

Food consumption and eating habits: a segmentation of university students from Central-South Italy

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1. Introduction

A growing interest is appearing at institutional and scientific level concerning the interactions between food consumption, nutrition and health, due to a departure from healthy dietary habits. The latest OECD health statistics (2014) describe the rise of obesity and overweight prevalence in Europe.

University students are considered as a vulnerable young-adult group due to lifestyle changes and negative modifications of their eating habits in terms of variety and quality of food-stuffs, as well as in terms of consumption frequency and food intake (Rodríguez *et al.*, 2013; Telean *et al.*, 2015). The experiences of young people when they live outside of their family home, for instance during the years spent in University education, can modify their tastes and eating behaviours (CIHEAM/FAO, 2015). Finally, the lack of interest of the young generation in the Mediterranean food cultural heritage and identity (Lacirignola and Capone, 2009; CIHEAM/FAO, 2015) and the important role of this generation in safeguarding and transmitting healthy food habits, are further reasons for analysing young food habits.

Abstract

This paper analyses the dietary models of a sample of Italian university students enrolled at the University of Molise and carries out a segmentation analysis. The frequency of consumption of twenty food items and variables related to individual, socio-cultural and community environments were recorded through a cross survey. Differences in food consumption were investigated according to students' age, gender, and living conditions. The segmentation analysis provided six clusters of dietary models based on the frequency of consumption of food items, that were further described according to individual and interpersonal characteristics, and to the adherence to the Mediterranean Diet Pyramid recommendations. The characterization of different dietary models may be useful to suggest ad hoc interventions aimed at improving food habits and at revitalizing the interest of young generations in their own Mediterranean cultural food heritage.

Keywords: dietary models, university students, cluster analysis, Central-South Italy, cross-sectional survey.

Résumé

Dans ce travail, nous allons étudier les modèles de consommation alimentaire d'un groupe d'étudiants de l'Université du Molise et effectuer une analyse de segmentation. La fréquence de consommation de vingt denrées alimentaires et des variables liées aux environnements individuel, socio-culturel et communautaire ont été enregistrées. Les différences dans la consommation alimentaire des étudiants ont été étudiées en fonction de leur âge, de leur sexe et de leurs conditions de vie. L'analyse de segmentation a mis en évidence six groupes de modèles alimentaires sur la base de la fréquence de consommation des denrées alimentaires. Ces groupes ont été décrit en détail compte tenu des caractéristiques individuelles et interpersonnelles et de l'adhésion à la pyramide de l'alimentation méditerranéenne. La caractérisation des différents modèles alimentaires peut être utile pour suggérer des interventions spécifiques visant à améliorer les habitudes alimentaires et à raviver l'intérêt chez les jeunes générations pour leur patrimoine culturel méditerranéen.

Mots-clés : modèles alimentaires, étudiants universitaires analyse de grappes, Italie centrale et du Sud, enquête transversale.

2. Literature background and study aims

Literature reports several empirical studies about food habits of university students in the European Mediterranean area. Some studies referred to the Greek population (Papadaki *et al.*, 2007; Kremmyda *et al.*, 2008; Tirodimos *et al.*, 2009), the Maltese (Cefai and Camilleri, 2011), the Portuguese (Rodrigues *et al.*, 2013; Vilela *et al.*, 2014) and the Spanish students (Serra-Majem *et al.*, 2006; Baldini *et al.*, 2009). Other surveys considered students from Tunisia (Cervera Burriel *et al.*, 2014; Callieris *et al.*, 2016), Morocco (El Fessikh *et al.*, 2014) and Algeria (Mohammed, 2016), the United Arab Emirates (Kerkadi, 2003), Kuwait (El-Ghazali *et al.*, 2010)

and Lebanon (Yahia *et al.*, 2008). Most of the aforementioned studies investigated eating patterns of college students at single country level and focused on single characteristics of student's profile.

Studies on dietary patterns of Italian university students were only conducted in some large areas and focused on some issues or foodstuffs (Bagordo *et al.*, 2013; Menozzi *et al.*, 2015) or on specific students' targets (Baldini *et al.*, 2009; Lupi *et al.*, 2015; Platania *et al.*, 2016).

Many disciplines investigate the food behaviour and several models are proposed in different disciplinary backgrounds other than the economic one, including psychological and sociological fields (Hardcastle *et al.*, 2015). The socio-ecological model, firstly proposed by Bro-

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fenbrenner (1979), views the dietary behaviour as the interaction between, and interdependence of, factors within and across multiple levels of influence. The model highlights the relationship between individuals and their environment (Larson and Story, 2009) and posits that behaviour has multiple levels of influence including intrapersonal (biological, psychological), interpersonal (social, cultural), community, physical and macro-level environments.

As for the intrapersonal environment, the students' profile may be characterised by biological characteristics and other individual information.

The students' interpersonal socio-cultural profile refers to beliefs and behaviours, such as the knowledge of nutritional advice, and the linkages between food behaviour and environmental and ethical attitudes. Indeed, these linkages are considered even more important for a sustainable and ethical food consumption (Gerson *et al.*, 2013; Forleo and Di Nocera, 2014); some authors (Pelletier *et al.*, 2013) found a positive association between attitudes towards organic foods and higher dietary quality among young adults.

At the community level, both college (university status, student's residence, department and course, habits of eating at university canteen or away from home) and family eating lifestyle may be considered.

The aims of this study were to investigate the dietary patterns of a university student population and to identify the prevalent dietary models by using a cluster analysis. In pursuing these aims, the study adopts a conceptual framework in which dietary patterns -in terms of consumption frequency of food items- are influenced by many forces, at individual, and contextual levels. Adopting a simplified socio-ecological approach, this study considers intrapersonal, interpersonal and community environments associated to student's food behaviour and dietary patterns. A questionnaire was provided for collecting information related to the above environments.

The analysis was performed focusing on the consumption of several foodstuffs within different dietary models rather than on the consumption of a single food item. In this respect, the study may provide new insights, compared to the previous literature, into food consumption at diet level and into the varied dietary patterns followed by university students. Furthermore, individual, socio-cultural and community variables were considered to describe students' dietary patterns.

3. Materials and methods

Students enrolled at the University of Molise (UniMol) were selected as reference sample. A cross-sectional survey was implemented in 2015. UniMol is the only public higher education institution in Molise Region and comprises 7311 students (internal data for the academic year 2014-2015; www.unimol.it/ateneo/dati-statistici/iscritti/). UniMol is characterised by students from Molise Region (54%) and from two neighbouring Southern Regions (Puglia and Campania, 40%).

An online questionnaire, previously validated on a pilot students' sample (data not shown), was sent to the students' email address.

The questionnaire was structured into three sections (Tab. 1): individual demographic characteristics; socio-cultural and community context related to eating habits; food and beverage consumption.

In the first part, several individual characteristics (age, gender, degree course year, department, relationship status and socio-economic status), anthropometric measure and information about health status were collected. In order to have a picture of students' nutritional status, the Body Mass Index (BMI) from self-reported measures was calculated and categorised according to the World Health Organization standard (<http://apps.who.int/bmi/index.jsp>). The BMI can be considered as a rough indicator of nutritional status (Nuttall, 2015), although it is commonly used for monitoring the increasing prevalence of overweight and obesity. In this study, the association between students' BMI and some variables (i.e. age, gender, living away from home) with food consumption frequencies was evaluated.

The second section of the questionnaire collected information related to interpersonal and community contexts considered as relevant for student's food patterns. Information about socio-cultural aspects refer to students' behaviour towards specific types of foodstuffs (organic, traditional, fair), perception of food safety risks, knowledge of nutritional recommendation, and pro-environmental behaviours. With respect to the community environment, data refer to the college lifetime (i.e. place of living during the study-time, if with the family or not; the daily place for having meals, if at the university canteen or not; the frequency of some recreational activities, as eating outside and practising sports), and to household's characteristics (size and eating habits; parents' job; parents' health status).

Among the individual, socio-cultural and community variables collected through the survey questionnaire, this study reports only those (Table 1) that were significant in statistical analysis.

The third part of the questionnaire was about eating patterns. A short Food Frequency Questionnaire was implemented to collect data on servings per week of twenty food items (Table 2). In order to synthesize the consumption of each food item into an aggregated index, frequency scores of single food items were averaged in six basic food groups, following the approach adopted by Baldini *et al.* (2009). Food groups were identified as follows: group I (cereals, bread, rice, pasta, potatoes and cookies); group II (fruit and vegetables); group III (milk, yoghurt and cheese); group IV (meats, meat products, fish, eggs, legumes); group V included sweets (pastries, cakes) and sugar-sweetened alcohol-free beverages; finally, group VI included alcoholic beverages (wine, beer) and spirits.

Table 1 - Questionnaire structure and relevant variables.

Questionnaire sections	Variables
1. individual characteristics and anthropometric measures Scores: dichotomic (Yes, No) and categorical (1=never, 2=rarely, 3=sometimes, 4=often, 5=always)	Gender; Age; Department Height; Weight Obesity, Allergy; Health Diet; Health Check, Sports practice
2. Socio-cultural context Scores: as above	Knowledge of caloric intake recommendations; Perception of food safety risks; Frequency of eating at university's canteen; Family living; Organic, European traditional food certifications (PDO, PGI, TSG), Fair and Ethnic foods frequency of consumption; Frozen foods and Long shelf life foods consumption; Recycling, Separate waste disposal, Animal welfare sensitiveness
3. Frequency of consumption of food items in terms of servings/week Scores: 1=never, 2=1 serving, 3=2-3 servings, 4=4-5 servings, 5=more than 5 servings	Milk, Yoghurt and Cheese; Bread, Pasta, Rice, Cereals, Potatoes, Cookies; Fruit and Vegetables; Legumes, Meat, Meat Products, Fish, Eggs; Pastries and cakes; Sugar added drinks (carbonated beverages and fruit juices); Alcoholic beverages (beer and wine); Spirits

A descriptive analysis (percentages, means and standard deviations) was carried out for the study population characteristics and food consumption frequencies. The consumption for each food items was compared with the newly suggested Italian Food Guide Pyramid (Vitiello *et al.*, 2016) in order to highlight the gap –with a higher or lower intake– and the percentage of adherence. In detail, the frequency of consumption per each food item was recoded as 1 in case of perfect adherence and as zero in case of no adherence (lower or higher) to the recommended intake. A global adherence score for each student was calculated by summing the score of each food item.

Bivariate analysis and t-test, ANOVA and F-test, were used to assess associations among variables and to compare mean scores, respectively; χ^2 statistic was used to verify equal distributions of food consumption frequencies between categorical variables.

The segmentation of students' food habits was based on the frequency of food consumption in student's weekly diet. A hierarchical cluster analysis was performed by using a complete linkage method and the Euclidean distance, and was based on the standardized scores of the six basic food

groups. A solution with six clusters of students' diet models was defined by looking at the distribution of the Calinski/Harabasz pseudo-F and Duda/Hart stopping rules indexes. To further characterise each diet group, clusters were described according to other significant variables and for their adherence to the Italian Food Guide Pyramid recommendations.

4. Sample description

Five hundred and forty-eight students gave valid answers to the questionnaire and were considered in the analysis. The gender distribution in the sample showed a slight predominance of women (n=368, 67.1% female) compared to the whole UniMol student population (59%) and to the overall Italian population of university students (56%).

Most participants aged less than 24 years (47.9%), in line with the age distribution of UniMol students (47.0%), and the remaining students were mainly 25-29 years old.

In our sample, 66% of students lived in Molise Region (Central Italy), while the remaining (33.7) were mainly from Campania and Puglia Regions (Southern Italy). About three out of four respondents (76.3%) were still living at home with parents during their studies.

Students in the sample reported an average BMI of 22.8. According to BMI categories, 7.6% of the students proved to be underweight, 68.6% of them had a normal weight, 19.8% were overweight, and 3.8% of the students were obese.

The consumption frequency (servings per week) of twenty food items is reported in Table 2. The average scores of consumption frequency was, in a decreasing order, as follows: bread, pasta, fruit, milk, vegetables, meat, cookies and alcohol-free drinks, cheese, sweets, meat products and fish; all remaining foodstuffs.

The adherence of students' food consumption to the new Italian Mediterranean Food Pyramid (Vitiello *et al.*, 2016) was assessed.

The maximum level of compliance was referred to 13 out of 20 food items, while the median value was 6 items over the whole sample. Data for single food items revealed the worst adherence for rice and cereals whose consumption is lower than recommended (Graph 1); other carbohydrates sources, mainly bread and pasta, were con-

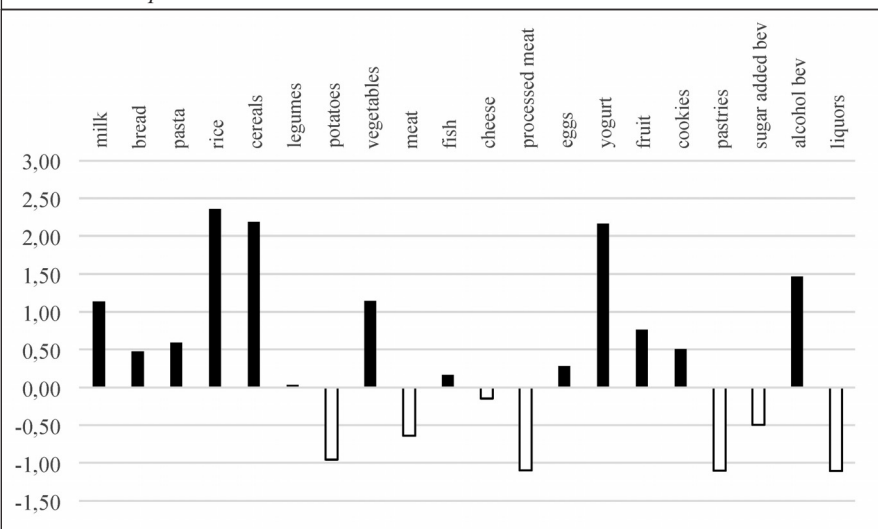
Table 2 - Food and beverages consumption frequencies (servings/week).

Food and beverages	Consumption frequencies ^a (%)					Total	Mean score	% of adherence to Med. Pyramid ^b
	1	2	3	4	5			
Bread	0.6	3.8	8.5	17.3	69.9	100.0	4.5	69.9
Pasta		2.4	10.5	31.2	55.8	100.0	4.4	55.8
Rice	1.3	42.5	47.6	8.1	0.6	100.0	2.6	0.6
Cereals	2.4	42.7	33.5	13.9	7.5	100.0	2.8	7.5
Legumes	0.4	21.6	60.0	17.5	0.6	100.0	3.0	60.0
Potatoes	0.6	22.7	58.3	17.7	0.8	100.0	3.0	58.3
Vegetables	0.8	6.4	24.1	44.2	24.6	100.0	3.9	24.6
Milk	1.7	22.9	12.4	13.7	49.2	100.0	3.9	49.2
Yoghurt	2.1	48.9	22.7	16.0	10.3	100.0	2.8	16.0
Cheese	1.3	22.6	40.6	31.4	4.1	100.0	3.1	40.6
Meat	0.4	5.5	32.9	52.6	8.6	100.0	3.6	32.9
Processed meat	0.2	25.6	42.7	27.6	3.9	100.0	3.1	25.6
Fish		28.6	60.5	10.5	0.4	100.0	2.8	60.5
Eggs	0.4	35.7	56.6	6.6	0.8	100.0	2.7	56.6
Fruit	0.8	7.5	12.2	26.7	52.8	100.0	4.2	52.8
Cookies	1.1	22.6	26.3	26.5	23.5	100.0	3.5	26.5
Pastries	0.8	29.3	37.2	24.6	8.1	100.0	3.1	37.2
Sugar-sweetened drinks	0.8	22.0	25.8	30.3	21.2	100.0	3.5	30.3
Alcoholic beverages	3.2	57.3	26.3	9.2	3.9	100.0	2.5	9.2
Liquors	4.9	82.9	9.4	2.6	0.2	100.0	2.1	82.9

^a Consumption frequencies: 1= never, 2=1 serving, 3=2-3 servings, 4=4-5 servings, 5= more than 5 servings.

^b For more details about the score method, see Vitiello *et al.*, 2016.

Graph 1 - Deviation between mean consumption of food items and Mediterranean Diet Pyramid in the sample.



The black column refers to food items with an intake lower than the recommended frequency. The white column shows an intake higher than recommended. The vertical axis measures the absolute gaps between the average reported consumption and the recommended intake.

sumed with a frequency that meets the Pyramid’s suggestions for about 60% of the students (last column, Table 2).

The percentage of students complying with the suggested intake was high for potatoes and legumes, but very low for vegetables. Food categories containing sugar were properly consumed by 30% of the sample. Among animal protein food, 32% and 25% of the students consumed meat and processed meat in agreement with weekly suggestions, while a higher compliance emerged for eggs (57%) and fish (60%).

Table 3 - Association of food consumption frequencies with gender, age and living with family.

Food items	Gender ^a	Age ^b	Family Living ^c
Bread			*
Pasta			*
Rice	*	**	**
Grain	*	**	
Potatoes		*	
Meat	**	***	***
Processed meat		***	*
Eggs		*	
Legumes			
Fish			
Milk			**
Yoghurt		**	**
Cheese			
Vegetables	***	***	*
Fruit		*	
Cookies			
Pastries		**	
Sugar sweetened drinks		***	***
Alcoholic beverages	***		**
Liquors	**		**

^a (*) 0.01 < p <= 0.05; (**) 0.001 < p <= 0.01; (***) p < 0.001

^a Fisher’s exact test; ^b t student and Chi2 test; ^c Fisher’s exact test.

Finally, the adherence was low for alcoholic and sugar added drinks, while it appears high for liquors.

5. Results

5.1. Gender, Age and Living with parents: associations with food consumption and eating habits

The aim of this paragraph is to demonstrate whether eating habits and food consumption frequencies were associated with gender, age and living conditions (Table 3).

Male and female students showed differences in several eating behaviours and food-related activities. The female gender was associated with a stronger feeling of food insecurity (39% of female students, 26% of male students never felt safe with food consumption). Women reported a higher intake of rice, grain and, above all, vegetables. On the other hand, the consumption of meat, alcoholic beverages and spirits was associated with male students. Data did not highlight a

gender difference in the consumption of other relevant food-stuffs in the Mediterranean Diet, like fish, fruit and legumes.

Statistically significant differences between mean age and some variables were identified. Briefly, the mean age of female students (24.7) was lower than that of males (25.4), while students living away from family had a mean age (27.4) higher than that of individuals living at home (24.5). Other statistically significant variables in relation to age were the following: frozen food frequency of consumption (“never” consumers aged 25.3, while “always” consumers aged 23.0) and long shelf life food products consumption (“never” consumers aged 25.2, while “always” consumers aged 23.1). Younger students used to have food away from home more frequently than other individuals (in detail, “eating at canteen”: “never” consumers aged 26.3, “always” consumers aged 24.0; and “having food outdoor”: “never” consumers aged 25.4, “always” consumers aged 24.0). Assessing differences in the consumption frequency by age, the most consumed foods by younger students were meat, meat products, eggs, potatoes and alcohol-free drinks; on the other hand, older students preferred pastries and alcoholic drinks.

Finally, we discussed variables significantly associated with students’ living conditions.

Students living with their parents frequently ate at the canteen (54% versus 35% among the students living away from home), probably at lunch, as commuter students. A normal body weight and lower obesity characterised students living at home (71.1% had normal BMI, 6.5 had a BMI higher than 30) more than those living away from family (60.1% with normal BMI; 7% with a BMI higher than 30). Students living at home showed a more frequent

consumption of organic and ethnic foods compared with other students. Furthermore, students living at home consumed higher servings/week of pasta, milk and meat; on the other side, students living away from their families were characterized by a higher consumption of alcoholic drinks and spirits. A significant difference by living status was also found for yoghurt, rice, and alcohol-free drinks, whose consumption was higher among students living at home. Regarding some typical foods of the Mediterranean Diet, such as fish, legumes and fruit, data did not reveal significant differences in consumption frequencies due to the students' living conditions.

5.2. Clusters of prevalent dietary models among students

A cluster analysis was carried out based on the reported frequencies of consumption of food and beverages that were averaged over the six basic food groups. This analysis allowed to group students in six clusters characterised by different diet models. Each cluster was labelled according to those food items that mostly characterised the students' diet because of a higher or lower frequency of consumption in comparison with the frequencies revealed within the whole sample. Students' clusters are described by the mean consumption score for the six food groups (Graph 2). For each cluster, the adherence to the recommendations of the Mediterranean Diet Pyramid is reported considering the percentage of students according to a global score (Graph 3), and for food items (Table 4). Finally, individual, socio-cultural and other variables that significantly differ among clusters were highlighted (Table 5).

Cluster 1. A diet rich of fruit and vegetables

The first cluster grouped 10% of sample units. The students' diet was mainly characterised by the consumption of fruit and vegetables (an average score of 4.4) that reached the highest score compared with other clusters. Another characteristic concerned the quite low consumption of alcoholic beverages (1.8). When compared with other clusters and with the total sample, the diet of these students showed a low frequency of servings per week for all other food groups. The intake of cereals and proteins appeared moderate and lower than in other clusters (an average score of 3.1 and 2.7, respectively); the consumption of cereals and proteins was homogenous among students in the cluster (SD 0.34 and 0.27, respectively), while some deviation emerged for sweets consumption (SD=1.02).

By recoding the frequencies of consumption in terms of Mediterranean Diet suggested intake (Table 4), the diet of this students' cluster should improve the consumption of all food items –mainly carbohydrates–, except for the meat groups, fruit and vegetables categories.

As concerns demographic characteristics, two aspects may be considered: the high age and the prevalence of female students (see Table 5). The BMI had on average the lowest level among clusters. These students were used to have meals at

home instead of at a university canteen or outside. Most students (49%) in the cluster declared feeling unsafe with food consumption due to the perception of health risks. More than two-thirds of students never/rarely consumed frozen foods, a type of behaviour that might be related to the food conservation process; finally, 53% of units declared a rare/zero consumption of food items with a long shelf-life, maybe preferring fresh foods. These students appeared sensitive to some environmental themes, such as animal welfare, and engaged in waste sorting and recycling practices. Despite this, students in the cluster did not show the highest frequency of consumption of organic food.

Cluster 2. A diet rich in milk and dairy products

This cluster counted 28% of all students. A highest consumption of milk and dairy products was the main characteristic of this cluster's diet. The consumption of fruit and vegetables appeared slightly higher than the average consumption in the sample. On the other side, the consumption of sweets had on average the lowest score (2.8) among the other clusters. The consumption of other food categories (cereals, proteins, beverages) had a frequency lower than the average.

The dietary pattern of this cluster is in line with the total sample. Some improvements in the dietary model of this cluster regard the consumption of pasta, sugar added drinks and alcohol beverages, that registered the lowest adherence to the Mediterranean Pyramid (Table 4).

Despite the lowest percentage of students ignoring their daily caloric needs, 23% of students declared as appropriate an intake lower than 1500 calories per day, a threshold that is under the suggested caloric intake of the Italian adult population (LARN, 2014).

Finally, 48% of students in the cluster (against an average of 54% in the sample) declared a zero consumption of organic food. Partly coherent with organic food consumption and its related environmental motivation, cluster's units showed some pro-environmental behaviours related to the high percentage of students being aware of animal welfare and adopting waste sorting practices.

Cluster 3. A diet poor in fruit and vegetables

A diet with a high consumption of sweets characterised 12% of students belonging to this cluster. On the contrary, this diet was very poor in fruit and vegetables consumption (a mean score of 2.9); furthermore, by looking at the standard deviation of fruit and vegetables consumption scores, a uniform distribution emerged in the cluster. The average frequency of consumption of protein food groups appeared in line with the average in the sample (3.1). Anyway, when considering single food items included in the protein group, a consumption of meat products higher (3.4) than that of fish (2.7) and of legumes (2.8) emerged.

The dietary pattern of this cluster appears very far from the Mediterranean Pyramid suggestions. In fact, two thirds of the students adhere to recommendations for six out of 20

food items; for fruit and vegetables consumption the percentage of adherence was close to zero. Even for the animal protein intake, a high percentage of students did not show adherence to the consumption of meat and fish (Table 4).

The cluster mainly includes young students and a high percentage of people living at home. Even if the distribution of answers among caloric intake classes appeared quite adherent to nutritional suggestions, 36% of students did not know their daily caloric intake. Furthermore, half of students were not used to practising sports activities (Table 5).

Cluster 4. A diet poor in milk and dairy products

A diet with a poor consumption of milk and dairy products characterised this cluster, which included 10% of students in the sample. Even the consumption frequency of fruit and vegetables was slightly lower than the average servings in the sample. The same result emerged for all other basic food categories, except for alcoholic beverages and spirits. Detailed data for single food items revealed a consumption frequency lower than the average for milk, cereals, fish and legumes. A reformulation of the cluster's diet would certainly require an increasing consumption of fish, fruit and vegetables. In terms of adherence to the Mediterranean Diet Pyramid, this cluster showed the worst performance with respect to the other ones, because about 53% of the students did not reach a point over 5 (Graph 2). Only for few foodstuffs, this cluster showed a better performance than other clusters, such as potatoes, pastries, sugar added drinks and the consumption of alcoholic beverages (Table 4).

Students in the cluster had the highest BMI (23.6). This cluster included the highest percentage of men (42%). Thirty-eight percent of the students stated that they did not know their daily caloric intake. The cluster counted the highest percentages of students who consumed food away from home (59% *versus* 49% in the sample) and that had meals at the canteen (62% *versus* 50% in the sample). Pro-environmental behaviours did not characterize these students: 42% of the students in the cluster (19% in the sample); finally, 64% of the cluster units never/rarely consumed organic food. Regarding health-related variables, 55% of the students did not practise any sports activities (42% in the sample); 42% declared that they never/rarely (31% in the sample) do clinical examinations of their own health status; 73% did not consider body care activities (69% in the sample).

Finally, in the cluster there was the lowest percentage of students residing in Molise region (51% *versus* 66% in the sample).

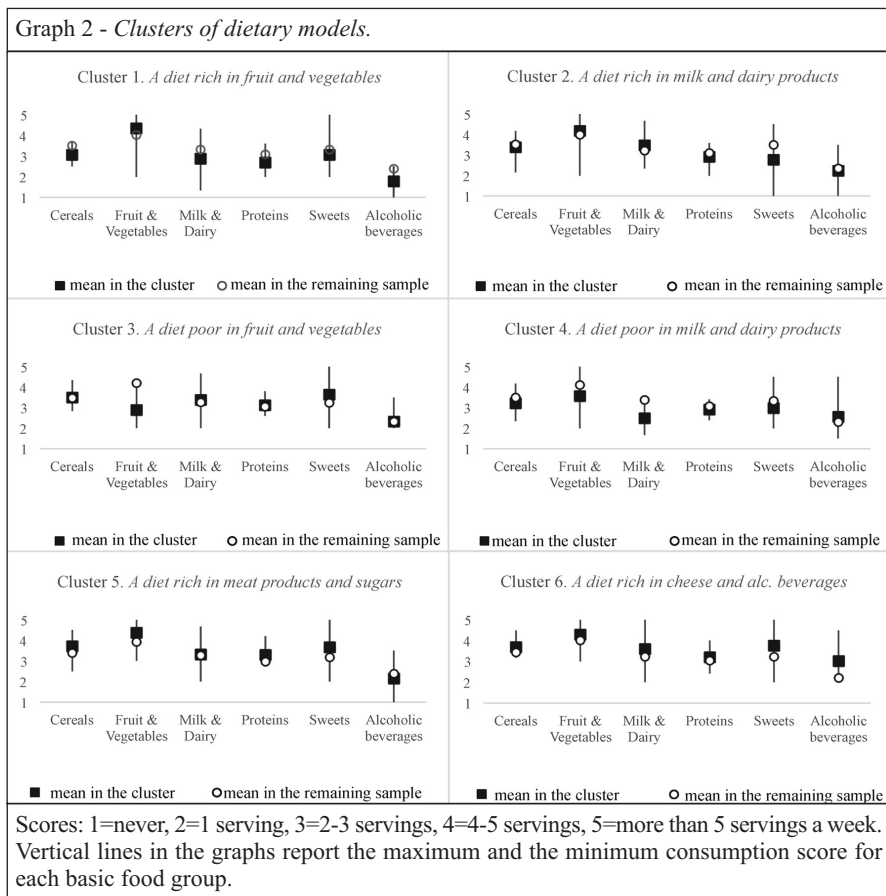
Cluster 5. A diet rich in meat products and sugars

This cluster included 26% of students in the sample. These students declared the highest consumption frequencies of many food groups, such as cereals, fruit and vegetables, sugars and proteins. In the protein group, the consumption of meat and meat products was very high compared to other groups. This cluster's diet showed the highest frequency of alcohol-free beverages consumption, whereas the consumption of alcoholic beverages was lower than in the whole sample. According to these frequencies, the characterization of this diet pattern is not compliant with the Mediterranean Pyramid for the consumption of meat and processed meat products, and for pastries and sugar sweetened beverages; furthermore, the consumption of potatoes should be reduced.

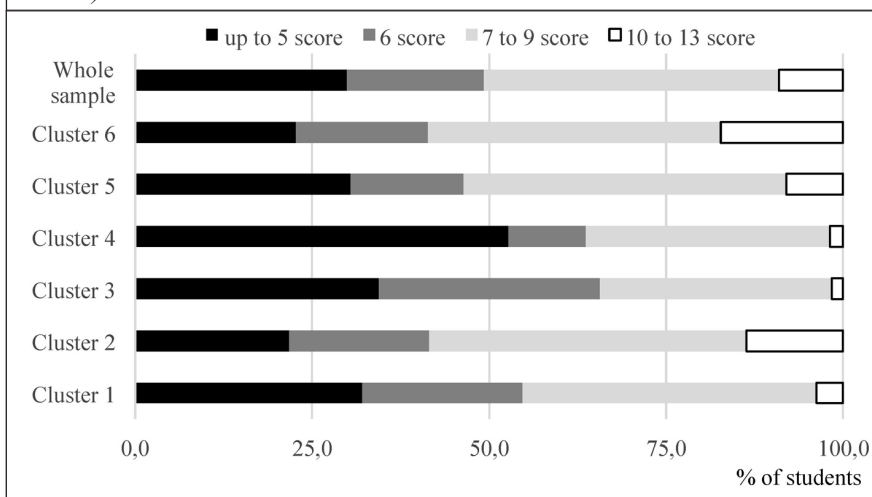
This cluster was characterized by youngest students and included a high percentage of female (73%) and of students living with parents (85%). Students' health status may be considered as good, taking into account their attention to diet and health routine clinical examinations; moreover, in this cluster, a majority (60%) of students practised sports activities. Finally, 35% of students did not know their recommended daily caloric intake, while 3% of them declared an intake exceeding 3,000 calories. This cluster was mainly composed by students living in Molise Region (73%).

Cluster 6. A diet rich in cheese and alcoholic beverages

Graph 2 - Clusters of dietary models.



Graph 3 - Score of adherence to the Mediterranean Diet Pyramid for each cluster (% of students).



The figure reports the percentage of students -in each cluster and in the whole sample- according to different scores of adherence. Per each food item, a score equal to one was assigned for a perfect adherence to the recommended intake. A maximum score of 13 (over 20 food items) is observed within the whole sample, while 6 points is the median value.

The sixth group included 14% of students who declared a high frequency of servings/week for all basic food groups. Their diet was similar to that of the students in the previous cluster in relation with cereals, fruit and vegetables, proteins and sweets consumption. The differential characteristic of this cluster was found in the high consumption frequency of alcoholic beverages, mainly liquors. Furthermore, cheese products were consumed with a higher frequency than in the remaining sample; a positive gap -but of lesser intensity- was

also found for milk and yoghurt consumption. On the other side, two positive aspects characterised the cluster: the highest consumption of fruit and fish, and the percentage of students regularly practising sports activities (60%) and taking care of their body (40%).

In terms of adherence to the Mediterranean Diet Pyramid, this cluster showed the best global performance compared with other clusters (graph 2), and 58% of the students recorded a score higher than the median value of the sample. Anyway, improvements in the diet pattern of the cluster may be possible in the meat items, pastries and liquors consumption (Table 4).

This cluster counted the highest percentage of males (55%). Students in the cluster reported the highest percentages of consumers of traditional (71% *versus* 62% in the sample), organic (55% *versus* 46% in the sample) and ethnical foods (16% *versus* 10% in the sample).

6. Discussion and conclusion

A first general conclusion resulting from the study is the evidence that sampled students should significantly change their eating habits towards healthier models. The analysis of consumption frequencies for single food items revealed quite a high intake of cookies, sweetened beverages, meat and meat products was determined. On the contrary, rice, cereals and vegetables were rarely consumed in comparison with the

Italian Food Pyramid (Vitiello *et al.*, 2016). A similar conclusion about an unhealthy food consumption was reported in other studies on university students' eating habits (Baldini *et al.*, 2009; Vecchio and Annunziata, 2013; Allman-Farinelli *et al.*, 2016) and in some studies indicating high BMI and insufficient physical activity among college students (Serra-Majem *et al.*, 2006). An unhealthy habit in this population group may depend on many factors, among which the lack of time and experience in cooking (Musaiger *et al.*, 2014), and the convenience of eating pre-cooked and frozen foods (Lupi *et al.*, 2015) could play the most important role.

Concerning student's BMI, our findings were in line with another study on the Italian young population (<http://www.epicentro.iss.it/passi/>) that reports 20% of overweight people and 4% of obese people. Students' percep-

Table 4 - Adherence to Med Diet Pyramid for food item and cluster (% of students).

Food items	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
Bread	49.1	64.6	78.1	47.3	81.2	84.0
Pasta	22.6	45.6	62.5	49.1	72.5	68.0
Rice	0.0	0.0	0.0	1.8	0.7	1.3
Cereals	5.7	8.2	3.1	1.8	8.7	13.3
Legumes	52.8	60.5	60.9	49.1	61.6	68.0
Potatoes	41.5	56.5	53.1	70.9	60.1	65.3
Vegetables	45.3	27.2	0.0	14.5	29.7	24.0
Milk	26.4	60.5	57.8	10.9	50.7	61.3
Yoghurt	15.1	21.8	9.4	5.5	18.1	14.7
Cheese	37.7	42.9	40.6	43.6	42.8	32.0
Meat	49.1	44.2	28.1	36.4	19.6	25.3
Processed meat	52.8	41.5	14.1	18.2	13.8	12.0
Fish	60.4	58.5	53.1	54.5	66.7	64.0
Eggs	24.5	53.1	70.3	52.7	68.1	56.0
Fruit	66.0	60.5	3.1	23.6	65.2	69.3
Cookies	15.1	19.0	37.5	23.6	28.3	38.7
Pastries	30.2	38.8	39.1	41.8	42.0	25.3
Sugar sweetened drinks	15.1	19.7	32.8	38.2	40.6	34.7
Alcohol beverages	0.0	4.8	6.3	14.5	3.6	33.3
Liquors	69.8	89.8	90.6	76.4	94.9	54.7

Adherence was considered according to the following frequencies: milk, yoghurt, bread, pasta, rice, cereals, fruit and vegetables, = more the 5 servings; cookies and alcoholic beverages, =4-5 servings; legumes, meat, fish, cheese, eggs, and sugar sweetened beverages, =2-3 servings; potatoes, processed meat and pastries, =1 serving; liquors, less than 1 serving/week. For more details, see Vitiello *et al.*, 2016.

Table 5 - Significant variables within the clusters.

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
Cluster size (n. of units)	55	151	66	57	142	77
Age (mean)	26.6	25.3	24.5	24.8	24.3	25.1
Age (SD)	4.0	3.6	3.4	3.4	2.9	3.8
BMI (mean)	21.94	23.25	22.31	23.55	22.63	23.01
BMI (SD)	2.93	3.63	3.91	3.83	3.22	3.39
Female	79.25	70.75	64.06	58.18	73.19	45.33
Family Living "Yes"	62.26	72.79	84.38	76.36	84.78	74.67
Food Safety "never/rarely"	49.06	39.46	34.38	32.73	33.33	21.33
Canteen "never/rarely"	71.70	53.74	56.25	38.18	42.03	48.00
Frozen food "never/rarely"	75.47	65.31	42.19	67.27	57.97	66.67
Organic food "never/rarely"	54.72	47.62	68.75	63.64	55.80	45.33
Sports practice "never/rarely"	43.40	41.50	50.00	54.55	34.78	40.00
Separate waste "never/rarely"	18.87	27.21	34.38	41.82	32.61	34.67

Data reported the % of students for each variable according to the scale reported in quotes. For age and BMI, data considered the mean value and the standard deviation. Under the line, only variables significantly different among clusters with a 0.05 p-value were reported.

tions about proper caloric intake did not fit with dietary recommendation (Fernandes *et al.*, 2015; Matthews *et al.*, 2016) and with the guide for the Italian adult population (LARN, 2014).

Some differences emerged in the eating behaviours of male and female students. Women had a lower BMI, in line with a previous study by Arganini *et al.* (2012). This result may be due to a greater concern over weight control in females (Afifi-Soweid *et al.*, 2002), or because women are more likely engaged in health-promoting behaviours than men (Gough and Conner, 2006). A gender difference emerged in food preferences, with males preferring meat and alcoholic beverages. A male preference for meat appears in agreement with some previous reports (Devine *et al.*, 2006), and not confirmed by other authors (Cervera Burriel *et al.*, 2014). In our study, females preferred vegetables, as reported by other authors (Cefai and Camilleri, 2011), while any gender relation in vegetables consumption was assessed in studies concerning Portuguese and Lebanese university students (Yahia *et al.*, 2008; Rodrigues *et al.*, 2013). Our data did not highlight a gender difference in the consumption of other relevant food items in the Mediterranean Diet, such as the consumption of fish, fruit and legumes. As far as fruit is concerned, even in the study by Rodrigues *et al.* (2013) no significant gender difference was found among Portuguese students. In our study, women had a stronger feeling of health-related risks of food choices, as reported in the work by Page-Reeves (2014). A problem of food insecurity among students also emerged in the study by Patton-Lopez *et al.* (2014).

Among students living away from home, this analysis showed a high consumption of alcohol and liquors, as reported by Bagordo *et al.* (2013), and a shift from the Mediterranean Diet model to unhealthy patterns (also in Lupi *et al.*, 2015). The effect of the absence of parental control and of acculturation phenomena in changing food habits towards undesirable directions was assessed even among Greek students (Papadaki *et al.*, 2007; Kremmyda *et al.*, 2008) and Portuguese university students living abroad (Vilela *et al.*, 2014).

Two more aspects are considered relevant and are somewhat above expectations. From a nutritional standpoint, the positive aspect is a low intake of spirits and quite a good frequency of consumption of fruit all over the sample. These aspects deserve a more thorough investigation. The downside that emerged from the analysis is the consumption of cookies, pastries and of sugar-added and carbonated beverages, which showed a frequency higher than that of other basic and healthy foods. These findings are in line with other international studies that focused on the high intake of calories from beverages and sweets and on their health-related

risks (Deliens *et al.*, 2015; Allman-Farinelli *et al.*, 2016).

Six homogeneous clusters and dietary habits were discussed according to the prevalent consumption of specific food items, and comparing clusters' diet with the sample diet. Food items that mainly characterised the dietary patterns of clusters were meat products, sugars, dairy products, fruit and vegetables, in some cases due to a high consumption, in others because of a low intake. According to these characterisations, adherence to the Mediterranean Diet Pyramid highlights the best or worst food eating behaviour. Anyway, the discussion of cluster's findings is not possible because few papers at Mediterranean level aimed at clustering university students were found in the literature. As far as Italian students are concerned, some similarities may be found between our findings and the study by Platania *et al.* (2016), but differences in data and methods limit the discussion. Indeed, due to different perspectives and methodologies adopted in the literature, it is not possible to compare students' habits at Mediterranean Basin, sub-regions and country levels. In this respect, implementing a study at Mediterranean level may be extremely interesting both as a research goal and in a policy intervention perspective.

Finally, our study, despite some limitations, provides significant insights for a wider research involving young generations in Mediterranean countries. Both in the descriptive and in the segmentation analysis, individual, socio-cultural and community environments reveal their importance, and some associations were found out. On the other hand, some aspects were not relevant in differentiating student's food consumption behaviour, such as students' family characteristics, and the department or the course attended at the University. It could be interesting to determine whether a similar characterization -in individual, intrapersonal, community terms, and in a wide context- will emerge at Mediterranean level or whether these segmentations overlap with country-specific patterns. To our knowledge, previous literature appears quite scarce. On the other hand, extensive research is needed on these topics as indicated in the CIHEAM/FAO White Paper on the Mediterranean food consumption pat-

terns (2015). Furthermore, to counter the erosion of the Mediterranean food related cultural heritage, the White Paper supports the development of research on socio-cultural factors and food consumption between different populations and cultures of the Mediterranean, and focuses, *inter alia*, on the transmission of food knowledge to younger generations. The need for increasing students' knowledge and information about healthy food habits, together with other study findings, may have implications for public health-related concerns, as well as for research and education, particularly in Mediterranean countries. Indeed, it may be useful to find out similarities/differences in students' food habits and in the gap between these habits and healthy diet recommendations – i.e. the Mediterranean Diet-. Furthermore, a deeper investigation into socio-cultural contexts related to food behaviours and into the influence of education on healthy food choices may support the transfer of research findings to the community (Ripabelli *et al.*, 2001). Research findings may allow to better address educational programmes that could be shared among Mediterranean countries and institutions -namely institutions in the higher education sector and along the educational chain- in order to support common food traditions and to promote better food habits and health conditions for current and future generations.

This study has some limitations. Sample units were selected among a sample of university students from Southern Italy, but they might not be representative of the whole university population in the country. Anthropometric measurements, as well as food consumption frequencies, were self-reported, as it occurs frequently in food surveys. The list of food items focused mainly on some categories, while some others were not collected, such as oils and fats, because they were not the focus of the study, although they are relevant within a Mediterranean Diet.

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