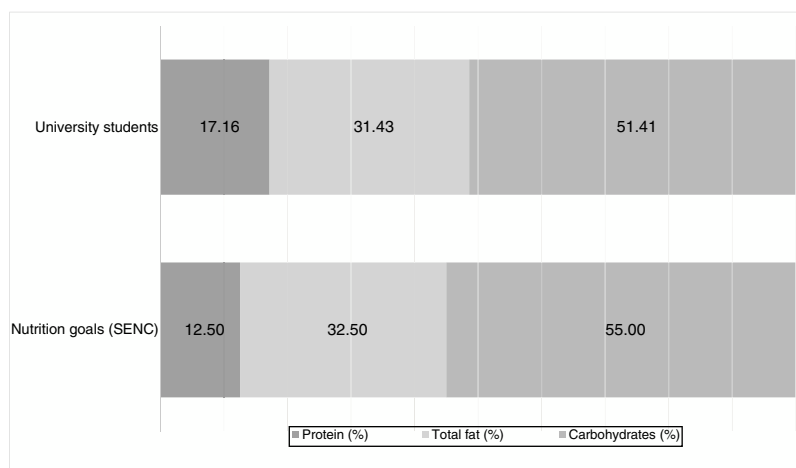


Figure 1 Energy contribution of macronutrients in university students compared to nutrition goals recommended by the Spanish Society of Community Nutrition (SENC)(Aranceta J., Serra-Majem L. Dietary guidelines for the Spanish population. Public. Health. Nutr. 2001;4:1403–1408).

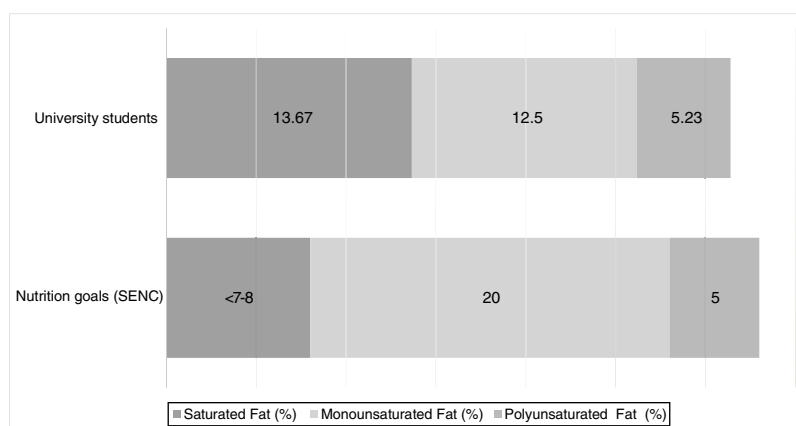


Figure 2 Energy contribution of saturated fat, monounsaturated fat and polyunsaturated fat in university students compared to nutrition goals recommended by the Spanish Society of Community Nutrition (SENC)(Aranceta J., Serra-Majem L. Dietary guidelines for the Spanish population. Public. Health. Nutr. 2001;4:1403–1408).

of the total fatty acid intake was monounsaturated. Additionally, as previously mentioned, we observed an excessive percentage of saturated fat consumption among university students compared to SENC goals. Despite monounsaturated fat intake is usually high in general Spanish population due to the great consumption of olive oil,^{21,33} our findings show the opposite in line with previous reports in university students.^{5,18,31} This fact could be explained by the continued loss of the “Mediterranean diet” pattern among the youngest generations that consume a more “westernized” and processed food diet.^{25,26,30} Due to the known role of saturated fatty acids (SFA) in several chronic diseases and considering that fatty acids can modify immune and inflammatory responses,³⁴ partial replacement of saturated fatty acids (SFA) with MUFA or PUFA should be a nutritional strategy to consider in university students and in general Spanish population.

With regard to micronutrients, it is important to consider the more daily intake is below the recommended and long through the time, much more would be the risk of

nutritional deficit. Our study group showed a poor intake of several important micronutrients specifically iodine, vitamin D and E. Previous studies performed in other university groups have shown similar results reporting vitamin D dietary insufficiency (17.35) and low intake of iodine and vitamin E.^{32,35,36} Considering the main role of vitamin D in bone metabolism and immunity and iodine in thyroid health^{2,32,37} together with the antioxidant and anti-inflammatory properties of vitamin E,³⁸ it would be relevant to encourage an adequate dietary intake of these micronutrients in order to prevent possible health problems.

In addition, both university students and controls showed a high intake of sodium. Since this mineral play a relevant role in the development of several diseases, WHO recommends a reduction to <2 g/day sodium (5 g/day salt) in adults.³⁹ Therefore, dietary recommendations must be intended to encourage potassium and reduce sodium intake.

This study has some limitations; one is its cross-sectional design that limits the ability to determine causal relationships. Another limitation is that we could not estimate the

Table 3 Mean dietary intake of micronutrients in university students compared with Spanish population as control values.

	Females (n = 401) Mean (SD)	Spanish population- control [†]	Male (n = 185) Mean (SD)	Spanish population- control [†]	Total (n = 585) Mean (SD)	Spanish population- control [†]
Calcium (mg)	801.00 (343.55)	788.80 (270.12)	852.47 (374.17)**	957.80 (372.88)	817.19 (353.96)	834.76
Iodine (mg)	78.58 (38.38)*	74.64 (35.70)	87.30 (36.09)*	94.54 (45.18)	81.33 (37.86)*	84.81
Iron (μg)	17.46 (14.37)**	12.5 (4.67)	18.34 (12.34)*	15.9 (7.01)	17.73 (13.76)**	13.7
Magnesium (mg)	304.36 (189.33)	305.04 (108.60)	310.35 (163.80)**	364.29 (133.75)	306.25 (181.54)**	353.84
Phosphorus (mg)	1343.99 (456.95)**	1253.96 (367.59)	1461.41 (509.41)**	1602.40 (532.58)	1380.92 (476.77)**	1294.73
Potassium (mg)	2308.56 (1431.29)**	2590.36 (738.04)	2690.78 (1594.55)	2905.35 (905.48)	2995.74 (1699.98)	2857.78
Selenium (μg)	134.03 (89.98)**	48.90 (24.61)	143.42 (79.11)**	61.96 (32.15)	136.99 (86.73)**	53.71
Sodium (mg)	2232.64 (1194.81)	2328.18 (764.32)	2646.24 (1478.29)	2755.99 (871.50)	2363.17 (1304.00)	2348.85
Vitamin A (retinol equivalents) (μg)	587.91 (470.53)*	650.52 (289.53)	624.55 (444.17)**	745.47 (321.72)	598.00 (462.24)**	722.52
Vitamin B1 Thiamin (mg)	1.44 (0.92)**	2.06 (5.37)	1.82 (1.16)*	2.05 (3.98)	1.56 (1.02)**	1.76
Vitamin B2 Riboflavin(mg)	1.77 (1.07)**	1.22 (0.55)	2.12 (1.33)**	1.57 (0.76)	1.88 (1.17)**	1.44
Vitamin B3 (niacin equivalents) (mg)	33.63 (15.54)**	39.10 (41.02)	40.41 (19.66)*	45.14 (35)	35.77 (17.22)**	39.37
Vitamin B6 Pyridoxine (mg)	1.88 (1.27)**	1.52 (0.90)	2.28 (1.52)*	2.05 (1.06)	2.00 (1.36)**	1.66
Vitamin B12 (μg)	8.98 (12.25)**	5.23 (3.33)	12.20 (16.14)**	7.65 (5.53)	10.00 (13.67)**	6.06
Vitamin C (mg)	78.80 (64.90)**	113.34 (73.04)	93.97 (76.66)**	116.69 (78.49)	83.58 (69.11)**	132.92
Vitamin D (μg)	2.36 (2.32)**	3.23 (3.22)	3.16 (2.73)**	4.09 (3.94)	2.61 (2.48)**	3.65
Vitamin E (μg)	5.43 (3.42)**	12.88 (6.34)	5.91 (3.95)**	14.81 (7.14)	5.58 (3.60)**	13.39
Zinc (mg)	8.90 (3.86)	8.62 (3.31)	9.77 (4.31)**	11.20 (4.22)	9.17 (4.03)*	8.72

[†] Spanish Adult data (18–24 years) used as control were taken from the Spanish dietary nutritional assessment (ENIDE study in 2011).

* $p < 0.05$.

** $p < 0.001$.

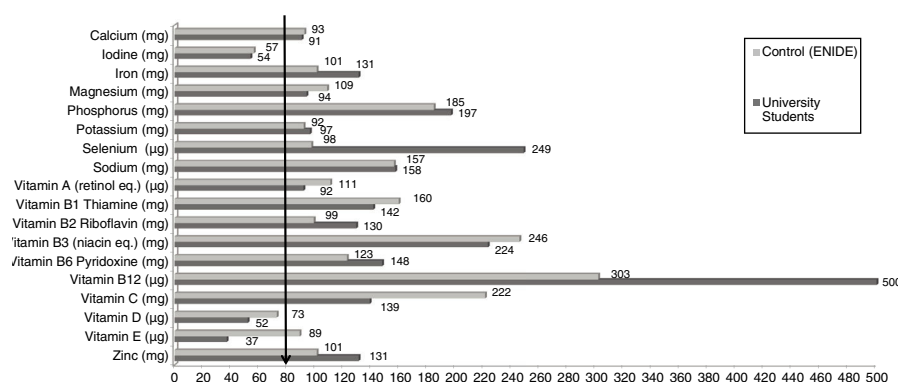


Figure 3 Micronutrient intake adequacy in university students according to the Federation of Spanish Societies of Nutrition and Dietetics (FESNAD).

serum levels of micronutrients. Thus, further research is needed to confirm if the poor adequacy to the recommended dietary intakes of the micronutrients correlates with serum values. Additionally, it should be noted that analyses were performed in the whole population and subgroup analysis according to health sciences degrees were not conducted due to the differences in the number of students of each degree. This could be relevant since nursing students have 60 mandatory hours of nutrition and dietetics, while for physiotherapy students it is an elective course and occupational therapy students do not have specific training in nutrition and dietetics. On the other hand, our study has several strengths. First, we used a 72-h recall for collecting data on average diet which is more accurate than the 24-h recall. The literature supports the use of 72-h recall as a convenient method for assessing dietary intake.⁴⁰ Secondly, in the present study the 72-h recall was interviewer-driven by well-trained investigators avoiding the probability of under-reporting of dietary intake observed in self-administered questionnaires.^{40,41} Additionally, standard household measures and pictorial food models were used for the accuracy in the estimation of food intake.

In conclusion, the key findings of the current report is that health sciences university students show in some aspects a better dietary pattern than other young adults, but exceeds protein, fat and specially saturated fatty acid intake recommendations. In addition, a poor micronutrient dietary intake was found for iodine, vitamin E and D as well as an excessive intake of sodium. Dietary strategies and nutritional counseling in order to ameliorate dietary habits among Spanish university students must be considered to prevent nutritional deficiencies, ensure a well-balanced diet and the maintenance of the Mediterranean food pattern in the following generations.

Author's contribution

Correa-Rodríguez M monitored data collection, wrote the statistical analysis plan, cleaned and analyzed the data and drafted and revised the paper. Pocovi Gabriela cleaned and analyzed the data and revised the paper. Schmidt Rio-Valle Jacqueline and González-Jiménez Emilio analyzed the data

and revised the draft paper. Rueda-Medina B analyzed the data, and drafted and revised the paper

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Written informed consent was obtained from all participants and the study was approved by the local ethics committee at the University of Granada.

Conflict of interests

Correa-Rodríguez María, Pocovi Gabriela, Schmidt- RioValle Jacqueline, González-Jiménez Emilio, Rueda-Medina Blanca declare that they have no conflict of interest.

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