

Adherence to recommended intake of pulses and related factors in university students in the UniHcos project

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Abstract

Pulses such as peas, beans or lentils are one of the most complete foods at the nutritional level; however, they are one of the most often neglected foods in the diets of university students. Entrance to university translates into a major lifestyle change for many young people, and the habits acquired or cemented at this time will remain into adulthood. The objective of this study is to analyse the association between personal/sociodemographic factors, dietary intake of other food groups and the consumption of pulses in first-year university students. This cross-sectional study is part of the UniHcos project, a multicentre study of multipurpose prospective cohorts in eleven Spanish universities. Data from 9862 university students were collected through an online self-questionnaire completed by all students who met the selection criteria and agreed to participate in the project during the 2011–2018 academic years. Of students, 75.8% presented an inadequate (≤ 2 times/week) consumption of pulses. Living outside the family home in either a student residence (OR 0.76; 95% CI 0.69, 0.84) or rental (OR 0.81; 95% CI 0.70, 0.95) decreased the compliance with recommendations on the consumption of pulses. Low consumption of pulses is seemingly not restricted to a specific profile or dietary pattern among university students, and no specific focus group for intervention can be identified. Policies promoting the consumption of pulses among the university population as a whole are necessary to increase compliance rates with the dietary recommendations.

Key words: Pulses: Legumes: Diet quality: Nutrition: University students

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An adequate diet not only provides certain amount of energy and nutrients but also promotes and maintains good health. If a diet is varied and balanced, the body will be able to obtain the necessary nutrients and energy to maintain an optimal state of health⁽¹⁾.

In recent years, the general population has undergone a nutritional transition, causing significant changes in the perception and consumption of food. Previous studies in the university population have shown a decrease in the consumption of fruits, vegetables, cereals, pulses and fish, together with an increase in the consumption of meats, sweets, snacks and sugary drinks^(2,3). The Spanish youth population has abandoned the traditional balanced Mediterranean diet characterised by combining foods such as olive oil, cereals, pulses, vegetables, fruits, nuts, fish, fermented beverages such as wine and beer, as well as a moderate intake of dairy products, meat, eggs and low consumption of red meat and sausages^(4,5) in favour of more westernised diet patterns⁽⁶⁾ characterised by the abandonment of 'basic foods' in favour of more elaborate and processed ones.

Pulses are a plant species of edible seeds that have been consumed for thousands of years by humans and animals. The FAO defines pulses as leguminous crops with dry and low-fat edible seeds. It does not consider the species used as vegetables (e.g. green peas or green beans), for the extraction of oil (such as soyabeans or peanuts) or others for planting purposes (such as clover and alfalfa) as pulses. Among the most well-known and consumed pulses worldwide are the common beans, chickpeas, mung beans, cowpeas, care beans, lupins, mesquite, carob, tamarind and lentils⁽⁷⁾.

Although pulses are one of the most nutritionally complete foods as well as a climate-friendly source of protein, they are one of the least consumed food groups in Spain^(8–12). The Spanish Society of Community Nutrition recommends that healthy adult population consume pulses >2 times/week with each serving being 60–80 g dry or 150–200 g cooked^(13,14).

Pulses are recognised as being a good source of protein with a high lysine and low methionine and cysteine content; however, the biological value of this protein is lower than that of protein from animal sources such as egg, milk and meat. The biological value of a protein depends on the composition of amino acids and the proportions between them⁽¹⁵⁾. The protein value is maximum when these proportions are those necessary to meet the nitrogen requirements to cover physiological needs⁽¹⁵⁾. In addition, other factors such as protein structure and the presence of proteases may reduce the digestibility and biological use by the body of vegetable proteins^(15,16). Pulses are also a source of resistant starch, fibre (soluble and insoluble), vitamins (B complex), minerals (Fe, Zn, folate, Mg and Ca) and have a low lipid content. In addition, the phytochemicals, saponins and tannins found in pulses possess antioxidant and anti-carcinogenic effects^(17–20). Different international agencies recommend the regular consumption of pulses as an alternative to meat to reduce the intake of saturated fats^(6,21). Pulse consumption can improve serum lipid profiles and positively affect CVD risk factors such as blood pressure, platelet activity and inflammation. Pulses also have a low glycaemic index, making them particularly beneficial to people with diabetes by assisting in maintaining healthy blood glucose and insulin levels^(17–20).

Entrance to university translates into a major lifestyle change for many young people. It can entail important changes such as living outside the family home, adapting to new activities and taking responsibility for their meals for the first time^(22–24). Assuming this responsibility will be determined by socio-economic factors and economic constraints, and/or the greater or lesser ability to cook. The dietary habits acquired during the university stage are generally those that will remain in adulthood^(3,25–27). The social conditions and the way of life have a special impact on the habits of these young people, and there are even differences in the food inherent to the region or community where they live, for example, between the north and the south of the same country^(28,29).

The hypothesis on which this study is based is that certain personal/sociodemographic factors and intakes of other food groups are related to worse adherence to the recommendations for the consumption of pulses. Identifying these factors could aid in the development of policies geared towards improving pulse consumption among university students. The objectives of this study are to determine the rate of adherence to the recommended intake of pulses and analyse the association between this adherence and personal/sociodemographic factors and dietary intake of other food groups in first-year university students.

Materials and methods

This cross-sectional study is part of the UniHcos project, a multi-centre study of multipurpose prospective cohorts in eleven Spanish universities (Alicante, Cantabria, Castilla-La Mancha, Granada, Huelva, Jaén, León, Salamanca, Valencia, Valladolid and Vigo), whose general objective is to know the students' lifestyles when they enter the university and their modification during their stay. The UniHcos project has the approval of the Ethics Committees of the collaborating universities and has therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments, and the integration of the information file in the Data Protection Agency complies with the Organic Law of Protection of Personal Data.

The main inclusion criteria for students in this study were to be both a first-year student and enrolled in all first-year courses for the first time in each of the participating universities. All students who met the selection criteria and agreed to participate in the project during the 2011–2018 academic years completed an online self-questionnaire that included informed consent and ethical permission.

The questionnaire was sent to the students by way of institutional email, and students were given ample time and reminders to respond as well as assured confidentiality. Measuring and adjusting for non-response bias using weighting class adjustments, post-stratification or propensity models were not possible due to the lack of sufficient demographic or database variables. Meanwhile, item non-response bias was not a concern as those students without sufficient information (not answering the question regarding intake of pulses in the questionnaire and/or not completing at least 85 % of the remaining questionnaire) were excluded from the study.



Totally, 277 325 students were invited to participate, 9874 returned the questionnaire, but 12 (0.12 %) had to be excluded due to providing incomplete data (Fig. 1). Finally, data from 9862 (3.6 % participation rate) university students were included in the study. Based on the nature of this study, the demographic profile of the population included in the sample was representative of university students in Spain.

Data collection

Analyses were conducted for those who provided complete dietary, demographic and socio-economic data. The personal and socio-demographic variables collected were: sex (male, female); age (years); BMI (<18.5, 18.5–24.5, 25–30, >30 kg/m²); marital status (single, domestic partner, married, separated, divorced, widowed); employment status (only study and I do not look for work, study and I look for work, study and work part time, study and work full time); housing, defined as the place where students live during the course (university residence; family home; own home; rental; other)

and coexistence, defined as people with whom the student lives during the course (with my parents, roommates/friends, with my partner, with my children, alone).

To simplify the interpretation of the data, the variables were re-categorised for some of the analyses as follows:

- Marital status: single (single, separated, divorced, widowed) and married (married, domestic partner).
- Employment status: unemployed (only study and do not look for work, study and look for work) and employed (study and work part time, study and work full time).
- Housing: family home, university residence (residence hall/university residence) and rental (rental, home-own, others).
- Coexistence: parents, roommates (roommates/friends), partner (with my partner, with my children) and alone.

Dietary assessment

The dietary intake estimations were constructed from the answers to the food frequency consumption section of the online

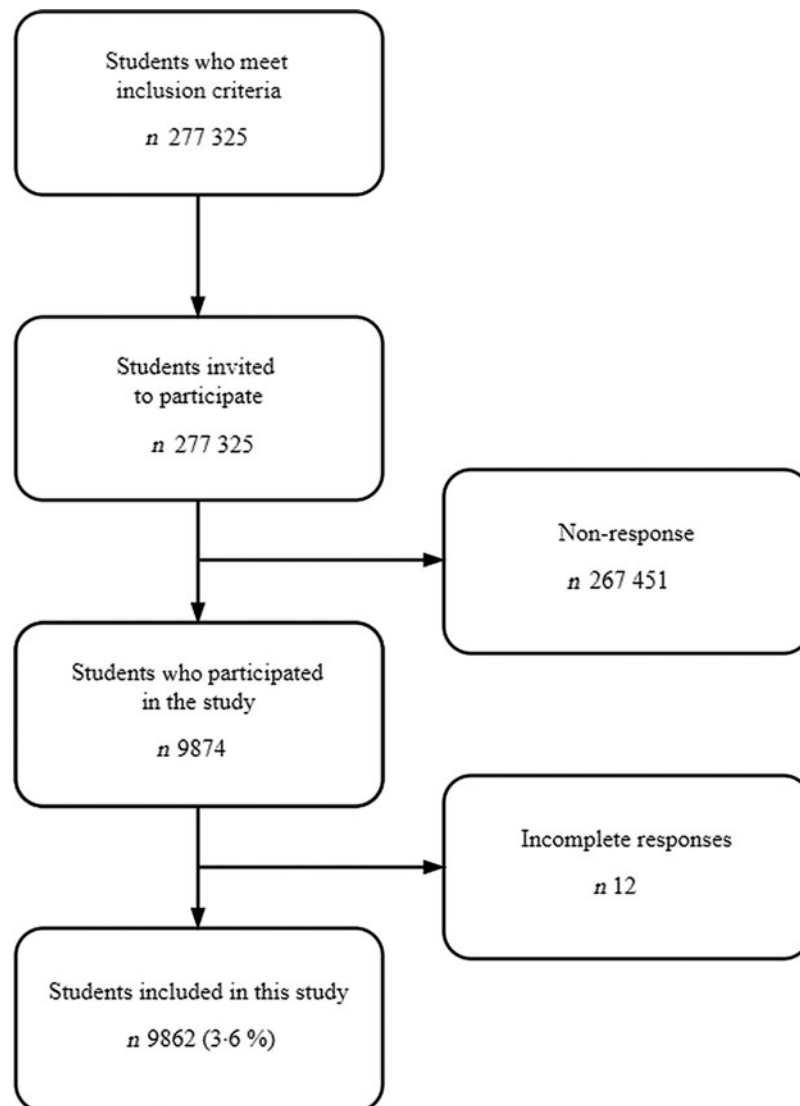


Fig. 1. Participant flow chart.

self-questionnaire which was modelled after question 96 of Section H4 of the 2006 Spanish National Health Survey^(25,30). There were five options (daily; 3–4 times/week, but not daily; 1–2 times/week; <1 time/week; never/almost never) for the frequency of consumption of pulses and other food groups assessed (meat (chicken, beef, pork, lamb); hamburgers, hot dogs and kebabs; eggs; fish; processed meats; dairy products; pizza; sweets (biscuits, cookies, pastries, jams, etc.); sugary drinks; juices and milkshakes; fresh fruit; pasta, rice, potatoes; bread and grains; vegetables). In this study, the five frequency options were regrouped into four during analysis; more specifically, the frequency 'daily' and '3–4 times, but not daily' were joined to create the group ≥ 3 –4 times/week.

For the assessment of compliance with the recommendations of the consumption of pulses, the recommendations established in the 'dietary guidelines for the Spanish population'⁽¹³⁾ were used as a gold standard; the recommended consumption of pulses for a healthy adult population is >2 times/week. For the interpretation of the result of the frequency of consumption of pulses, students were grouped according to their compliance with the established recommendations as follows: 'complies' or 'does not comply'. The category 'complies' corresponds to the food frequency consumption section responses '3–4 times a week, but not daily' and 'daily'; the category 'does not comply' corresponds to '1–2 times a week', 'less than 1 time a week' and 'never or almost never'.

Statistical analysis

All analyses were conducted using survey routines and the dietary survey weights to maintain the nationally representative character of the data. Analyses were conducted in IBM-SPSS version 20.0 (IBM SPSS Statistics for Windows, Released 2011; IBM Corp.).

A descriptive analysis was used for frequencies of consumption (absolute and relative) and was performed for the total sample, according to sociodemographic variables. The χ^2 or Fisher's exact test with a statistical significance level of $P < 0.05$ was performed to check if there was a relationship between the groups.

Logistic regression modelling was employed to determine the contributors to students' odds of meeting the dietary intake recommendation for pulses. All models were controlled for age, sex, household income, total energy intake and survey year. The crude OR and 95% CI were stratified by the university of origin. A decision tree analysis was performed to corroborate the results of the logistic regression analysis and detect the strongest predictor variables in regard to compliance with pulses intake recommendations⁽³¹⁾.

Results

Table 1 shows compliance with pulses consumption recommendations depending on location and living situation without re-categorisation. Of the students in the eleven participating universities, 75.8% presented an inadequate consumption of pulses. It is noted that there was no significant difference between compliance with the frequency of consumption of pulses according to sex ($P = 0.299$), BMI ($P = 0.151$) or marital status ($P = 0.558$). However, regarding the frequency of consumption of pulses according to the current situation in terms of work and study, there

was a significant difference ($P = 0.001$). Students who study and look for work were the group that comply with the recommended frequency of consumption of pulses in the greatest proportions (27.3%). A significant difference ($P < 0.001$) was found between compliance with the frequency of consumption of pulses with respect to where they lived during the course. Those who lived in the family home comply with the frequency of consumption of pulses in the highest proportion (26.5%), while those who did so in rental apartments had the lowest rate of compliance (21.2%). Compliance with the frequency of consumption of pulses with respect to coexistence shows a significant difference ($P < 0.001$), with those who lived with their parents/partner/friends having the highest compliance rate (50.0%) for groups whose members represent at least 1% of the population sample. The lowest rate of compliance is found in those living with partner/friends (19.6%). There was a statistical difference ($P < 0.001$) between compliance with the frequency of consumption of pulses regarding the university attended. The highest rate of adequate consumption of pulses was in the Universities of León (29.0%) and Valladolid (28.1%) with those with the lowest rate compliance being the Universities of Castilla-La Mancha (20.1%) and Vigo (19.8%) ($P < 0.001$).

Table 2 describes the re-categorised characteristics of the population studied according to geographical location. It was observed that women accounted for 72.2% of the studied population which had an average age of 20 (sd 4.52) years, without significant difference between north and south. There was no significant difference in the BMI distribution or the current situation in terms of work and study. There was a significant difference in relation to marital status and student accommodation and coexistence during the academic year. Students in the north lived in a significant proportion in university residences (16.6 *v.* 7.4%) or alone (11.7 *v.* 7.3%) compared with those from the south who in turn were more likely to be married (9.1 *v.* 7.9%).

Table 3 shows the factors associated with compliance with the nutritional recommendations on the frequency of consumption of pulses, according to the geographical region. Sex, BMI, marital status, employment and coexistence did not appear to affect compliance with the recommendations on the consumption of pulses in either group of universities. In relation to place of residence during the academic year, living in a student residence decreased compliance (OR 0.76; 95% CI 0.69, 0.84) with the recommendations on the consumption of pulses without showing significant differences between northern (OR 0.79; 95% CI 0.67, 0.93) and southern (OR 0.74; 95% CI 0.65, 0.84) universities. Meanwhile, living in a rental decreased overall compliance (OR 0.81; 95% CI 0.70–0.95) with the recommendations on the consumption of pulses and compliance in northern universities (OR 0.76; 95% CI 0.62, 0.93).

In the decision tree created for compliance with the recommended pulses intake, it was observed that the strongest associated variable among the studied personal and sociodemographic characteristics was place of residence during the academic year. The dependent variable of this tree diagram was compliance with the pulses consumption recommendations, while its independent variables were: sex, BMI, marital status, employment status, place of residence during the academic year and coexistence during the academic year. However, place of residence was the strongest





Table 1. Compliance with the recommendations on the frequency of consumption of pulses by universities and according to geographical distribution and living situation (Numbers and percentages; 95% confidence intervals)

	Compliant			Non-compliant			P*
	n	%	95 % CI	n	%	95 % CI	
Sex							0.31 0.30
Male	682	28.6	26.76, 30.42	2055	27.5	26.49, 28.52	
Female	1706	71.4	69.57, 73.24	5419	72.5	71.47, 73.51	
BMI (kg/m ²)							0.16 0.15
Underweight (<18.5)	227	9.5	8.37, 10.77	762	10.2	9.52, 10.91	
Normal weight (18.5–24.5)	1752	73.6	71.54, 75.12	5321	71.4	70.15, 72.22	
Overweight (25–30)	316	13.3	11.91, 24.48	1107	14.9	14.02, 15.64	
Obese (>30)	85	3.6	2.87, 4.40	258	3.5	3.06, 3.90	
Marital status							0.59 0.56
Married	40	1.7	1.21, 2.30	116	1.6	1.29, 1.86	
Divorce	5	0.2	0.07, 0.52	21	0.3	0.18, 0.44	
Common-law partnership	185	7.7	6.72, 8.91	511	6.8	6.28, 7.44	
Separated	4	0.2	0.05, 0.46	7	0.1	0.04, 0.20	
Single	2152	90.1	88.83, 91.27	6813	91.2	90.48, 91.78	
Widowed	2	0.1	0.01, 0.33	6	0.1	0.03, 0.18	
Employment status							<0.001 0.001
Looking for work	622	26.0	24.31, 27.87	1659	22.2	21.26, 23.16	
Working full time	63	2.6	2.05, 3.38	187	2.5	2.16, 2.89	
Working part time	182	7.6	6.60, 8.78	609	8.1	7.54, 8.80	
Not looking for work	1521	63.7	61.72, 65.62	5019	67.2	66.07, 68.22	
Place of residence							<0.001 <0.001
University residence	278	11.6	10.40, 13.01	823	11.0	10.32, 11.75	
Family home	1190	49.8	47.81, 51.86	3294	44.1	42.94, 45.21	
Own home	65	2.7	2.12, 3.48	205	2.7	2.39, 3.14	
Rental	821	34.4	32.48, 36.33	3050	40.8	39.69, 41.93	
Other	34	1.4	1.00, 2.01	102	1.4	1.12, 1.66	
Coexistence							<0.001 <0.001
Roommates/friends	854	35.8	33.84, 37.73	3091	41.4	40.24, 42.48	
Partner	69	2.9	2.27, 3.66	253	3.4	2.99, 3.83	
Partner/roommates/friends	19	0.8	0.49, 1.26	78	1.0	0.83, 1.31	
Partner/children	26	1.1	0.73, 1.62	84	1.1	0.90, 1.40	
Partner/children/roommates/friends	0	0.0	0.00, 0.20	1	0.0	0.00, 0.09	
		0.0	0, 94.54		100.0	5.46, 100	

Table 1. (Continued)

	Compliant			Non-compliant			P*
	n	%	95 % CI	n	%	95 % CI	
Children	11	0.5	0.24, 0.85	21	0.3	0.18, 0.44	
Children/roommates/friends	3	34.4	19.17, 53.23	0	65.6	46.77, 80.81	
Parents	1109	0.1	0.03, 0.40	3069	0.0	0.00, 0.06	
Parents/roommates/friends	55	100.0	31.00, 100	189	0.0	0, 69.00	
Parents/partner	20	46.4	44.43, 48.47	44	73.5	72.08, 74.78	
Parents/partner/roommates/friends	3	26.5	25.22, 27.92	7	2.5	2.19, 2.92	
Parents/partner/children	1	2.3	1.76, 3.01	1	77.5	71.60, 82.44	
Parents/children	6	0.8	0.53, 1.32	12	0.6	0.43, 0.80	
Alone	147	31.3	20.57, 44.20	409	68.8	55.80, 79.43	
Alone/roommates/friends	36	0.1	0.03, 0.40	108	0.1	0.04, 0.20	
Alone/partner	4	30.0	8.09, 64.63	14	70.0	35.37, 91.91	
Alone/partner/roommates/friends	0	0.0	0.00, 0.27	6	50.0	2.67, 97.33	
Alone/parents	18	0.3	0.10, 0.58	65	0.2	0.09, 0.29	
Alone/parents/roommates/friends	4	33.3	14.36, 58.85	16	66.7	41.15, 85.64	
Alone/parents/partner	2	6.2	5.24, 7.21	6	73.6	69.65, 77.14	
Alone/parents/children	1	26.4	22.85, 30.35	0	1.4	1.19, 1.75	
Universities		1.5	1.07, 2.10		75.0	66.97, 81.67	<0.001
Alicante	194	0.2	0.05, 0.46	594	0.2	0.11, 0.32	<0.001
Cantabria	20	22.2	7.37, 48.08	65	77.8	51.92, 92.63	
Castilla-La Mancha	32	0.0	0.00, 0.20	127	0.1	0.03, 0.18	
Granada	739	0.0	0, 48.32	2191	100.0	51.68, 100	
Huelva	113	0.8	0.46, 1.21	314	0.9	0.68, 1.11	
Jaén	72	21.7	13.69, 32.35	216	78.3	67.65, 86.31	
León	240	0.2	0.05, 0.46	588	0.2	0.13, 0.35	
Salamanca	266	20.0	6.61, 44.27	831	80.0	55.65, 86.31	
Valencia	302	0.1	0.01, 0.33	1145	0.1	0.03, 0.18	
Valladolid	173	25.0	4.45, 64.43	443	75.0	35.58, 95.55	
Vigo	237	100	0.00, 0.20	960	0.0	0.03, 0.18	
		100	5.46, 100		0.0	0, 94.54	

* P value obtained through the χ^2 test or Fisher's exact test for percentages in both column and rows.

predictor of compliance during the study period. According to node 1, 26.3 % of the students who lived in the family home complied with the recommendations. The results show that as in the OR calculations, only the place of residence during the school year presents a significant effect on the rate of compliance with the recommendation for pulses consumption.

Table 4 shows the compliance with the recommendations on the frequency of consumption of pulses by the frequency of

different types of food consumed by the university population. Statistical differences in compliance rates with the recommendations on the frequency of consumption of pulses appear for all the studied food items.

Within those students who comply with the frequency of consumption of pulses, 84.3 % consumed pulses 3–4 times/week and 15.7 % consumed them daily. The majority (60.9 %) of the students who did not meet the recommended weekly pulses intake



Table 2. Characteristics of the university sample according to the geographical location of the universities (Numbers and percentages; 95% confidence intervals)

	Universities of the north*			Universities of the south†			P‡
	n	%	95% CI	n	%	95% CI	
Sex							0.001
Male	1181	29.7	28.24, 31.11	1556	26.5	25.34, 27.61	
Female	2801	70.3	68.89, 71.75	4324	73.5	72.39, 74.66	
BMI (kg/m ²)							0.82
Underweight (<18.5)	391	9.9	8.92, 10.80	598	10.2	9.42, 10.98	
Normal weight (18.5–24.5)	2860	72.1	70.39, 73.21	4213	71.9	70.48, 72.80	
Overweight (25–30)	584	14.7	13.59, 15.81	839	14.3	13.39, 15.19	
Obese (>30)	133	3.4	2.81, 3.96	210	3.6	3.12, 4.09	
Marital status							0.019
Married	315	7.9	7.10, 8.80	537	9.1	8.41, 9.90	
Single	3662	92.1	91.06, 92.78	5340	90.9	90.04, 91.54	
Employment status							0.20
Not working	3575	89.8	88.79, 90.69	5246	89.2	88.39, 89.99	
Working	407	10.2	9.31, 11.21	634	10.8	10.00, 11.61	
Place of residence							<0.001
Family home	1705	42.8	41.28, 44.37	2779	47.3	45.98, 48.55	
University residence	663	16.6	15.51, 17.85	438	7.4	6.80, 8.16	
Own home	109	2.7	2.26, 3.30	161	2.7	2.34, 3.20	
Rental	1429	35.9	34.39, 37.40	2442	41.5	40.27, 42.80	
Other	76	1.9	1.52, 2.40	60	1.0	0.79, 1.32	
Coexistence							<0.001
Parents	1760	44.2	42.65, 45.76	2756	46.9	45.59, 48.15	
Roommates	1604	40.3	38.76, 41.82	2438	41.5	40.20, 42.74	
Partner	173	4.3	3.74, 5.04	259	4.4	3.90, 4.97	
Alone	443	11.7	10.17, 12.15	427	7.3	6.61, 7.96	

* Universities of the north: Cantabria, León, Vigo, Salamanca and Valladolid.

† Universities of the south: Granada, Jaén, Huelva and Alicante.

‡ P value obtained through the χ^2 test.

Table 3. Factors associated with compliance with the nutritional recommendations on the frequency of consumption of pulses, according to the geographical region (Odds ratios and 95% confidence intervals)

	Universities of the north*		Universities of the south†	
	Crude OR‡	95% CI	Crude OR‡	95% CI
Sex				
Male	1		1	
Female	0.88	0.76, 1.04	0.99	0.87, 1.14
BMI (kg/m ²)				
Underweight (<18.5)	1.11	0.75, 1.65	0.93	0.67, 1.29
Normal weight (18.5–24.5)	1		1	
Overweight (25–30)	1.21	0.77, 1.89	1.04	0.72, 1.51
Obese (>30)	1.38	0.89, 2.11	1.03	0.71, 1.47
Marital status				
Married	1		1	
Single	1.23	0.95, 1.59	1.08	0.88, 1.33
Employment status				
Not working	1		1	
Working	1.06	0.83, 1.35	0.97	0.79, 1.18
Place of residence				
Family home	1		1	
University residence	0.79	0.67, 0.93	0.74	0.65, 0.84
Own home/rental	0.76	0.62, 0.93	0.91	0.71, 1.16
Coexistence				
Parents	1		1	
Roommates	1.00	0.79, 1.27	0.94	0.74, 1.19
Partner	1.27	0.99, 1.62	1.25	0.98, 1.58
Alone	1.52	0.99, 2.35	1.07	0.75, 1.54

* Universities of the north: Cantabria, León, Vigo, Salamanca and Valladolid.

† Universities of the south: Granada, Jaén, Huelva and Alicante.

‡ OR and 95% CI obtained through logistic regression.

Table 4. Compliance with the recommendations on the frequency of consumption of legumes, according to the Sociedad Española de Nutrición Comunitaria (Spanish Society of Community Nutrition), by the frequency of different types of food consumed by the university population (Numbers and percentages; 95% confidence intervals)

	Compliant			Non-compliant			P*
	n	%	95% CI	n	%	95% CI	
Total	2388	100	99.80, 100	7474	100	99.94, 100	
		24.2	23.37, 25.07		75.8	74.92, 76.62	
Pulses							<0.001
Never/almost never	0	0.0	0.00, 0.20	968	13.0	12.20, 13.74	<0.001
<1 time/week	0	0.0	0, 0.49	1953	100	99.51, 100	
1–2 times/week	0	0.0	0.00, 0.20	4553	26.1	25.14, 27.14	
3–4 times/week but not daily	2014	0.0	0, 0.24	4553	100	99.76, 100	
Daily	374	0.0	0.00, 0.20	0	60.9	59.80, 62.02	
		84.3	82.80, 85.76	0	100	99.89, 100	
		100	99.76, 100	0	0.0	0.00, 0.06	
		15.7	14.24, 17.20	0	0.0	0, 0.24	
		100	98.73, 100	0	0.0	0.00, 0.06	
					0.0	0, 1.26	
Meat (chicken, beef, pork, lamb)							<0.001
Never/almost never	220	9.2	8.10, 10.46	200	2.7	2.33, 3.07	<0.001
<1 time/week	74	52.4	47.49, 57.23	209	47.6	42.77, 52.51	
1–2 times/week	374	3.1	2.46, 3.90	1595	2.8	2.44, 3.20	
3–4 times/week but not daily	1185	26.1	21.21, 31.75	4010	73.9	68.25, 78.79	
Daily	535	15.7	14.24, 17.20	1460	21.3	20.42, 22.29	
		19.0	17.30, 20.81		81.0	79.19, 82.70	
		49.6	47.60, 51.65		53.7	52.51, 54.79	
		22.8	21.68, 23.98		77.2	76.02, 78.32	
		22.4	20.76, 24.14		19.5	18.64, 20.46	
		26.8	24.89, 28.83		73.2	71.17, 75.11	
Hamburgers, hot dogs and kebabs							<0.001
Never/almost never	873	36.6	34.63, 38.53	2229	29.8	28.79, 30.88	<0.001
<1 time/week	958	28.1	26.57, 29.77	3187	71.9	70.23, 73.43	
1–2 times/week	470	40.1	38.15, 42.12	1777	42.6	41.52, 43.77	
3–4 times/week but not daily	75	23.1	21.84, 24.43	257	76.9	75.57, 78.16	
Daily	12	19.7	18.12, 21.35	24	23.8	22.82, 24.76	
		20.9	19.26, 22.67		79.1	77.33, 80.74	
		3.1	2.49, 3.94		3.4	3.04, 3.88	
		22.6	18.28, 27.55		77.4	72.45, 81.72	
		0.5	0.27, 0.90		0.3	0.21, 0.48	
		33.3	19.10, 51.05		66.6	48.95, 80.90	
Eggs							<0.001
Never/almost never	113	4.7	3.93, 5.68	411	5.5	4.99, 6.05	<0.001
<1 time/week	314	21.6	18.17, 25.39	1315	78.4	74.61, 81.83	
1–2 times/week	1155	13.1	11.83, 14.58	4038	17.6	16.74, 18.48	
3–4 times/week but not daily	691	19.3	17.40, 21.29	1533	80.7	78.71, 82.60	
Daily	115	48.4	46.34, 50.39	177	54.0	52.89, 55.16	
		22.2	21.12, 23.40		77.8	76.60, 78.88	
		28.9	27.13, 30.81		20.5	19.60, 21.45	
		31.1	29.16, 33.05		68.9	66.95, 70.84	
		4.8	4.01, 5.77		2.4	2.04, 2.74	
		39.4	33.79, 45.26		60.6	54.74, 66.21	
Fish							<0.001
Never/almost never	320	13.4	12.07, 14.85	858	11.5	10.77, 12.23	<0.001
<1 time/week	354	27.2	24.66, 29.82	1557	72.8	70.18, 75.34	
1–2 times/week	911	14.8	13.44, 16.33	3492	20.8	19.92, 21.77	
3–4 times/week but not daily	697	18.5	16.82, 20.36	1439	81.5	79.64, 82.18	
Daily	106	38.1	36.20, 40.14	128	46.7	45.59, 47.86	
		20.7	19.51, 21.92		79.3	78.08, 80.49	
		29.2	27.38, 31.06		19.3	18.37, 20.17	
		32.6	30.65, 34.67		67.4	65.33, 69.35	
		4.4	3.66, 5.36		1.7	1.44, 2.04	
		45.3	38.84, 51.91		54.7	48.09, 61.16	
Processed meats							<0.001
							<0.001



Table 4. (Continued)

	Compliant			Non-compliant			P*
	n	%	95% CI	n	%	95% CI	
Never/almost never	416	17.4	15.93, 19.02	964	12.9	12.15, 13.68	
<1 time/week	308	12.9	11.59, 14.32	1500	20.1	19.17, 20.99	
1–2 times/week	654	27.4	25.62, 29.23	2164	29.0	27.93, 29.99	
3–4 times/week but not daily	594	24.9	23.16, 26.67	1935	25.9	24.90, 26.90	
Daily	416	17.4	15.93, 19.02	911	12.2	11.46, 12.96	
		31.3	28.87, 33.03		68.7	66.07, 71.13	
Dairy products							<0.001
Never/almost never	93	3.9	3.17, 4.77	160	2.1	1.83, 2.50	<0.001
<1 time/week	79	3.3	2.64, 4.13	245	3.3	2.89, 3.71	
1–2 times/week	198	8.3	7.23, 9.49	640	8.6	7.94, 9.22	
3–4 times/week but not daily	355	14.9	13.48, 16.37	1274	17.0	16.20, 17.92	
Daily	1663	69.6	67.74, 71.47	5155	69.0	67.90, 70.02	
		24.4	23.38, 25.43		75.6	74.57, 76.62	
Pizza							<0.001
Never/almost never	532	22.3	20.63, 24.01	1484	19.9	18.96, 20.78	<0.001
<1 time/week	1121	46.9	44.93, 48.97	3764	50.4	49.22, 51.50	
1–2 times/week	537	22.5	21.78, 24.16	1884	25.2	24.23, 26.21	
3–4 times/week but not daily	130	5.4	4.58, 6.45	270	3.6	3.21, 4.07	
Daily	68	2.8	2.23, 3.62	72	1.0	0.76, 1.22	
		48.6	40.10, 57.13		51.4	42.87, 59.90	
Sweets (biscuits, cookies, pastries, jams, etc.)							0.05
Never/almost never	277	11.6	10.36, 12.97	814	10.9	10.20, 11.62	0.049
<1 time/week	465	19.5	17.91, 21.13	1330	17.8	16.94, 18.68	
1–2 times/week	587	24.6	22.88, 26.37	1765	23.6	22.66, 24.60	
3–4 times/week but not daily	570	23.9	22.18, 25.64	1975	26.4	25.43, 27.44	
Daily	489	20.5	18.89, 22.16	1590	21.3	20.35, 22.22	
		23.5	21.72, 25.42		76.5	74.58, 78.28	
Sugary drinks							0.031
Never/almost never	884	37.0	35.08, 38.99	2506	33.5	32.46, 34.61	0.027
<1 time/week	585	24.5	22.79, 26.28	1885	25.2	24.24, 26.22	
1–2 times/week	490	20.5	18.93, 22.21	1638	21.9	20.99, 22.87	
3–4 times/week but not daily	248	10.4	9.20, 11.70	862	11.5	10.82, 12.28	
Daily	181	7.6	6.56, 8.73	583	7.8	7.21, 8.44	
		23.7	20.75, 26.90		76.3	73.10, 74.25	
Juices and milkshakes							<0.001
Never/almost never	452	18.9	17.39, 20.57	1504	20.1	19.22, 21.05	<0.001
<1 time/week	367	15.4	13.96, 16.89	1335	17.9	17.00, 18.75	
1–2 times/week	427	21.6	19.65, 23.61	1504	20.1	19.22, 21.05	
		22.1	20.29, 24.04		77.9	75.96, 79.71	

Table 4. (Continued)

	Compliant			Non-compliant			P*
	n	%	95% CI	n	%	95% CI	
3–4 times/week but not daily	531	22.2	20.59, 23.97	1569	21.0	20.08, 21.94	
Daily	611	25.6	23.86, 27.40	1562	20.9	19.98, 21.84	
Fresh fruit		28.1	26.24, 30.07		71.9	69.93, 73.76	<0.001
Never/almost never	138	5.8	4.89, 6.81	803	10.7	10.06, 11.47	<0.001
<1 time/week	177	7.4	6.41, 8.55	880	11.8	11.06, 12.53	
1–2 times/week	309	12.9	11.63, 14.37	1348	18.0	17.17, 18.93	
3–4 times/week but not daily	575	24.1	22.38, 25.86	1731	23.2	22.21, 24.14	
Daily	1189	49.8	47.77, 51.82	2712	36.3	35.20, 37.39	
Pasta, rice, potatoes		30.5	29.04, 31.96		69.5	68.04, 70.96	<0.001
Never/almost never	12	0.5	0.27, 0.90	48	0.6	0.48, 0.86	<0.001
<1 time/week	67	2.8	2.20, 3.57	322	4.3	3.86, 4.80	
1–2 times/week	541	22.7	21.00, 24.40	2400	32.1	31.06, 33.18	
3–4 times/week but not daily	1221	51.1	49.10, 53.15	3653	48.9	47.74, 50.02	
Daily	547	22.9	21.24, 24.66	1051	14.1	13.28, 14.88	
Bread and grains		34.2	31.91, 36.62		65.8	63.37, 68.09	<0.001
Never/almost never	54	2.3	1.72, 2.96	211	2.8	2.46, 3.23	<0.001
<1 time/week	120	5.0	4.20, 5.99	495	6.6	6.07, 7.22	
1–2 times/week	196	8.2	7.15, 9.40	825	11.0	10.34, 11.78	
3–4 times/week but not daily	464	19.4	17.87, 21.09	1535	20.5	19.63, 21.48	
Daily	1554	65.1	63.12, 66.98	4408	59.0	57.85, 60.10	
Vegetables		26.1	24.96, 27.20		73.9	72.80, 75.04	<0.001
Never/almost never	41	1.7	1.25, 2.34	629	8.4	7.80, 9.07	<0.001
<1 time/week	93	3.9	3.17, 4.77	983	13.2	12.40, 13.94	
1–2 times/week	323	13.5	12.19, 14.98	2237	29.9	28.90, 30.98	
3–4 times/week but not daily	957	40.1	38.11, 42.08	2005	26.8	25.83, 27.85	
Daily	974	40.8	38.81, 42.79	1620	21.7	20.75, 22.63	
		37.5	35.69, 39.44		62.5	60.55, 64.31	

* P value obtained through the χ^2 test for percentages in both column and rows.

consumed them 1–2 times/week, while those who never consume pulses form the smallest group (13.0%).

The foods whose daily or almost daily consumption is associated with higher adherence to the recommended frequency of consumption of pulses are hamburgers, hot dogs and kebabs; eggs; fish; sausages and cold meats; pizza; juices and milkshakes; fresh fruits; pasta, rice and potatoes; bread and cereals. On the

other hand, for meat and dairy products, students who consumed these products never or almost never present the highest proportion of adherence to the recommended frequency of consumption of pulses. In the case of sweets and sugary drinks, compliance rates were similar across all intake groups but the group with the worst compliance was that which consumed sweets or sugary drinks 3–4 times/week.



Discussion

It was identified that 75.8% of the participating students presented an inadequate consumption of pulses, which indicates that the standard recommendations of consumption of pulses as >2 times/week⁽¹³⁾ are not being met. This is higher than that found in previous studies where compliance was found to be close to 50%^(4,32–34) but is in accordance with another Chilean study where compliance was about 22.5%⁽³⁵⁾ and much better than the results found in a Canadian study where none of the subjects met recommendations⁽³⁶⁾ and a Mexican study where pulses were consumed by <10% of the population⁽³⁷⁾. A study carried out in Costa Rica in medical students found that they consumed significantly greater amounts than the recommendations⁽³⁸⁾. Meanwhile, two Spanish studies showed that 70.9 and 91.9% of female and 84.6 and 95.2% of male students in Madrid⁽³⁹⁾ and Murcia⁽⁴⁰⁾, respectively, consumed pulses at least once a week, but no data are given as to the actual quantities consumed and compliance with the recommendation cannot be assessed. However, the national average consumption per capita of pulses in Spain of 3.20 kg per person per year corresponds to an average of <1 weekly ration (80 g/ration)⁽¹²⁾, well below the recommended amount.

The sample consists primarily of women (72.2%); women are over-represented given that the official statistics for the 2018–2019 academic year in Spain shows only 55% of newly enrolled students being women⁽⁴¹⁾. Regarding geographical location, the students of universities of the south account for 59.6% of the sample, while those of universities of the north for 40.4%. This difference in participation between regions must be highlighted as there can exist inherent diet differences according to the region or community of origin of the student⁽⁴²⁾.

Most students do not work (89.4%); however, compliance with the recommendations is higher among those who look for work. In this case, the low price of pulses, compared with other food groups, may perhaps be a factor in the higher compliance with the recommendations in those looking for work; however, with the currently available data, no further conclusion can be made. Among those students who do work, those who work full time have better compliance rates. There seems to be a relation between working more hours or actively seeking work and adequate pulses consumption. No other studies on the association between employment status in university students and pulses consumption have been found for comparison.

In this study, students who lived at home or in university residences were significantly more likely to meet the recommendations for pulses intake than those who lived in rented accommodations. As for coexistence or who the student lives with during the academic year, it can be observed that those students who live with their parents have the highest compliance rates, while those who live with roommates, be it a partner or friends, have the lowest rate of compliance. These findings are also supported by other previous studies thus suggesting that young people living away from the parental home comply less with the recommendations^(22,40). This may be because many students assume responsibility for their food for the first time; the purchase of food, elaboration of a daily menu and the preparation of food, which are all factors that will strongly influence

eating habits, now fall to the students. Lack of practice or knowledge may lead students to include foods in their diets that do not require complex processing or prolonged cooking times, such as frozen foods, pizzas, sausages or precooked meats⁽⁴⁾.

No clear pattern can be detected between the consumption of pulses and that of other foods but some trends do appear. Higher consumption of pulses is associated with higher intakes of healthy foods and also seems to be associated with lower consumption of unhealthy foods such as sweets and sugary drinks but at the same time with a higher consumption of pizza. When studying the association with meat products, fish and dairy products, there appears to be a polarisation of the consumption of these products related to pulses intake. The higher compliance rates among those with little to no consumption of these products may be due to following a restrictive diet (vegetarian, flexitarian, vegan, etc. which have recently increased in popularity⁽⁴³⁾) in which animal products have been substituted in part by pulses. However, for those without diet restrictions, it seems that pulses intake is positively associated with the consumption of these products. Further specific and detailed information on diet restriction is not available in this study. A study relating the consumption of pulses and other foods in the university population carried out by the Spanish Nutrition Foundation in twenty-one Spanish universities coincides with this study when comparing the consumption of meat products and sweets with the consumption of pulses⁽⁵⁾.

Limitations

This work has limitations but can serve as a launching pad for future research on this topic. Although a large number of information were collected in the UniHcos survey, information such as the diet restrictions mentioned previously is missing. Another of the limitations of this study is its transversal design given which the results must be interpreted with caution. The questionnaire used to collect the information, a self-completed food frequency consumption section, could present a possible bias of social desirability in terms of wanting to indicate the consumption of foods that young people consider to have better or healthier characteristics. However, it is possible that this bias was controlled because the user had to concentrate on determining the number of times he/she consumes pulses and not on its healthy characteristics. In addition, food frequency consumption section is one of the most used questionnaires in population studies, to obtain information on the times or frequency with which a specific food is consumed to compare it with nutritional recommendations.

Participation in the study was completely voluntary, and invitations were sent by way of email to the students' academic email accounts. These two factors could have influenced the participation as first-year university students may not prioritise taking part in such studies and/or may not utilise the academic emails often. The low participation rates in research similar to that presented here are common among first-year university students, and this carries with it the potential for unit non-response bias. To avoid this as much as possible, the online self-questionnaire was designed to try to avoid making it more likely for certain groups to participate or not in the study. However, the very low participation rate observed may still



be the most important limitation of this study as the sample may not be representative of the Spanish university student population. This limitation is a difficult one to overcome, but changes in the methodology used to collect the data that may improve response rates should be studied and applied in future similar studies.

Conclusion

The results of this study show that compliance with the recommendations for consumption of pulses in Spanish university students is very low across all studied universities denoting a deviation from the traditional Mediterranean dietary pattern which is increasingly being abandoned by the younger generations. Compliance rates are not related to sex, BMI, marital status, employment status or coexistence but are related to the students' place of residence during the academic year. Those who live outside the family home are less likely to comply with pulses consumption recommendations. Compliance with the recommendations for consumption of pulses seems to be associated with higher intakes of healthy foods and lower intakes of unhealthy foods with a dichotomy appearing for animal-derived products. Therefore, low consumption of pulses is seemingly not restricted to a specific profile or dietary pattern among university students, and no specific focus group for intervention can be identified. Policies promoting the consumption of pulses among the university population as a whole are necessary to increase compliance rates with the dietary recommendations.

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