

Unhealthy Eating Behaviors of First Year Latin-American Students, An Opportunity for Sustainable Nutritional Interventions

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Abbreviations: NCDs: Non-Communicable Diseases; MD: Mediterranean Diet; HSD: Healthy and Sustainable Diet

ABSTRACT

The poor eating habits in the first year of college could trigger health problems and academic performance in students. The change of environment when moving from their home or country to the university could contribute to the adoption of those inadequate habits, where nutritional educational interventions can improve the student's habits. There was evaluate the association of eating behaviors with adherence to a healthy and sustainable diet in multinational university students, establishing a foundational framework to create interventions that promote healthy eating habits. A cross-sectional study was conducted using print questionnaires to adherence to the Mediterranean diet and eating behaviors. The participants consist of three hundred university students from sixteen countries who voluntarily completed the surveys. The only eligibility criterion was to be a first-year student. The analysis was made by a descriptive statistic, correlational, ANOVA, and regression. The mean adherence for 300 students was 7.68 (low adherence). A total of 172 first-year students showed unhealthy and very unhealthy eating behaviors (57.3%). High adherence was observed only in four countries: Ecuador (n = 2; 3.1%), Guatemala (n = 1; 2.7%), Honduras (n = 3; 2.6%), and other countries (n = 1; 9.1%). Eating behaviors were the only predictor variable. These variables accounted for 15.3% of the variance in adherence to Mediterranean diet scores. In conclusion, Interventions and regulatory standards are needed, including policies supporting the development of healthful dietary behaviors using sustainable principles.

Introduction

The global food system, currently, fails to meet the need of the population, classifying it as being unsustainable [1,2], generating challenges in public health, environment, food safety, nutrition, and health [3]. On the other hand, mortality levels increase concerning all forms of malnutrition [4-6]. The most current statistics show that 2 billion adults are overweight or obese [1], while 820 million are undernourished or hungry [7]. It has been shown that the economy, culture, and social resources contribute to uneven development in health outcomes [8] such as weight gain and the development of Non-Communicable Diseases (NCDs) [9-11] with repercussions

on the diet of the population. The mass commercialization of processed foods and the rapid distribution into low and middle-income markets [12-14] has resulted in the abandonment of traditional diets and the adoption of highly processed diets, which lack in nutritional quality [15]. In terms of a healthy and sustainable diet, the Mediterranean Diet (MD) meets all established standards. It is recognized as a healthy, affordable, and environmentally sustainable eating model [16-18] being a Healthy and Sustainable Diet (HSD). It is widely documented that its adherence is linked to multiple health benefits in humans [19]. Recent meta-analyses have associated high adherence to MD and a reduction in general

mortality, cardiovascular diseases, the incidence of certain types of cancer, diabetes, and metabolic disorders, among others [20-22].

First-year students enter a new phase of life, which is marked with diet and lifestyle changes, including making independent decisions on their own nutrition, generating vulnerability to malnutrition, sedentary lifestyle, and being overweight [23,24]. In this context, diet and nutrition are crucial components in the promotion and maintenance of a healthy condition [17]. Furthermore, diets must meet energy needs, provide a variety of foods with nutritional quality, and be accessible and culturally appropriate [3]. Specifically, the transition to university life is characterized by major changes, increased responsibilities arising from the independence of their parents and the reduction of time as a result of studies. Due to the different interests and levels of importance, a healthy lifestyle falls behind when compared to other aspects of the student's life [25,26]. From another perspective, young adults tend to present bad habits, among which the omission of meals or fewer mealtimes per day stands out, as well as infrequent snacking, affecting the quality of their diet [27]. Also, there is a demonstrated tendency to a sedentary lifestyle, with the consumption of alcohol, cigarettes, among others, which leads to excess weight gain and deterioration of health [25,28,29]. Additionally, it has been shown that low adherence to MD can be associated with lower academic achievement [30]. Therefore, it is possible to combat poor food choices through nutritional education, while significantly reducing the environmental impacts of agriculture [31]. The current study aims to determine the association of eating behaviors with adherence to HSD in multinational university students, establishing the foundations to create interventions that improve their eating habits.

Materials and Methods

Location

This study was conducted at Zamorano University, Honduras, whose undergraduate program has a student population from around 29 countries, especially from the American continent. The students reside on campus from January until December for four years. The university has food services in the principal dining room, and there are also cafeterias, supermarkets, and restaurants offering a variety of food to students.

Participants and Recruitment

This study complies with the ethics protocols, which was approved by the Zamorano University Graduate Research Directorate meeting the ethics. The 319 first-year undergraduate students, come from 16 countries: Belize, Bolivia, Colombia, Costa Rica, Ecuador, El Salvador, United States, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, and the Dominican Republic. All of them were summoned to receive a keynote talk on nutritional education, during the first period of the 2020 academic

year. The study was socialized, indicating the objective, topic, and benefits for the participant and researchers. The recruitment was voluntary, and participants were asked to sign an informed consent form. The 300 students who decided to participate received an electronic copy of the consent form.

Type of Study

An observational descriptive study of cross-sectional cohort was conducted. The eating behavior surveys were conducted in two groups on February 22 and 29, 2020, respectively. A healthy and sustainable eating model based on HSD as a lifestyle was proposed, which aimed to improve the eating behavior of first-year students.

Instruments

The data were collected through the adherence questionnaire to the Mediterranean Diet and a questionnaire of eating behaviors (both in printed form). To determine adherence to the MD, a 14-point questionnaire was applied using the PREDIMED study (Prevention with Mediterranean Diet) [31]. The questionnaire is composed of 14 direct questions about the consumption of the main foods of MD. The scores were grouped into four categories: high adherence (12-14 points), medium adherence (8-11 points), low adherence (5-7 points) and very low adherence (<5 points) [26]. Subsequently, the students completed an eating behavior questionnaire with 28 multiple-choice questions, with scores grouped into four categories: healthy (23-30 points), moderately healthy (16-22 points), unhealthy (8-15 points) and very unhealthy (<8 points) [32].

Statistical Analysis

The proposed model consists of the dependent variable being adherence to the HSD, and the independent variables: country, gender, eating behaviors. The model seeks to determine the variability in adherence to the HSD. The results were summarized by descriptive statistics such as means, percentages, and standard deviation. A linear regression of the model and a Pearson correlation were carried out for the independent variables with respect to the dependent variable. The categorical variable "countries", Honduras was excluded, as it is the host country. For adherence and eating behaviors, an ANOVA was performed with Duncan mean separation for each level.

Results

Participating age were 61% men and 39% women. Most of them, 38.67%, came from Honduras (n = 116), followed by Ecuador 21.67% (n = 65), Guatemala 12.33% (n = 37), El Salvador 11.33% (n = 34), Panama 4% (n = 12), Nicaragua and Others (Belize, Costa Rica, USA, Haiti, Mexico, Paraguay, Peru, and Dominican Republic) with 3.67% (n = 11) each one. Finally, Colombia and Bolivia had the lowest number of participants each with 2.33% (n = 7). The model had statistical significance (P <0.001), according to the R2

obtained, the model explains approximately 15.3% the variability in adherence to the HSD where the only “eating behaviors” were significance. The variables of country and gender did not show predictive ability on adherence to the HSD ($P > 0.05$), however, the variable eating behaviors have the predictive ability on the adherence to HSD ($P < 0.05$). A student from Ecuador and Bolivia have an average of 0.48 and 0.82 points more adherence to the HSD respectively than a student from Honduras. On the other

hand, students from Guatemala, El Salvador, Panama, Nicaragua, Colombia, and members from other countries have, a lower adherence score than a Honduran student. The adherence average of a male was 0.31 points more than the adherence of a female (Table 1). When performing the correlations of the variables, there was an only significant correlation in eating behaviors ($P < 0.001$; Pearson's r : 0.344), with a low positive correlation indicating dependence between adherence to the HSD and eating behaviors.

Table 1: Linear regression on the dependent variables to the independent one: adherence.

Predictor	Estimate	S.E.	t	P value
Intercept ^a	4.11	0.60	6.84	<0.001
Country:				
Ecuador	0.48	0.31	1.56	0.12
Guatemala	-0.28	0.37	-0.74	0.46
El Salvador	-0.35	0.38	-0.91	0.36
Panama	-0.89	0.60	-1.48	0.14
Nicaragua	-0.26	0.62	-0.43	0.67
Others	-0.04	0.62	-0.06	0.95
Bolivia	0.82	0.77	1.07	0.29
Colombia	-0.44	0.77	-0.58	0.57
Gender:				
1 – 0*	0.31	0.24	1.33	0.19
Behaviors	0.23	0.04	6.23	<0.001

Note: ^aRepresent the level of reference.

S.E: Standard error.

*1 = Male, 0 = Female

Adherence to Mediterranean Diet

When performing the ANOVA for the adherence, a significant difference was found between each level of adherence ($P < 0.001$). The mean adherence of the 300 participants was 7.68, ranking in low adherence (Table 2). The percentage scale was made for each country and gender based on the four levels of adherence to the HSD. High adherence was observed only in four countries: Ecuador (3.1%), Guatemala (2.7%), Honduras (2.6%), and Others (9.1%) (Table 4). All countries had medium adherence, with Bolivia being

the country with the highest percentage of participants (85.7%), followed by Ecuador (61.5%), and the countries with the lowest number of participants with medium adherence were Others and Panama with 36.4% and 33.3% respectively. In low adherence, most of the participants were between 57.1 and 50% (Colombia, El Salvador, Nicaragua, Others and Panama). Additionally, very low adherence was obtained in 5 countries: Panama, Guatemala, Honduras, El Salvador, and Ecuador. Regarding gender, 56.8% of men and 53.8% of women had medium adherence (Table 3).

Table 2: Adherence levels mean separation.

Very Low (n = 21)		Low (n = 106)		Medium (n = 167)		High (n = 6)		Total (n = 300)
Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	P value
3.19 d	0.87	6.21 c	0.79	8.99 b	0.95	12.14 a	0.37	<0.001

Note: S.D: Standard deviation.

Lowercase letters a-c shows mean separation.

Table 3: Distribution of adherence levels across countries and gender.

Country	Total Observations	Very Low (n = 21)		Low (n = 105)		Medium (n = 167)		High (n = 6)	
		n	%	n	%	n	%	n	%
Bolivia	7	0	0	1	14.3	6	85.7	0	0
Colombia	7	0	0	4	57.1	3	42.9	0	0
Ecuador	65	2	3.1	21	32.3	40	61.5	2	3.1
El Salvador	34	2	5.9	17	50	15	44.1	0	0
Guatemala	37	4	10.8	10	27	22	59.5	1	2.7
Honduras	116	11	9.5	34	29.3	68	58.6	3	2.6
Nicaragua	11	0	0	6	54.5	5	45.5	0	0
Others*	11	0	0	6	54.5	4	36.4	1	9.1
Panamá	12	2	16.7	6	50	4	33.3	0	0
Gender									
Male	183	10	5.5	63	34.4	104	56.8	6	3.3
Female	117	11	9.4	42	35.9	63	53.8	1	0.9

Eating Behaviors

According with the ANNOVA, there was a significant difference between each level of eating behaviors ($P < 0.001$). The mean for the eating behaviors of the 300 participants was 14.85, ranking in unhealthy behaviors. (Table 4). The percentage scale was made for each country and for each gender based on the four levels of eating behaviors (Table 5). Healthy behaviors were obtained only in 1.7% of the Honduran students and moderately healthy behaviors in all

countries except Panama. Panama was the country with the highest proportion of students with unhealthy behaviors with 100% of the participants, and the 1.5% of Ecuadorians presented very unhealthy behaviors. For the gender, 1.7% of the women presented healthy behaviors. The 47% of the women and 38.9% of the men had moderately healthy behaviors, 60% of the men and 52.2% of the women had unhealthy behaviors and 1% of the men exhibited very unhealthy behaviors.

Table 4: Mean separation for eating behaviors.

Very Unhealthy (n=1)		Unhealthy (n = 171)		Moderately Healthy (n = 126)		Healthy (n = 2)		Total (n = 300)
Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	P value
7 d	*	12.74 c	1.8	17.76 b	1.7	23.5 a	0.71	<0.001

Note: S.D: Standard deviation.

Lowercase letters a-c shows mean separation.

Table 5: Distribution of adherence levels across countries and gender.

Countries	Total, Observations	Very Unhealthy (n = 1)		Unhealthy (n = 171)		Moderately Healthy (n = 126)		Healthy (n = 2)	
		n	%	n	%	n	%	n	%
Bolivia	7	0	0	3	42.9	4	57.1	0	0
Colombia	7	0	0	4	57.1	3	42.9	0	0
Ecuador	65	1	1.5	43	66.2	21	32.3	0	0
El Salvador	34	0	0	19	55.9	15	44.1	0	0
Guatemala	37	0	0	13	35.1	24	64.9	0	0
Honduras	116	0	0	66	56.9	48	41.4	2	1.7
Nicaragua	11	0	0	6	54.5	5	45.5	0	0
Others*	11	0	0	5	45.5	6	54.5	0	0
Panama	12	0	0	12	100	0	0	0	0
Gender									
Male	185	1	1	111	60	72	38.9	0	0
Female	115	0	0	60	52.2	54	47	2	1.7

Note: *Countries with less than 5 participants were grouped into Others: Belize, Costa Rica, United States, Haiti, Mexico, Paraguay, Peru, Dominican Republic.

Discussion

Our results show that eating behaviors have predictive ability on adherence to the HSD. However, no positive association was found concerning the variables country and gender on adherence to the HSD. These findings are important to identify behaviors and food consumption patterns in students that require interventions to promote the adequate intake of healthy foods, using the MD standards for nutrition and human health as a reference. When analyzing the eating behaviors of the students, a low percentage of healthy behaviors was found. Most countries had moderately and unhealthy behaviors, except Panama, where unhealthy behaviors prevailed in its entirety, as well as in Ecuador, ranking in the lowest category regarding unhealthy behaviors. The academic transition to University is a turning point in the lifestyles of young people as students face several changes [33]. These changes include becoming independent from their parents, as well as the different cultural changes generated when students move to the country where they will study. In this case, the host country, can generate changes in terms of eating patterns due to the change in the availability of inputs, ingredients and cultural modifications generated by the change between the student's former environment [34-36]. University students are in a critical period for the development of lifestyles, which are of utmost importance for their future health, where the eating behavior of their peers, their economic situation, and the ability to cook and make changes to their eating habits [37,38] all have an influence.

Cervera-Burriel, et al. [39], identified that more than 91% of the students at the University of Castilla, La Mancha, were in a situation that required changes in diet towards healthier patterns both in students living outside the home and in students living with their families. Whereas Trigueros, et al. [40], showed that the academic change to university and the pressure of the grades can generate little adaptive consequences for the consumption of healthy foods. On the other hand, the familiarity and frequency of use of Mediterranean foods increased as age increased, in a group of students whose age was 18 years and older [41], thus supporting the importance of work on nutritional education that aims to consume sustainable healthy food in university students. In this context, in the study carried out by [42], in which they related the eating habits of university students who lived away from home, reported that living away from home as a college student leads to unhealthy eating habits. In general, university students around the world must follow unhealthy eating habits [43,44,33], helping to explain the behaviors observed in this research. For this reason, eating behaviors are considered a modifiable risk factor and require early intervention in young people to avoid future social and health costs [45]. According to the adherence to HSD, our results show that most students have low compliance concerning the bases of a MD. In general, a high percentage of medium adherence was observed (55.6%). Honduras, El Salvador, and Ecuador present

the lowest adherence. Only seven participants (2.33%) showed high adherence to MD, as previously observed in Table 4. There is scarce information on adherence to MD in college students in Latin America, and this research is the first to address it in a multicultural environment with countries of North, Central, and South America. In a study carried out on college students in Portugal, 59% of them showed average adherence, between 6 and 9 points presenting only 12.5% high adherence [46]. Although these results are low for a mediterranean country they are far from the results of this study.

On the other hand, a study conducted on medical students at Kocaeli University in Northwestern Turkey, found that 59.1% of women and 40.9% of men amongst first-year students showed moderate adherence using their academic knowledge on their healthy lifestyles [47]. However, other studies show that, although they have knowledge in nutrition, this does not guarantee they make better food choices where there is a greater influence of social and economic factors that leads to unhealthy choices [47,48], which provides a range of opportunities to perform nutritional education interventions that emphasizes the sustainability of the food production chain. A study in college students in Bogotá and Montería (Colombia), more than 60% of the participants presented a medium adherence, while an exceedingly low adherence was observed in 30.3% of the participants from Bogotá and the 7.7% of the participants of Montería [49]. Also, in Latin America, a study from Chile, report a medium, successively low adherence [50]. Another investigation carried out by Redondo del Río [51], in which dietary intake and mediterranean adherence were analyzed in a group of college students from Valladolid (Spain), reports low and very low adherence, finding a pattern of preference for industrialized foods and a low consumption of healthy foods. These results show that students must improve their diet. Among the possible causes for these low levels of adherence, the preference to ingest processed and ultra-processed foods stand out, modifying the eating pattern and discouraging healthy food preparation. In addition to their high content of critical ingredients, add other risk factors related to obesity and chronic diseases [52].

On the other hand, [17] and [29] argue that proper adherence could prevent negative effects on health and the environment. The benefits of a MD are particularly due to the high consumption of vegetables, fruits, seafood, olive oil, and minimally processed products [53], which are available in the student's cafeteria. Students who live in university dorms show less adherence to MD [54]. Moreover, Chacón-Cuberos, et al. [55], observed that with greater adherence to MD, the stress levels decreased in college students. Martinez-Lacoba, et al. [56], showed an association between the consumption of food groups based on the recommendations of a MD and academic level. In studies related to gender, Martinez-Lacoba, et al. [57], identified that Spanish college students do not fully comply with the healthy eating recommendations. Additionally, gender is the social determinant with the greatest effect on differences in the

consumption of groups of MD. This contrasts with our research, as gender had no impact on the consumption of foods of this dietary pattern expressed in the level of adherence ($P = 0.185$), contrary to this, eating behaviors did have an impact on the level of adherence ($P < 0.001$). On the other hand, the percentages of adherence to DM in this study were higher in the males than in the females. Opposites a Galician university study, where females presented better adherence [58]. Preieri, et al. [59], using the Italian Mediterranean flavor index, found that women have greater adherence than men. Similarly, studies of New Zealand [60] and Spain [61] confirmed that gender is a factor associated with dietary patterns.

In the same context, another study which evaluated nutritional knowledge and adherence to MD in the southeastern United States [62], indicated that women have a greater nutrition knowledge, obtaining higher adherence scores in college female's students. According to our research, a study carried out in Colombia found that female sex was significantly higher in terms of a very low-quality diet and with a greater inclination for processed foods, unlike men [46]. The only statistically significant correlation for adherence to MD was the one estimated for eating behaviors. Confirming the possibility of creating institutional strategies in the nutritional field to improve behaviors and eating habits while promoting MD or HSD. The community nutrition is important, since it seeks to identify and evaluate nutritional problems to design, organize, evaluate, and implement nutritional intervention programs [63]. These interventions achieve a healthy nutritional profile over time [64], through planned activities or with specific groups as participants [65]. The intervention strategy is the way to address an identified problem to achieve the objectives of nutritional policy programs or community nutrition [66]. To meet the proposed goals, it is necessary to have an interdisciplinary group for the planning of food and nutritional policies, thus promoting the participation and research process [67].

Nutritional education is one of the fundamental tools of this type of program [63], which when carried out online reflects high rates of satisfaction, understanding, and retention of the information by the participants [68]. Martinez-Lacoba et al. [59], state that students, in addition to studying subjects not related to health and that their family and are not in the university town, are factors associated with an unhealthy diet. Like evidenced in this study with unhealthy behaviors in students reinforcing the importance of conducting nutritional education and sustainability campaigns [68].

Conclusion

This study reports the need to create an institutional strategy that guides university students towards better eating behaviors since the lack of healthy practices and a distancing from healthy food choices is evident in this population. It is necessary to direct research towards institutional policies in universities that emphasize good eating habits and behaviors, instilling lifestyles

and sustainable products such as DM. The MD has been described as a healthy and sustainable diet, which can be applied both in the Mediterranean and non-Mediterranean countries, in different cultures, ages, and in a complementary way, it not only offers health benefits but also benefits the environment through sustainability. In this sense, health and nutrition education should be promoted within the university environment, to improve healthy practice in food intake and to increase physical activity.

Author Contribution

J.P.E. and A.H.S. conceived and designed the study; J.P.E. performed data analysis; and J.P.E., S.W.B.A., and A.H.S. wrote the paper. All the authors provided a critical review of the manuscript. All authors have read and agreed to the published version of the manuscript.

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Ethical Statement

This study complies with the ethics protocols, which was approved by the Zamorano University Graduate Research Directorate meeting the ethics. Informed consent was obtained from the students prior to data collection.

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