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Consumption practices, preferences and barriers of nuts intake amongst university of Jordan students

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SUMMARY

Background: Frequency of nuts consumption has shown positive results, as preventive practices, on chronic diseases — such results were reviewed by recent epidemiological studies. There was also the emphasis on the intake pattern of nuts consumption with respect to encourage eating them. The objective of this study is to quantify and assess nuts intake, the average portion size against the percentage of consumers, mean grams eaten amongst subjects, and reporting the intake of nuts consumed as whole (raw, fried and roasted) or derived hidden sources. Finally, this work also aims to identify the predictors (attitudes, preferences and barriers) of nuts consumption. Data was obtained from a questionnaire on dietary nuts intake collected from 200 healthy adult students in the University of Jordan. The five nuts types under test were: cashew, almond, pine, pistachio and peanut. In general, the consumption of total nuts was lower than expected. Gender, BMI (body mass index), smoking and taking supplements, all have had a significant impact on the consumption of particular types of nuts (p value < 0.05). Students' field of study or level of physical activities did now show any significant impact on nuts consumption. However, students' gender and their associated BMI have had significant impact on nuts consumption preferences, practices and barriers of intake. Additionally, different forms of nuts may appeal to different age and socio-economic student groups. Attitudes and practices among our sample regarding the health effects of nuts are did not necessarily follow similar patterns found in recent research findings. In conclusion, the low percentage of nuts

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1. Introduction

Nuts are considered as an important part of a healthy diet and are consumed widely in everyday routine either as a snack or part of a meal. Nuts are dense in a variety of energy yielding nutrients mostly fat [8]. In addition to that, nuts are condensing with multiple bioactive constitutes such as vitamins (e.g. vitamin E, vitamin B_6, and niacin), minerals, antioxidants, phytochemicals and phytoestrogens [1,2].

It has been demonstrated by epidemiological studies that nuts consumption is related to fetal and non-fetal coronary heart disease and all causes of mortality. Foods rich in nuts combined with exercise can decrease cardiovascular risk markers by decreasing blood cholesterol, blood pressure, visceral adiposity, oxidative stress, inflammation, and vascular reactivity [9] (Ros; 2016). It has been demonstrated that nuts can be consumed to improve immunity, digestion, wound healing, circulation, analgesics, CVD risk reduction, and mortality reduction [10].

Edible tree nuts by definition are dry fruit with one seed with hard wall after maturity. This family includes almonds, cashews, pine nuts, pistachios and peanuts. Up to the present time, according to research that had demonstrated the beneficial health effects, nuts are now a main intrinsic part of numerous dietary guidelines around the world. Interestingly, nuts do not lose most of their functionality during processing [1,2] which make nuts one of the favorable snacks and food item that can be included in most meals.

Albeit the importance of nuts consumption being well demonstrated, and to the authors' best knowledge, limited objectives and reliable data exist on the Jordanian adult's intake profiles and qualitative & quantitative differences in their consumption patterns. Most analytical assessments and data about nuts consumption profiles come from the Jordanian Household Expenditure and Income Survey (JHEIS) 2010. However, limited analyses come from data based on individual dietary intakes. Furthermore, most of dietary questionnaire used in such nutrition surveys contained very limited analytical details, if any, at all.

The aim of this study is to assess the mean intake of nuts across 200 healthy male and female student adults in the University of Jordan with different academic interests. The study aims to draw a supposition about the level of awareness of nuts nutritional and health aspects as well as consumption patterns.

The results of this study are useful for the formulation of new scientific propositions related the intake of nuts with respect to preventive practices for reducing health risks. In addition to that, the study aims to aid in the efforts for policy-making in intake recommendations for this food group.

2. Materials and methods

2.1. Study design and methods

Cross-sectional questionnaire that used a sample of 200 adults (100 males and 100 females) aged from 19 to 24 years old undergraduate students in the University of Jordan took place in the period of February to March 2017. Participants were recruited randomly from the University of Jordan following a few criterions. Such criterions emphasized all participants have to be healthy and from similar backgrounds. The local institutional review boards approved the protocol and all consumers provided written informed consent. Participants were invited to complete a questionnaire with information on knowledge and perceptions of nuts and their consumption. A number of 166 questionnaires were completed by the participants (88 females and 78 males).

2.2. Ethical approval

It is approved by the ethical committee of the university of Jordan reporting number 17/2018/4102.

2.3. Determination of nuts consumption

In the present study, peanuts, almonds, pine nuts, pistachios and cashews were all considered nuts. A 73-item food-questionnaire was used to determine nuts consumption.

The questionnaire was divided into 3 sections:

1. Life style and demographic information.
2. Eating attitudes and background knowledge with respect to nuts.
3. Individual nuts conditions when consumed - separately recalled (cashew, almonds, pines, pistachio, peanuts):
   a. Cashew consumed as
      i. Whole
      ii. Hidden
   b. Almonds consumed as
      i. Whole
      ii. Hidden
   c. Pines Consumed as
      i. Whole
      ii. Hidden
   d. Pistachio Consumed as
      i. Whole
      ii. Hidden
   e. Peanuts Consumed as
      i. Whole
      ii. Hidden
4. The consumption of nuts was referred into amount (piece) and frequency (per day). Wherein the consumer reported their intake of nuts into 5 scales (none, 3 times per month, one time per week, 2 to 4 times per week, and more than 5 times per week).

2.4. Dietary assessment

Questionnaire data were self-reported by the subjects at the University of Jordan and supervised by trained interviewers. Each interviewer would have administered one questionnaire containing the 3 sections previously mentioned in this paper, and would also have collected the results in the same working day.

2.5. Determination of nut consumption

Nuts consumption is assessed using dietary recall data for each kind of tested nuts (almonds, pine, cashew, pistachio, and peanuts) and subsequently divided into two categories (1): whole (2) hidden. The hidden nuts type and the associated amount consumed were determined with the assistance of the research nutritionists who are familiar with the food items recipes and products. A search for nuts quantity from these hidden sources was undertaken.

2.6. Demographic

Demographic variables were self-reported by the consumers under the supervision of the research assistance. Variables included age, sex, major of education, BMI, smoking, healthy status, fitness and nutritional knowledge.

2.7. Education

Consumers were recruited from the University of Jordan from undergraduates' level of bachelor education. For analysis, they were subdivided into two groups according to the major (academic course) they are studying: (1) science-related major, and (2) literature major.

2.8. Anthropometry

Trained interviewers carried out height and weight measurements for the subjects. Standing height is measured using stadiometer (Seca 214; Seca) and weight is measured using digital scales (Seca 835; Seca). BMI is calculated as weight (kg)/height (m)^2. The WHO BMI cut-offs are used to categories BMI status in consumers aged 19 years and over.

2.9. Statistical analyses

The questionnaire adopted in this study is accounted for all analysis presented in this paper. Consumer characteristics and the percentage of nuts consumption are presented as actual frequencies and questionnaire -adjusted percentages. Mean of nuts eaten among consumers (piece/d) is presented as questionnaire -adjusted means and 95% CI. Results are expressed as mean ± SD or percentages.

Regression models included sex, education major, BMI category, physical activity, smoking status were used to calculate adjusted (least-squares) means for pieces of nuts eaten amongst consumers. Multiple logistic regressions were used to estimate the adjusted OR and 95% CI.

All statistical analyses were performed using SPSS. All statistical tests were two-sided, and $p < 0.05$ was considered statistically significant. Pairwise comparisons were made between the levels of that variable. No adjustments for multiple comparisons were made.

3. Results

Table 1 describes the demographic results of the study. The total number of completed and returned questionnaires to us for the study is 166, where 78 (47%) are males and 88 (53%) are females as it is shown in Table 1. The age of the sampled population ranges from 19 to 23 years old with a mean age (21 ± 1.7). The gender diversification rate is nearly equal 47% and 53% for males and females respectively. The marital status of the sample is 98% single, and subjects do not complain from any fatigue or tiered symptoms and are healthy with no chronic diseases. The WHO BMI cut-offs were used to groups BMI status using the website of Centers for Disease Control and Prevention/BMI Percentile Calculator for adult. BMI between 18.5 and 24.9 are categorized as normal weight, less than 18.5 are considered low weight and BMI between 25 and 29.9 considered overweight [3]. More than half of the subjects of this study, 60%, are found normal weight, while 20% of them are over-weights and the same percentage of 20% are also found to be under-weight. Another indication of physical activity is identified with 60% of the subjects are found to be physically active. We define Physical Activity whereas the subject does 30 min of exercise per day every week or no. To the contrary, the remaining segment of the subjects, i.e. the 40%, is sedentary which means they do the daily routine activity only.

Tables 2A and 2B demonstrate the variety of consumption of different nuts based on gender, body mass index, University major, smoking, physical activity and taking supplements. Based on gender, males were found to consume significantly more cashews (4.5 pieces ± 0.4) compared to females (3.4 pieces ± 0.3) with no differences in the consumption of the other types of nuts. The difference in individual's University Major had no effect on the nuts consumption portion size. Underweight participants are shown to have consumed more peanuts with a mean of (6.9 ± 0.7) and p-value < 0.05 compared to their overweight peers with mean (5.0 ± 0.8) and normal-weight (5.4 ± 0.5).

Nonsmokers consumed significantly more pistachio (5.0 ± 0.3) compared to smokers (3.7 ± 0.5) (p value = 0.03) as shown in Table 2B. The participants who use supplement-aids consumed more pistachio (5.3 ± 0.7) in comparison to those who do not use supplements (4.5 ± 0.3) with p-value < 0.05 as shown in Table 2B. Regarding physical activity, and participants' University Major, there were no significant differences in the consumption of different nuts or total nuts as illustrated in Tables 2A and 2B

Table 1
Demographic data (n = 166).

Factors	Mean	Range
Age (y)	21 ± 1.7	18–28
	N	**%**
Gender		
Male	78	47
Female	88	53
BMI (kg/m^2)		
Underweight	34	20
Normal weight	99	60
Overweight	33	20
Martial		
Single	162	98
Married	4	2
Major		
Science	106	64
Literacy	60	36
Smoking		
Yes	45	27
No	121	73
Chronic diseases		
Yes	8	5
No	158	95
Fatigue		
Yes	8	5
No	158	95
Physical activity		
Yes	100	60
No	66	40

[*] Data are presented as mean ± SEM.

Table 2A
Descriptive Statistics of Practice of nuts consumption in participants based on gender, studying major and body mass index (BMI).

Factors piece/day	Gender		p-value	Major		p-value	BMI			p-value
	Male	Female		science	literary		Underweight	Normal weight	Overweight	
Cashew	**4.5 ± 0.4**	**3.4 ± 0.3**	**0.035**	4.6 ± 0.2	4.2 ± 0.2	0.175	4.0 ± 0.5	4.2 ± 0.3	3.1 ± 0.6	0.274
Almond	4.1 ± 0.2	4.1 ± 0.2	0.977	4.2 ± 0.2	3.9 ± 0.3	0.34	3.9 ± 0.3	4.3 ± 0.2	4.0 ± 0.3	0.443
Pine	5.0 ± 0.4	4.4 ± 0.4	0.28	4.8 ± 0.3	4.4 ± 0.5	0.441	4.3 ± 0.6	5.0 ± 0.4	4.2 ± 0.6	0.376
Pistachio	4.2 ± 0.4	5.1 ± 0.4	0.123	4.8 ± 0.3	4.4 ± 0.5	0.421	4.7 ± 0.6	4.7 ± 0.4	4.5 ± 0.6	0.943
Peanuts	5.3 ± 0.5	5.8 ± 0.5	0.477	5.2 ± 0.4	6.2 ± 0.6	0.179	**6.9 ± 0.7**	**5.4 ± 0.5**	**5.0 ± 0.8**	**0.039**
Total nuts	5.2 ± 0.2	5.3 ± 0.2	0.433	5.4 ± 0.2	5.2 ± 0.15	5.1 ± 0.3	0.705	5.3 ± 0.1	5.2 ± 0.2	0.88

[*] Data are presented as mean ± SEM, and were considered statistically significant at $p < 0.05$ that indicates bold values.

Table 2B
Descriptive Statistics of Practice of nuts consumption in participants based on smoking, physical activity and supplements intake.

Factors piece/day	Smoking		p-value	Physical activity		p-value	Supplements			p-value
	Yes	No		Yes	No		Yes	No	Preferred not to say	
Cashew	4.3 ± 0.3	4.5 ± 0.2	0.612	4.0 ± 0.3	3.8 ± 0.4	0.631	4.5 ± 0.3	4.4 ± 0.2	4.0 ± 1.3	0.936
Almond	4.3 ± 0.3	4.1 ± 0.2	0.496	4.3 ± 0.2	3.9 ± 0.2	0.279	3.7 ± 0.4	4.2 ± 0.2	4.5 ± 1.4	0.401
Pine	5.2 ± 0.5	4.4 ± 0.3	0.193	4.9 ± 0.4	4.2 ± 0.4	0.193	4.7 ± 0.7	4.6 ± 0.3	6.1 ± 2.5	0.83
Pistachio	**3.7 ± 0.5**	**5.0 ± 0.3**	**0.033**	4.8 ± 0.4	4.5 ± 0.4	0.655	**5.3 ± 0.7**	**4.5 ± 0.3**	**4.9 ± 2.5**	**0.028**
Peanuts	5.2 ± 0.7	5.6 ± 0.4	0.615	5.6 ± 0.4	5.5 ± 0.6	0.897	4.9 ± 0.9	5.7 ± 0.4	2.9 ± 3.2	0.456
Total nuts	5.3 ± 0.2	5.2 ± 0.1	0.741	5.5 ± 0.2	5.2 ± 0.1	0.173	4.9 ± 0.3	5.3 ± 0.1	5.6 ± 1.0	0.385

Data were considered statistically significant at $p < 0.05$ that indicates bold values.

Preferences and barriers towards consumption of nuts found in the participants are illustrated in Tables 3A and 3B. The preference of 72% of females and 71% of males is found to be in favor if eating nuts as a snack. This is a significant difference against the preference of eating nuts with meals (p value = 0.0014). Most of the different participants in their different categories in this study preferred to eat nuts as a snack. The major barrier to eat nuts has been found to be the allergic susceptibility, which is a significant reason amongst genders and BMI. All participants in this study preferred to eat nuts even if there is an alternative snack in offer. Most of the participants, irrespective being male or female, or majoring in literary or science, smoker or nonsmoker, normal weight or obese, physically active or not, reported that they feel fullness more rapidly if the meal contains nuts.

4. Discussion

This study presents an overview of the mean intake and average daily portion sizes in adult students in the University of Jordan reporting intake of nuts consumed as whole or hidden.

To the best of our knowledge, the present study is the first of its kind to assess the reasons for consuming or avoiding nuts, as well as perceptions of nuts, in Amman, Jordan.

Table 3A
Descriptive Statistics of preferences and barriers of nuts in participants based on gender and BMI.

Factors	Gender		*p*-value	BMI			*p*-value
	Female %	Male %		Underweight %	Normal weight %	Overweight %	
When do you prefer to eat the nuts:							
With meals	16	44	**0.0014**	11	32	36	0.346
Snack	81	58		71	58	52	
Is there anything that prevents you from eating nuts?							
Price	11	21	**0.04**	11	16	23	**0.03**
Allergic susceptibility	71	61		67	69	60	
Do not prefer the taste	7	8		11	7	0	
Energy content	11	10		11	8	17	
Do you feel fullness more rapidly if the meal contains nuts?							
Yes	39	39	**0.027**	45	34	46	0.034
No	27	36		10	25	24	
No difference	44	36		44	46	31	
Do you prefer to eat nuts even when there are an alternative are available?							
Yes	68	77	**0.006**	61	77	72	0.055
No	32	23		39	23	28	

Data statistically significant at $p < 0.05$ that indicates bold values.

Table 3B
Descriptive Statistics of preferences and barriers of nuts in participants based on physical activity, major and smoking.

Factors	Physical activity		*p*-value	Major		*p*-value	Smoking		*p*-value
	Yes n%	No n%		Literary n%	Science n%		Yes n%	No n%	
When do you prefer to eat the nuts?									
With meals	28	29	0.056	12	38	**0.019**	26	35	0.070
Snacks	72	71		88	62		74	65	
Do you prefer to eat nuts even when there are an alternative are available?									
Yes	75	67	**0.024**	70	73	0.001	72	76	**0.039**
No	25	33		30	27		29	24	
What is the barrier that prevents you from eating nuts?									
Price	15	18	0.560	11	19	0.464	17	13	0.826
Allergic susceptibility	65	70		70	65		69	68	
Do not prefer the taste	8	5		9	5		5	8	
Energy content	13	7		11	10		10	10	
Do you feel fullness more rapidly if the meal contains nuts?									
Yes	36	44	0.097	41	38	0.585	41	39	0.803
No	26	13		15	3		22	18	
No difference	39	43		44	76		38	43	

Data were considered statistically significant at $p < 0.05$ that indicates bold values.

In this study, much effort was placed in identifying hidden sources (e.g. local products, commercial products, confectionaries, sweets) of nuts intake. By analyzing the various foods consumed by each subject within the questionnaire data, finding foods or products that may have contained nuts and estimating their content. However, some hidden sources may have been missed and so the present results may underestimate the actual intakes. Nonetheless, these results show that this category may be a major source of overall nut intake. The intake patterns of nuts, e.g. whether they are consumed more as snacks or as a main meal component, is also of great interest.

Jordanian cuisine depends on nuts in different types of food (main dishes, appetizers, sweets or side dishes). Even if the main dish doesn't contain nuts, a local habit in Jordan includes topping up some of the main dishes with plenty of fried nuts. Traditional sweets in Jordan contain large amounts of nuts as well. The participants in this research study reported that nowadays they are more inclined to consume the Western cuisine such as *fast foods* that contain no nuts in their ingredients plus the confectionary sweets such as cakes, and the pies that are also poor in nuts. All of these factors have contributed to shift the local population's consumption away from nuts.

Gender may be a key factor affecting nuts intake patterns and levels. In the present study, an analysis of intake trends by gender was significantly higher in men than in women, in cashew nuts (*p* value = 0.035). The participants in this study are all from the University of Jordan and were recruited independent of their dietary habits and so it may be assumed that their dietary habits are likely similar to their family generally practiced in their regions. It must still be noted that most subjects can be a true/local representation of the Jordanian community due to the large number (47000) of students on campus.

Consuming nuts as snacks are shown in this study to be the most favorable preference amongst the subjects. This was significantly higher than the preference of consuming nuts within meals. Approximately 54% of females and 67% of males preferred to eat nuts at snacks. Overweight subjects dis not show any preference in respect to consuming times for eating nuts, they would eat it any time available for them – yet, most of our obese subjects reported eating nuts and nut hidden foods in a daily basis.

The analysis also demonstrates the strongest barrier to not eating nuts stems from nuts allergy. Otherwise very few subjects reported their barrier to be price-orientated and others also reported barriers with respect to taste and odor-related etc.. This barrier was highly significant amongst weight-based categories and gender-based as well. Attitudes towards nuts are noticeable amongst weight-based categories in which they feel full after eating nuts while the other categories of subjects based on other topics than weight didn't show any differences. This might be due to the knowledge and awareness that exist amongst the subjects in regards to the energy-rich content of nuts which happens to be reported in the barrier-related questionnaire where there was a small number of subjects who avoided eating nuts due to their associated calories content. Amongst Jordanian students, the preference of choosing nuts is a significant despite the availability of other items.

At the population and individual levels, differences in the relative intakes of different nuts are also important because nuts may vary somewhat in their macro- and micro-nutrient contents [11]. The most common nuts consumed were peanuts due to its reasonable price and the most availability as hidden nuts [1]. The types of experimented nuts also present some variation of intake amongst the subjects, please refer to Tables 2A and 2B For example, according to this data, pistachios are more consumed by non-smokers than smokers (3.7 vs. 5 piece per day, respectively) (*p* value = 0.033). The same pistachio comparison carries on amongst subjects who take supplements against those who do not take supplements (*p* value = 0.028) which would reflect the knowledge/awareness of being and keeping a healthy eating and life style.

Peanuts were found to be highly consumed by underweight subjects rather than their overweight peers (*p* value = 0.039) which would be explained by how peanuts suppresses hunger and desire to eat, and increases fullness after ingestion that makes them eat less meals afterward [8]. Gender had also an effect on the attitude of eating nuts time in which females were found to go with eating nuts at any time while the majority of males go with nuts at snacks. The effect of subjects' University Major has had no significant impact on nuts intake portions. However, most of the subjects from the different University Majors experimented in this study prefer to have nuts as a snack rather than within meals (*p* value = 0.019).

The high satiety value of nuts was confirmed by a review written by [8], showed that eating nuts due to its strong compensatory dietary responses, and the inefficiency in absorption of the energy they contain which leads to an increment in resting energy expenditure, and an augmentation of fat oxidation. Preliminary evidence suggests that these properties are especially evident when they are consumed as snacks. This is also mirrored in this study as Table 3A shows significant number of reporting by subjects feeling full after a meal containing nuts.

However, this study identified the barrier(s) of eating nuts amongst the University of Jordan students, please refer to Tables 3A and 3B Other related work in the literature have examined cultural aspects, taste preferences (e.g. use of nuts in local dishes or recipes, flavor, odor taste), marketplace pressures (e.g. price) and marketing strategies (higher concentration of advertising), allergic susceptibility of specific types of nuts, or high calorie content of the nuts (rich in fat). Sensory properties are among the strongest determinants of ingestive decisions [7] and [4].

It must be noted, however, that some nuts and nut products may be spiced, flavored or salted, but not heating process affecting their nutritional quality [2]. This present study confirms that the barrier from eating nuts mainly stems from health-related factors (allergic susceptibility) amongst gender and weight sub-categorizes and neither due to price nor the energy/calories associated with nuts eating. It is worth noting that amongst our subjects sample, none of them had an allergy but they reported that the only barrier to prevent them from eating nuts would be any healthy issue such as allergy.

Mediterranean style diets, (Jordan food style is one of them), include major characteristics in higher reliance on nuts and seeds as a source of food energy [8]. From the data presented in this paper, most of the subjects prefer eating nuts even if there was an alternative available. The abundance of nuts availability puts it on the top of food items amongst participants.

Nuts share some common characteristics, such as higher fat levels, rich content of antioxidants, various phytochemicals, and other nutrients [2,8]. As such, they are often placed together in one food group (fat group). This research's analytical data shows a high degree of heterogeneity in the intake of these foods. Nut intakes remain lower than recommended among our participants' environment. Understanding how the general population perceives nuts could inform strategies to promote regular nut consumption and increase intakes amongst the general public [5,6].

5. Conclusion

This study describes the mean intake and average daily portion sizes of nuts from 166 subjects from the University of Jordan students. The authors of this paper, Dr Ghazzawi & Prof Al-Ismail, undertook the collection of questionnaire reports from the participants from the Science and Literature Colleges in the University of Jordan as part of this study. The data shows that all subjects did in fact consume nuts; total nuts intake averaged 5 nuts per day. Out of all nuts consumed as whole or hidden, peanuts were the most common of all types. The data from this study may be of use in devising research and health policy strategies based on the intake of this important emerging food group. The needs for educational and awareness purposes about nuts benefits are substantial.

Albeit the basic knowledge of the overall nutritional value of nuts, a large proportion of the college population was unaware of the health properties of nuts. This work has identified common motives for eating/avoiding nuts, as well as perceptions of nuts that could affect attitudes towards nuts intake. All of these findings are believed to support public health messages to increase normal nuts consumption. Knowledge gaps in the public should also be addressed.

Transparency declaration

This work was held in the University of Jordan by the corresponding author. Hence any information in regard to this work you are willing to contact her.

Author contribution

Dr Hadeel Ghazzawi conceived designed and supervised the study and the data collecting, dealing with the participants and drafted the manuscript.

Prof. Khalid AL-Ismail was responsible for curation, analysis and interpretation of the data. All authors critically reviewed the manuscript and approved the final version.

Dr Muhnad Akash helped in the statistical analysis.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.yclnex.2019.01.001.

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