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Aziouz Aidoud[1], Lourdes Franco[2], María Pilar Terrón[2], Omar Elahcene[3], Ana Beatriz Rodriguez[4]

[1]Bioinformatics, Applied Microbiology and Biomolecules Laboratory. Faculty of Sciences. M'Hamed Bougara University. Boumerdès, Algeria. [2]Faculty of Medicine and Health Sciences. Universidad de Extremadura. Badajoz, Spain. [3]Faculty of Natural and Life Sciences. Ziane Achour University. Djelfa, Algeria. [4]Faculty of Sciences. Universidad de Extremadura. Badajoz, Spain

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Correspondence: Aziouz Aidouda. Bioinformatics, Applied Microbiology and Biomolecules Laboratory. Faculty of Sciences. M'Hamed Bougara University. Avenue de l'Indépendance. Boumerdès 35000. Algeria
e-mail: a.aidoud@univ-boumerdes.dz

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ABSTRACT

Objective: the Ramadan fast (RF) is practiced by millions of adult Muslims globally for a whole lunar month every year. Fasting is a common practice in different religious disciplines, including Islam, Christianity, Judaism and Hinduism. In Islam, the practice entails abstinence from eating and drinking between dawn and sunset. This study aimed to characterize food intake of undergraduate students (male and female) from M'Hamed Bougara University, Boumerdes, Algeria, observed before and during Ramadan.

Methods: during a month before Ramadan and during the month of Ramadan, 120 undergraduate students (male and female) from

M’Hamed Bougara University, Boumerdes, Algeria, completed 24-h dietary recalls. Dietary intake was studied using food groups as well as macro and micronutrients consumption.

Results: significant differences in dietary intakes were observed before and during Ramadan in both sexes, with a significantly higher intake of cereals, milk, milk products and eggs in women compared to men before Ramadan, while men consume more vegetables, fish and oils during this period. During Ramadan in women there is a significant increase in cereals, vegetables and fruits and a significant decrease in milk and dairy products and eggs, while in men there is a significant increase in fruits, meat and oils, and a decrease in milk and eggs. Such differences in food groups intake were reflected in macro and micronutrients intakes including carbohydrates, saturated fats, calcium, vitamin A, vitamin C and sodium.

Conclusion: In summary, the findings of this study are that gender-specific variations persist, influencing dietary habits and micronutrient intake, suggesting diversity in Ramadan diets to address imbalances and promote healthier eating behavior among students.

Keywords: Nutrition. Ramadan. Algeria. Undergraduate students.

RESUMEN

Objetivo: el ayuno de Ramadán (RA) es practicado por millones de musulmanes adultos en todo el mundo durante todo un mes lunar cada año. El ayuno es una práctica común en diferentes disciplinas religiosas, incluidos el islam, el cristianismo, el judaísmo y el hinduismo. En el islam, la práctica implica la abstinencia de comer y beber entre el amanecer y el atardecer. Este estudio tuvo como objetivo caracterizar la ingesta de alimentos de estudiantes universitarios (hombres y mujeres) de la Universidad M'Hamed Bougara en Boumerdès, Argelia, observada

antes y durante el Ramadán.

Material y métodos: durante un mes antes del Ramadán y durante el mes de Ramadán, 120 estudiantes universitarios (hombres y mujeres) de la Universidad M'Hamed Bougara en Boumerdès, Argelia, completaron recordatorios dietéticos de 24 horas. La ingesta dietética se estudió utilizando grupos de alimentos, así como el consumo de macro y micronutrientes.

Resultados: se observaron diferencias significativas en la ingesta alimentaria antes y durante el Ramadán en ambos sexos, con una ingesta significativamente mayor de cereales, leche, productos lácteos y huevos en las mujeres en comparación con los hombres antes del Ramadán, mientras que los hombres consumen más verduras, pescado y aceites durante este período. Durante el Ramadán, en las mujeres hay un aumento significativo de cereales, verduras y frutas y una disminución significativa de leche, productos lácteos y huevos, mientras que en los hombres hay un aumento significativo de frutas, carnes y aceites, y una disminución de leche y huevos. Estas diferencias en la ingesta de grupos de alimentos se reflejaron en la ingesta de macro y micronutrientes, incluidos carbohidratos, grasas saturadas, calcio, vitamina A, vitamina C y sodio.

Conclusión: en resumen, los hallazgos de este estudio son que persisten las variaciones específicas de género, lo que influye en los hábitos alimentarios y la ingesta de micronutrientes, lo que sugiere diversidad en las dietas de Ramadán para abordar los desequilibrios y promover un comportamiento alimentario más saludable entre los estudiantes.

Palabras clave: Nutrición. Ramadán. Argelia. Estudiantes universitarios.

INTRODUCTION

Religious identity is a prominent feature of the global population, with Islam being the second most prevalent faith following Christianity (1). Most major religions have their own distinct dietary guidelines, which adherents may or may not strictly follow. Religious practices and celebrations, such as rituals and feasts, are among the primary factors influencing eating habits and food choices (2). The holy month when Muslims shift their meals from daytime to nighttime, exemplifies how religious convictions influence people's dietary choices. Globally, approximately 1.5 billion Muslims worldwide observe fasting during Ramadan (3).

Ramadan requires Muslims to fast from dawn to sunset for 29 to 30 consecutive days, abstaining from eating and drinking (4,5). A typical practice during Ramadan includes having a substantial meal after sunset and a lighter one before dawn. Unlike fasting practices in other religions, there are no specific dietary restrictions between dusk and dawn in Ramadan, such as avoiding certain foods like animal-based products, oil, or fish (6).

This annual fast, coupled with various lifestyle changes in physical activity, sleep patterns, and circadian rhythms (7-9) has been shown to result in significant alterations in dietary habits and food consumption patterns. These changes (10,11) have implications for health, cardiovascular and metabolic blood sugar regulation, and inflammatory markers (12). The fast is broken at sunset with a meal called “iftar”, which traditionally begins with dates and milk, in accordance with the practice of the Prophet Muhammad. This is followed by a more substantial meal, often including dishes such as chorba or harira (rich soups), bourek (a kind of pastry stuffed with meats) and various salads. Suhoor, the pre-dawn meal, is also important. It consists of light, high-energy foods to prepare for the day's fasting. Ramadan meals in Algeria

bring families and friends together to share these special dishes.

Previous studies have examined changes in dietary patterns during Ramadan, with specific focus on alterations in timing and frequency of meals (13,14). More specifically, food intake during Ramadan has been associated with salient changes in the nutritional patterns, types of foods consumed, and the intake of energy, macronutrients, and micronutrients. However, the available evidence on these changes is not entirely conclusive (15-17) while some studies have reported lower energy intake during Ramadan (18,19). Others have found increased energy consumption, primarily driven by higher carbohydrate. (11,20) and fat intake, particularly sugary foods (21,17).

These alterations in dietary habits during Ramadan are particularly important to consider, especially among individuals who are at risk for metabolic diseases like obesity, diabetes, and hypertension (22,23). This is especially relevant in countries with a high burden of non-communicable diseases, where a significant portion of the population observes fasting during Ramadan.

MATERIALS AND METHODS

Participants

The present cross-sectional study was conducted on 120 undergraduate students (both sexes, mean age = 21.50 ± 2.27 years) who were recruited from M'Hamed Bougara University, Boumerdes, Algeria. The participants were randomly selected from the Biology Department during the 2020/2021 academic year. The inclusion criteria were: 1) Students at M'Hamed Bougara University, 2) Algerian nationality, 3) not pregnant and breastfeeding women, 4) not having any chronic diseases, 5) nonsmokers**.** The flow diagram of the study selection is presented in figure 1. All research conducted at M'Hamed Bougara University adheres

to the ethical principles of the Helsinki Declaration, particularly for cross-sectional studies. The present study was conducted in accordance with these institutional ethical standards and received approval from the Scientific Committee of the Biology Department. Participant characteristics are detailed in table I.

Data collection

Students were asked to fill out a self-reported quantitative questionnaire that included questions on their eating, drinking, and physical activity. Also, their weight, height, and body mass index were measured. Body mass index (BMI) was used to assess students' weight status. BMI values were categorized according to the World Health Organization (WHO) criteria as follows: < 18.5 kg/m^2 as underweight, 18.5-24.9 kg/m^2 as normal weight, 25-29.9 kg/m^2 as overweight, and ≥ 30 kg/m^2 as obese (24).

Participants were asked to record in detail the daily food and beverage intake (type, quantity, and mealtimes) throughout twenty-nine consecutive days before the month of Ramadan (B. Ram) and during Ramadan (Ram) (13th of April until 12th of May, 2021). The students from the Biology Department were recruited from M'Hamed Bougara University and were offered incentives such as certificates of achievement for their participation in a food consumption study during Ramadan. They were also made aware of the flexibility of their participation. Furthermore, the program should include opportunities to learn relevant software, such as DIAL (Alce Ingeniería S.L., Spain), which is used for data analysis of food intake. This should be complemented by workshops and hands-on experience. The professional relevance of these skills should be emphasized, and a supportive, interactive learning environment should be created through group work and fun challenges. This approach adds educational value and strengthens participants' commitment to the study. The participants received training related to

dietary behaviors and how to use the DIAL® software. In addition, this software allows you to calculate diets depending on age, body composition, and basal metabolic rate, among other variables. Data were computer-processed for the nutritional assessment using the DIAL software. The variables provided by the software were: body mass index (BMI) as weight (kg) / height^2 (m^2), dietary content of nutrients (macro- and micronutrients), energy intake, lipid content, and percentage of energy consumed according to food groups. All nutrient levels in diets are compared to recommended dietary allowance (25,26) considering the self-reported weekly physical activity. The nutritional composition of the diets was analyzed by students trained in the DIAL® software, which contains information about energy and nutrient content in terms of foods and recipes. Food items collected from the self-reported quantitative questionnaire were entered into DIAL® software and were used to estimate dietary intake of food groups, energy, macro and micronutrients.

Statistical analysis

Results were expressed in terms of mean ± standard deviation (SD). Analysis of statistical significance was computed by using the Student's t-test. The significance level was set at $p < 0.05$. Statistical analysis was performed using GraphPad Prism® (version 5.0, 2007; GraphPad Software, Inc.; San Diego, CA). to assess the adequacy of selected nutrients, their recommendations as set by the Institute of Medicine (IOM): the acceptable Macronutrients Distribution Range (AMDR) for macronutrients and their Dietary Reference Intakes for micronutrients. Nutrient adequacy was compared between the month before Ramadan (B. Ram) and during Ramadan (Ram) using the Chi-square test. A $p < 0.05$ was considered statistically significant.

RESULTS

Characteristics of the study participants

This cross-sectional study examined 120 students from the University of Boumerdes (Algeria). All participants were residing and enrolled at the university during the 2021 academic year. Anthropometric data (age, weight, height, and BMI) were collected across two time periods: before Ramadan and during Ramadan. These measurements were stratified by gender for comparative analysis, as detailed in table I. Statistically not significant differences were observed between genders in relation to BMI. However, the highest percentage in the obesity category was reported by males' students. Moreover, the highest overweight percentages were observed in females' students in comparison with their males' colleagues, respectively (33.33 %, 16.67 %). The proportion of normal weight observed in male and female participants was 65 % and 56.67 %, respectively. Table I demonstrates that no statistically significant differences were observed in weight or body mass index (BMI) between the pre-Ramadan and during-Ramadan periods in both men and women. However, when examining specific subgroups, certain changes were identified. In this regard, there was an increase in the percentage of underweight women during the month of Ramadan (the 29th day of Ramadan), while a decrease was recorded in the obese group for both sexes.

Food groups' intakes before and during Ramadan

The analysis of mean kilocalorie intake by food group highlights significant dietary changes between Ramadan (Ram) and Before Ramadan (B. Ram) periods for both sexes. Female students exhibited an 18.4 % decline in cereal consumption (1153.49 kcal/day to 941.14 kcal/day) during Ramadan, while males reported decreased intakes of cereals (-7 %), dairy products (-31 %), fish (-54 %), and oils and dietary fats (-18 %). In contrast, Ramadan intake of vegetables (+26 %), fruits (+42 %), meat (+45 %), eggs (+154 %), and beverages

(+171 %) increased significantly for males, while females showed similar patterns, consuming 87 % more fruits, 42 % more meat, 124 % more vegetables, and 174 % more beverages. These findings underscore a consistent transition during Ramadan toward greater consumption of protein-rich foods and hydrating beverages at the expense of staple grains and dairy products across both genders.

Energy, macro and micronutrient intakes before and during Ramadan

The mean intakes of energy and macronutrients before and during Ramadan in both sexes for study participants are summarized in table III. Before Ramadan, a significantly higher intake of carbohydrates are observed in the female group compared to that of males, while male students consume more protein and lipids and more saturated fatty acids and polyunsaturated fatty acids.

During Ramadan, women eat more carbohydrates than men and men consume more protein and the different lipid groups: saturated, monounsaturated, and polyunsaturated compared to women.

Besides, during Ramadan there is an increase in majority the parameters analyzed, except for protein, saturated fatty acids and PUFAs, in the group of males' students with respect to their values before Ramadan, while in female during the month of Ramadan there is a significant decrease in lipids being significant in saturated fatty acids, and an increase in fiber with respect to their values before Ramadan.

Micronutrient intake in relation to their Recommended Dietary Allowances (RDA) values are shown in table IV. As for vitamin A, it is consumed statistically more in men than in women both before and during Ramadan, RDA values were not reached in women either before or during Ramadan. In the case of folic acid, men consume more of this vitamin both before and during Ramadan, with an increase in intake observed in women during Ramadan, the statistically significant

differences between both sexes and also before and during Ramadan increased during Ramadan. Vitamin C is consumed statistically more in men than in women both before and during Ramadan. However, during Ramadan consumption increases significantly in women, exceeding the RDA values, which before Ramadan were below the RDA. As far as vitamin E is concerned, there is an increase in its intake in both sexes, reaching its RDA value, which before Ramadan was below it. Calcium in women is statistically higher before than during Ramadan, and the RDAs are not reached either before or during Ramadan. In the case of iron, its consumption increases significantly in men during Ramadan and is also significantly higher in men than in women, RDA values were not reached in women either before or during Ramadan. Regarding the sodium intake, there are significant differences between men and women, with this consumption being higher in women before Ramadan and higher in men during Ramadan. Between both periods there are significant differences in the group of men so that their consumption is multiplied by 6, far exceeding the RDA value in all cases.

DISCUSSION

This study represents the first investigation into the dietary habits of healthy undergraduate students from Algeria during the Islamic holy month of Ramadan and in the period preceding their observance of the fast. The characteristics of the intake produced during the month of Ramadan are similar to those observed in an intermittent diet, in which an increase in carbohydrate intake has been documented. These findings align with those reported in the Moroccan population and are consistent with the results of our study (27).

This study indicated that Ramadan fasting led to a decrease in body weight and BMI in both genders, and improvements in total calorie intake, especially in male students, but there were no significant differences. However, both obese men and women experienced a slight

decrease in their BMI during this period. This slight weight reduction with Ramadan fasting is in agreement with the findings in other studies (28,29). This decrease in weight may be attributed to fasting-induced metabolic changes and adaptations to time-restricted feeding. During Ramadan fasting, a significant majority of altered metabolites decrease (29,30), indicating reduced catabolic activity in daylight hours. Furthermore, the 18-hour daily fast enhances fat oxidation and insulin sensitivity, overriding caloric excess through three key mechanisms: 1) the high thermic effect of protein (a 20-30 % metabolic boost from increased meat/egg intake) promotes lean mass preservation; 2) circadian-timed eating (concentrated in evening meals) improves nutrient partitioning over fat storage; and 3) glycogen depletion from reduced cereal consumption (-18.4 %) releases bound water, while increased intake of fruits and vegetables provides fermentable fiber that reduces net caloric absorption. Consequently, a negative net energy balance results despite increased intake, compounded by the natural reduction in sedentary activity during Ramadan.

Similarly, as observed in the Lebanese population during Ramadan, a shift in dietary habits also occurs in Algeria during this period (3). As evidenced by these authors, the consumption of vegetables, fruits, meat, and beverages increases during Ramadan. Nevertheless, the consumption of cereals, milk and dairy products, fish and oils, and dietary fats is observed to decline during Ramadan in the Algerian and Lebanese populations (3). Additionally, the data indicate a notable rise in eggs consumption among the male cohort, accompanied by a concurrent decline in milk and dairy intake. This is associated with a reduction in calcium consumption, which is of particular significance for women, as this could potentially elevate the risk of developing osteoporosis in the future.

There are discernible differences in dietary habits between the sexes both before and during the holy month of Ramadan (31). As illustrated in

table II, before the month of Ramadan, males and females' participants typically consume a greater quantity of energy from food groups such as cereals, milk and dairy products, fish, and oils. This behavioral tendency may be influenced by a number of cultural and social determinants that prescribe the same food preferences for each gender. During the month of Ramadan, a change in food intake is observed. Specifically, males and women tend to consume greater amounts of vegetables, fruits, meat and beverages. In addition, men consume more eggs during Ramadan, while the women decrease their intake of eggs during the fasting month. This change may be attributed to an adaptation to the dietary restrictions associated with fasting, where the availability of specific foods may fluctuate. Furthermore, it is noteworthy that while both sexes increase their consumption of vegetables, fruits, meat and drinks. The participants of both sexes decrease significantly their food intakes of cereals, milk and dairy products and fish. These findings indicate that gender dynamics play a pivotal role in dietary practices during Ramadan, which could have implications for health and nutrition in these populations (32,33).

In relation to micronutrient intake, a multitude of disparities have been identified. In the Lebanese population examined by Shatila et al. (3), the predominant variations in vitamin A and C were observed to be more pronounced during Ramadan. Conversely, our study revealed that vitamin A remained constant before and during Ramadan. However, in contrast to these findings, vitamin C exhibited an inverse trend, demonstrating a decline during Ramadan in the female participants. In the Lebanese population, sodium, iron and vitamin D remain unchanged, while in our study sodium intake decreases in women and increases in men, iron intake and calcium intake increase.

In men, there is an increase in vitamin E intake, which correlates with higher fat intake. This fat gain is also linked to increased cholesterol in men (34).

In this study, as in others, the increased intake of fiber, folic acid and vitamin C during Ramadan could be explained by a higher consumption of vegetables and fruits, while the increase in vitamin E intake reached the RDA. This is more relevant in women because vitamin E is used in the fight against breast, cervical, endometrial, and ovarian cancer (35). In addition, this increase is related to the increase in the intake of oils and dietary fats, findings contrary to the study by Guerrero et al. (20), in which they observed a decrease in the intake of fats or oils, especially saturated fats, data that do agree with our study, in which the increase in fat intake led to a decrease in saturated fats and an increase in fats monounsaturated.

Vitamin C intake is also higher in men than in women before and during Ramadan. However, there is a notable increase in women's consumption during Ramadan, exceeding RDA values. This highlights the importance of considering dietary changes during fasting periods, as they can significantly affect micronutrient intake (3).

In terms of vitamin A, men have a higher intake compared to women both before and during Ramadan, and women do not reach RDA values during both periods. This is because women consume less eggs and dairy products. This gender discrepancy suggests possible gender-specific dietary habits or preferences that may warrant further investigation.

Similarly, folic acid intake is higher in men compared to women, with an increase seen in women during Ramadan. Significant differences in intake between the sexes and before and during Ramadan indicate the dynamic nature of dietary patterns during fasting periods and emphasize the need for personalized nutritional guidelines (3).

Calcium intake in women is higher before Ramadan compared to during Ramadan, and RDA values are not reached in either period. This finding underscores the challenge of meeting dietary calcium requirements, particularly during fasting periods, which may require targeted

interventions to ensure adequate intake. This is because women consume less milk and dairy products (3).

Iron intake increases significantly in men during Ramadan, and men also consume higher amounts compared to women. However, women do not meet the values of the recommended daily dose of iron intake before and during Ramadan, indicating a potential risk of iron deficiency in this group. This may be a risk factor in people of reproductive age (36).

Regarding sodium consumption, significant differences exist between men and women, with higher intake in women before Ramadan and higher intake in men during Ramadan. The substantial increase in sodium consumption in men during Ramadan, exceeding RDA values, raises concerns about potential health implications associated with excessive sodium intake (37,28).

Overall, the findings underscore the complex interplay between dietary habits, fasting practices, and micronutrient intake, emphasizing the importance of tailored nutritional guidance to optimize dietary quality and meet individual nutritional needs during Ramadan and other fasting periods. Further research is warranted to explore the underlying factors contributing to gender-specific and temporal variations in micronutrient intake and to develop targeted interventions to address potential nutritional deficiencies. These findings suggest that there must be control over the foods eaten during the Ramadan period and the rest of the year so that the consumption of both macro and micronutrients is adequate to guarantee correct intake.

This study has certain limitations. Physical activity during the month of fasting decreases. This factor was not measured in this study. In addition, the population investigated represents a healthy population and may not be representative of people with chronic diseases such as diabetes and cardiovascular disorders. The sample is limited to a small population in the community of Boumerdes, which may limit the ability to generalize the results across different demographic groups. In

addition, all participants were selected from a single university, so the results may not reflect the backgrounds of students from diverse environments. Other factors, such as differences in socioeconomic status, may affect students' patterns during the fasting month, including access to resources, food preferences and their overall well-being.

CONCLUSION

The dietary patterns of Algerian students during Ramadan reflect an intermittent fasting-like pattern, characterized by increased consumption of vegetables, fruits, meat, and beverages, and decreased intake of cereals, dairy products, oils, and fish. Gender differences persist in both overall dietary patterns and micronutrient intakes -- particularly folic acid, vitamin E, iron, zinc and calcium -- highlighting the influence of cultural dietary preferences and food accessibility. These findings highlight the need for targeted nutritional guidance during Ramadan to correct imbalances and promote healthier eating habits among students.

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Table I. Characteristics of the study population (*n* = 120) before and during Ramadan

	B. Ram	**Ram**
Weight (kg)	Mean ± SD	Mean ± SD
Male	78.52 ± 13.96	77.29 ± 12.86
Female	65.58 ± 10.91	64.33 ± 10.57
Total	72.05 ± 14.11	70.81 ± 13.40
	Mean ± SD	**Mean ± SD**
BMI (kg/m^2)		
Male	24.12 ± 4.67	23.74 ± 4.34
Female	24.88 ± 3.94	24.41 ± 3.66
Total	24.50 ± 4.25	24.07 ± 4.01
- Underweight (< 18.5)		
Male (*n*, %)	3, 5	3, 5
Female (*n*, %)	1, 1.67	3, 5
Total (*n*, %)	4, 3.33	6, 5
- Normal (18.5-24.9)		
Male (*n*, %)	39, 65	41, 68.33
Female (*n*, %)	34, 56.67	33, 55
Total (*n*, %)	73, 60.83	74, 61.67
- Overweight (25-29.9)		
Male (*n*, %)	10, 16.67	9, 15
Female (*n*, %)	20, 33.33	20, 33.33
Total (*n*, %)	30, 25	29, 21.17
- Obese (≥ 30)		
Male (*n*, %)	8, 13.33	7, 11.67
Female (*n*, %)	5, 8.33	4, 6.67
Total (*n*, %)	13, 10.83	11, 10.83

Table II. Comparison of food groups' intakes before and during Ramadan

Food groups	B.Ram				Ram			
	Males		Females		Males		Females	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Cereals	817.43[ca]	155.28	1153.49[d]	201.12	756.3[b]	181.41	941.14	243.25
Vegetables	356.1[ca]	184.14	168.41[d]	101.12	449.84	204.25	376.99	191.35
Fruits	63.57[c]	29.5	65.57[d]	31.75	90.43[b]	41.78	122.43	55.45
Milk and dairy products	114.29	27.25	157	41.25	78.43	23.78	100.64	14.71
Meat	268.14[c]	101.51	243.29[d]	91.45	387.86	112.41	345.43	115.78
Fish	71.57[a]	31.71	6.1	3.65	32.71[b]	12.85	0	0
Eggs	31.47[ca]	5.23	24.14[d]	11.25	80[b]	24.12	2.01	0.61
Oils and dietary fats	613.29[ca]	47.25	423.71[d]	26.57	504.14[b]	98.46	302.43	61.85
Beverages	27.71[c]	8.55	27[d]	10.12	75.14	25.64	74.14	23.45
Total (kcal)	2363.57	198.81	2268.71	302.31	2454.86	368.21	2265.21	223.62

Results are expressed as mean kcal ± SD. [a]Significantly different ($p < 0.05$) among genders before Ramadan. [b]Significantly different ($p < 0.05$) during periods Ramadan male vs female. [c]Significantly different ($p < 0.05$) in males in Ramadan vs before Ramadan. [d]Significantly different ($p < 0.05$) in females in Ramadan vs before Ramadan. $n = 120$.

Table III. Comparison of energy, macronutrients fiber and cholesterol Intakes between the month of Ramadan and before Ramadan

	B. Ram (*n* = 120)		**Ram (*n* = 120)**	
	M (*n* = 60)	**F (*n* = 60)**	**M (*n* = 60)**	**F (*n* = 60)**
Energy (kcal)	2363.57 ± 513.7	2268.71 ± 375.70	2454.86 ± 382.98	2265.21 ± 752.78
Proteins (g)	118.11 ± 28.74	43.80 ± 21.11[abd]	105.64 ± 24.93	77.96 ± 41.48
Carbohydrates (g)	274.94 ± 38.66	372.49 ± 56.86[abcd]	259.00 ± 39.28	412.21 ± 119.68
Total lipids (g)	80.40 ± 10.54	59.19 ± 16.43[abcd]	103.94 ± 20.86	27.54 ± 13.84
SFA (g)	327.35 ± 40.20	21.87 ± 5.60[abcd]	29.50 ± 8.45	8.12 ± 4.97
MUFAs (g)	24.29 ± 2.76	19.78 ± 6.66[abcd]	49.71 ± 10.04	9.27 ± 4.48
PUFAs (g)	34.33 ± 11.22	7.92 ± 2.01[abc]	14.64 ± 4.51	5.77 ± 2.75
PUFAs/SFA	0.14 ± 0.28	0.46 ± 0.36[abcd]	0.50 ± 0.53	0.32 ± 0.36
(PUFAs + MUFAs) / SFA	0.25 ± 0.35	1.63 ± 1.55[abcd]	2.18 ± 1.72	1.54 ± 1.45
Fiber (g)	33.90 ± 6.28	35.40 ± 7.31[a]	30.42 ± 4.39	28.36 ± 14.64
Cholesterol (mg)	327.35 ± 40.20	287.29 ± 155.01[abcd]	440.14 ± 93.03	193.71 ± 107.59

Results are expressed in terms of mean ± SD. [a] Significantly different ($p < 0.05$) among genders before Ramadan. [b] Significantly different ($p < 0.05$) during periods of Ramadan, male vs female. [c]Significantly different ($p < 0.05$) in males in Ramadan vs before Ramadan. [d]Significantly different ($p < 0.05$) in females in Ramadan vs before Ramadan. $n = 120$.

Table IV. Comparison of micronutrients Intakes between the month of Ramadan and before Ramadan

	RDA		B. Ram		Ram	
	M	**F**	**Male (*n* = 60)**	**Female (*n* = 60)**	**Male (*n* = 60**	**Female (*n* = 60)**
Vitamin A (µg Eq. retinol)	900	900	1232.14 ± 505[a]	693,86 ± 237,69	1214.00 ± 174.19	696.43 ± 65.32
Vitamin B1 (mg)	1.2	1.1	1.12 ± 0.40	0.93 ± 0.31	1.36 ± 0.19	1.30 ± 0.47
Vitamin B2 (mg)	1.3	1.1	1.26 ± 0.33	1.26 ± 0.35	1.53 ± 0.37	0.96 ± 0.40
Folic acid (µg activity)	400	400	307.29 ± 116.30[a,b]	218,00 ± 89[a,c]	407.00 ± 36.62	373.14 ± 154.17
Vitamin C (mg)	90	90	240.81 ± 148.73[a,b]	69,83 ± 52,60[a,c]	219.86 ± 68.74	139.57 ± 42.65
Vitamin E (µg Eq. of retinol/day)	15	15	7.18 ± 2.28	6.64 ± 3.65	15.12 ± 2.31	13.48 ± 2.61
Vitamin D (µg/day)	5	5	1.34 ± 1.13	0.97 ± 0.75	2.02 ± 1.13	1.31 ± 1.03
Calcium (mg)	1000	1000	436.00 ± 59.77	597,86 ± 127,9[a]	501.29 ± 85.12	313.57 ± 147.72
Iron (mg)	8	18	15.10 ± 6.85[b]	12,41 ± 4,59	19.79 ± 4.91	13.84 ± 7.91
Sodium (mg)	1500	1500	1650.00 ± 178.38[a,b]	3561,71 ± 849,25[a,c]	10421.43 ± 246.47	2189.00 ± 1653.74
Magnesium (mg)	420	320	381.23 ± 99.27	285.72 ± 73.23	411.19 ± 21.33	323.38 ± 70.13
Zinc (mg)	11	8	8.14 ± 2.07	7.35 ± 2.22	10.59 ± 2.99	8.31 ± 1.75

Results are expressed in terms of mean ± SD. [a] Significantly different ($p < 0.05$) among genders before Ramadan. [b]Significantly different ($p < 0.05$) during periods Ramadhan, male vs female. [c]Significantly

different ($p < 0.05$) in males in Ramadan vs before Ramadan. [d]Significantly different ($p < 0.05$) in females in Ramadan vs before Ramadan. $n = 120$.

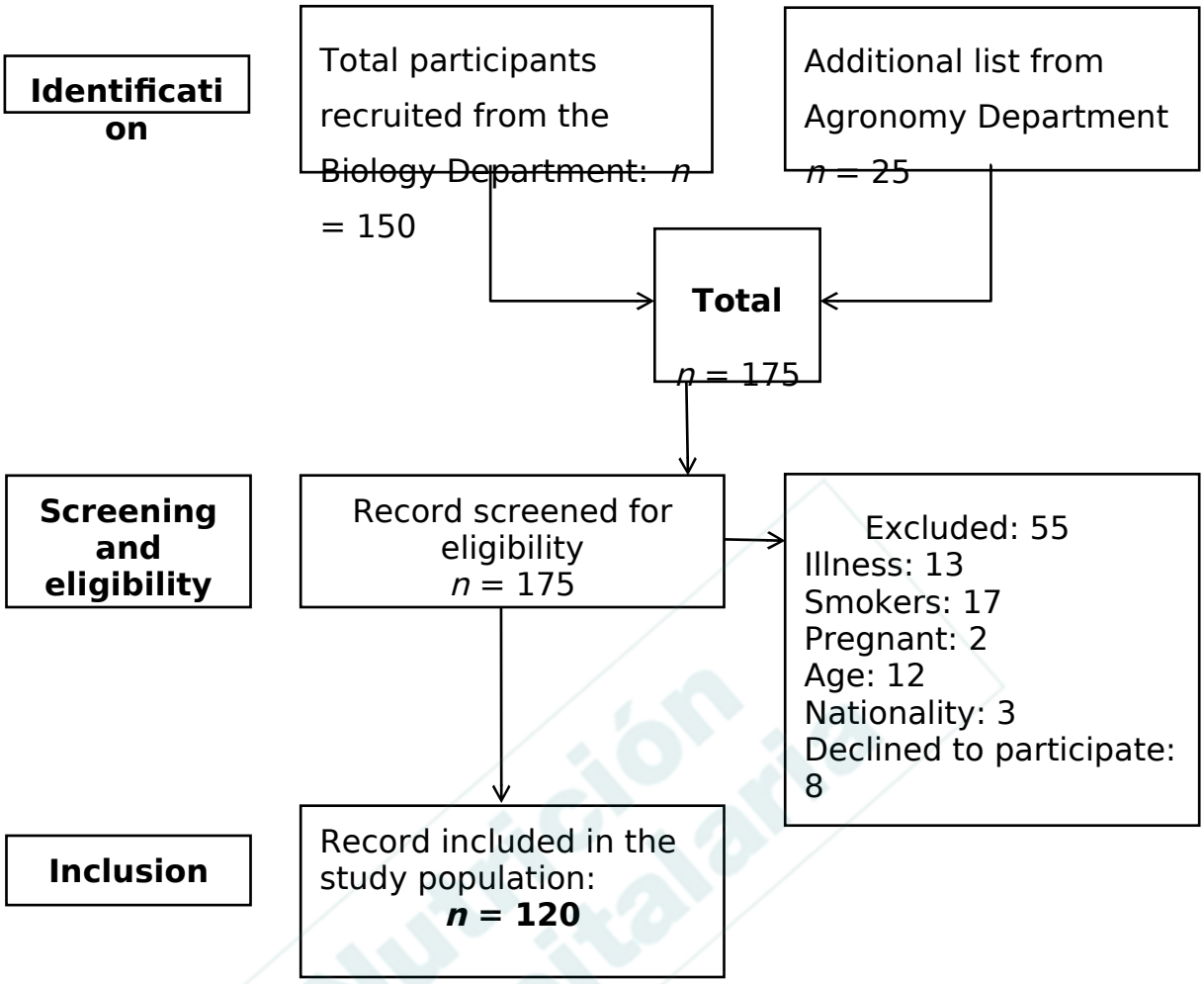

Figure 1. Flow diagram showing study selection based on inclusion and exclusion criteria.