

Measuring the knowledge, awareness and acceptance of students of King Abdulaziz University in Jeddah about quinoa seeds and its nutritional value

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ABSTRACT

The aim of the research is to measure the awareness of the students of King Abdul Aziz University in Jeddah, Saudi Arabia about the importance of quinoa seeds and ways to benefit from them and the nutritional and therapeutic value of quinoa seeds. The study used 40 students from King Abdul Aziz University in Saudi Arabia at different age levels, economic levels, and specializations. The study used questionnaire forms to show the awareness of the students of King Abdul Aziz University in Jeddah, Saudi Arabia about the importance of quinoa seeds and ways to benefit from them. The nutritional and therapeutic value of quinoa seeds. The results of the study showed that 77.5% of the members of the research sample had no previous knowledge of the quinoa seeds and its importance. A questionnaire was used to show the acceptance of the sample of quinoa seeds used in some food products, sensory assessment of salad fortified with quinoa seeds, as well as the rice cake fortified with quinoa flour, showed excellent acceptance, with the students of King Abdulaziz University, suggesting that students accept quinoa seeds. Quinoa is a functional food that reduces the risk of different diseases due to their containment of minerals and vitamins, only fatty acids and antioxidants. The study recommended the importance of educating Saudi society on the nutritional and medical importance of the seeds of quinoa, as well as the importance of cultivation of quinoa in the kingdom's regions rather than importing them abroad. Cultivation of quinoa and knowledge of its nutritional and medicinal importance and its use in some foods will be positively reflected on the health.

Key words: knowledge of quinoa seed, quinoa flour, sensory evaluation, nutritional and therapeutic value of quinoa seeds.

Introduction

Quinoa (*Chenopodium quinoa* Willd.) is a plant belonging to the family Amaranthaceae, native to the Andean regions being adaptable to different types of soil and climatic conditions, Its composition has aroused the attention of the scientific community for its high nutritional value, being rich in proteins, unsaturated fats, dietary fiber, vitamins and minerals, with an extraordinary balance of essential amino acids, It is also characterized by being a gluten-free grain, that enables its use in the diet of celiac patients (Maradini-Filho *et al.*, 2017). Quinoa is a complete food with high-nutritional value due mainly to its high content of good quality protein. Besides protein content, many studies have been made of their lipids, starch, minerals, and saponins it also contains minerals and vitamins like vitamin B, vitamin C and vitamin E. In 1996, quinoa was catalogued by FAO as one of the most promising crops for the humanity, not only for its great properties and its multiple uses, and it is also considered an option to solve human nutrition problems FAO (2011). The high nutritional value, medicinal properties, and gluten-free quality of quinoa may benefit several at-risk consumer populations, including children, the elderly, high-performance athletes, lactose intolerant consumers, osteoporosis-prone women, and people with anemia, diabetes, dyslipidemia, obesity, or celiac disease (Bhargava *et al.*, (2006). Though the number of animal and human clinical trials on quinoa's therapeutic potential is limited, several studies indicate various benefits associated with quinoa consumption. Carbohydrates are the major portions of quinoa seed dry matters; it comprises starch

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and dietary fibers as major components. Carbohydrates content in quinoa seeds vary from 67% to 74% of the dry matter; out of it, starch makes up about 55-65%. In quinoa seeds primarily starch compound is located in per sperm as simple units or as spherical aggregates having very small grain size, less than 3 μm (Atwell *et al.*, (1983). When compared for its amylose content, quinoa starch contains 11% amylose which is less than other cereals like rice (17%), wheat (22%), or barley (26%) According to Lamothe *et al.* (2015), quinoa contains 10% total dietary fiber. Fiber is the carbohydrate fraction which is resistant to enzymatic digestion and absorption in the small intestine, and which usually undergoes full or partial fermentation in the large intestine. Dietary fiber is considered essential for optimal digestive health and also imparts various functional benefits (Brownawell *et al.*, (2012). The protein content, fat, ash and minerals of quinoa are higher than in other cereals such as wheat, rice, and maize (Wright *et al.*, 2002 and Rojas *et al.*, 2010). It is considered a functional food, especially because of its high nutritional value and protein quality, and is gaining importance in the development of infant food formulas (Vega-Galvez *et al.*, 2010). Quinoa proteins are mainly albumin and globulin type, with a balanced amino acid composition similar to casein, the protein found in milk. Quinoa is an excellent source of dietary fiber – both soluble and insoluble – comprising about 6% of the total weight of the grain. The fiber is easily digestible; it is free of gluten and contains the phytoestrogens daidzein and genistein, Jacobsen (2003), making it a good substitute for people with celiac disease and a perfect alternative to meat and other products of animal origin. Quinoa contains a relatively high amount of oil, which makes it a potential source for oil extraction (Repo-Carrasco, 2003). The nutritional composition of quinoa varies among ecotypes owing to strong genetic variability as well as environmental differences in the Andean region (Repo-Carrasco *et al.*, 2010). Quinoa stand out for its high mineral content in comparison with other cereals such as wheat, corn, rice, barley, oats, rye, and triticale, especially in calcium, iron, phosphorus, magnesium, and zinc. Thus, for example, quinoa contains almost three times more calcium than rice, four times more than corn and a much higher content than wheat. The iron content in quinoa is five times higher than in rice, three times more than in wheat, while maize lacks this mineral. The phosphorus levels in quinoa are similar to those found in wheat but higher than in rice and, in particular, maize (Stikic *et al.*, 2012). Antioxidant potential of seeds and sprouts of selected pseudo cereals amaranth and quinoa were done by the methods like Ferric Reducing Ability of Plasma (FRAP) assay, radical scavenging activity (ABTS) and radical scavenging activity (DPPH). Total polyphenols and anthocyanins were also determined. In this study, it was focused on the nutritional value of sprout as a good source of antioxidants present in the quinoa. Total Antioxidant capacity (TAC) values for quinoa seeds are as FRAP 4.97 in $\text{mmol Fe}^{2+} \text{ kg}^{-1} \text{ DW}$, ABTS 27.19 in $\text{mmol Trolox kg}^{-1} \text{ DW}$, DPPH 38.84 in $\text{mmol Trolox kg}^{-1} \text{ DW}$, Total Anthocyanins 120.4 – ANT $\text{mg CGE } 100 \text{ g}^{-1} \text{ DW}$, total polyphenols -3.75 TP $\text{mg GAE g}^{-1} \text{ DW}$ (Pawel *et al.*, 2009). Quinoa is a good source of minerals; when compared with common staple foods like barley, oats, rice, corn, or wheat quinoa seeds contain high-quality proteins, higher levels of energy, calcium, phosphorus, iron, fiber, and B vitamins (Dini *et al.*, 2010). Comparative data of the mineral content of quinoa seeds (Koziol, (1992).

The aim of the research is to measure the awareness of the students of King Abdul Aziz University in Jeddah, Saudi Arabia about the importance of quinoa seeds and ways to benefit from them and the nutritional and therapeutic value of quinoa seeds.

Material and Methods

Quinoa seeds and flour were obtained from local market in Jeddah City. Measuring the awareness of King Abdulaziz University students in Jeddah, Kingdom of Saudi Arabia for quinoa seeds, nutritional value and proper preparation method. The descriptive approach will present the study tool used in terms of the steps of its construction and description as well as the procedures used to verify its veracity. Then determine the steps of applying the study and statistical processing in the analysis of the results. Fifty questionnaires were worked out and distributed to 50 students representing all the students, as well as representing different strata of society. The study responded to 40 students out of a total of 50 students by 80%. Forty questionnaires were analyzed after the elimination of 10 questionnaire forms for the following reasons:-

1. Personal data is not mentioned.
2. The answers were one pattern.
3. The answers were contradictory.

4. The answers were less than 50%.
5. No questions to be answered on the questionnaire form.

Questionnaire form:-

Questionnaire form divided into two sections
Section One: Preliminary data on the study community.
Section Two: Questions to gauge the awareness of the students of King Abdulaziz University about quinoa seeds and their knowledge of their nutritional and health value, as well as sensory assessment forms to measure the acceptability of the search sample for quinoa seeds.

Exploratory experience:-

15 questionnaire questionnaires were distributed as an exploratory experiment for 15 students from the research category to assess the understanding of questionnaire questions. In the light of the observations of the exploratory experiment, the questionnaire form was modified before being distributed to the target sample.

Secondary sources:-

The theoretical study relied on some secondary sources, such as -scientific journals, research, previous studies, documents, publications, and Web sites.

Study Limits:-

Objective limits:-to gauge the awareness of the students of King Abdulaziz University in Jeddah, Saudi Arabia, of quinoa seeds, nutritional value, and proper preparation method.

Spatial and human boundaries:-Application of the study to 40 students at King Abdulaziz University in Jeddah, Saudi Arabia.

Analytical Methods

Moisture, total protein, ether extract, total ash, crude fiber, and minerals were determined according to methods in the A.O.A.C., (2010). Total carbohydrates were calculated by difference.

Results and Discussion

Chemical constituents and minerals content of quinoa flour are presented in Table (1). It could notice that the quinoa flour contained 7.8%, 15.9%, 4.6 %, 2.3 %, 8.9 % and 60.8% for moisture, Crude protein, Crude fats, Total ash, Crude fiber and Total carbohydrates respectively. While, Calcium, Iron, Zinc, Potassium, and Magnesium were 75, 7.6, 4.2, 900, 523, and 156 mg/100g on dry weight basis respectively. On the other hand, Thiamine, Riboflavin, and Niacin were 0.32, 0.34 and 1.4 respectively. These results are agreement with Ascheri *et al.* (2002) and Zevallos *et al.* (2012).

Table 1: Chemical constituents and minerals content of quinoa flour

Components		Quinoa flour
Moisture content	%	7.8
Protein	g/100g	15.9
Fat	g/100g	4.6
Ash	g/100g	2.3
Dietary fiber	g/100g	8.9
Total Carbohydrates	g/100g	60.8
Calcium	mg/100g	75
Iron	mg/100g	7.6
Zinc	mg/100g	4.2
Potassium	mg/100g	900
Phosphorus	mg/100g	523
Magnesium	mg/100g	156
Thiamine	mg/100g	0.32
Riboflavin	mg/100g	0.34
Niacin	mg/100g	1.4

Age Level: -

The age range of this study samples are presented in Fig (1). The age range of this study samples was between 18 and 25 years. The age of the research sample aged 12 to 23 years was 47.5% followed by the age level of 18 to 20 years by 45% and the age level from 24 to 25 years by 7.5%.

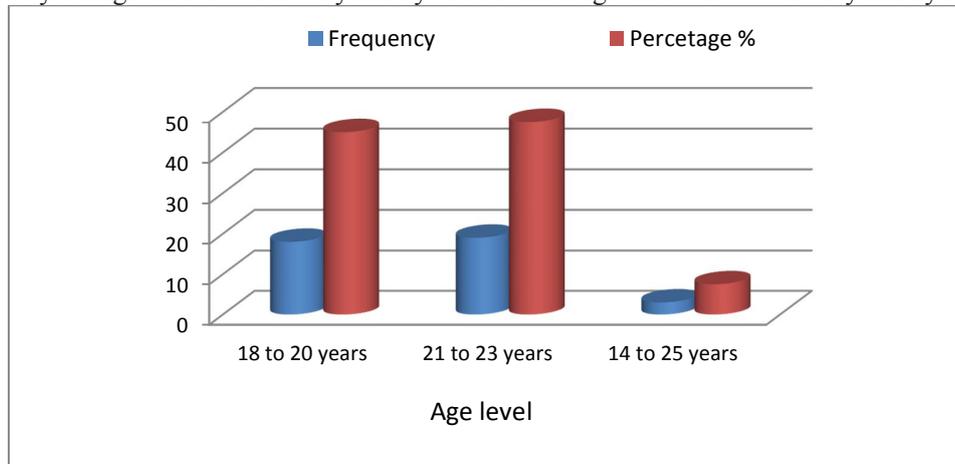


Fig 1: Age Level of the study sample.

Social status:-

Marital statuses of the samples are shown in Fig (2). Marital status of the sample of the study are shows that the percentage of married 7.5% while the proportion of non-married 92.5% of the total sample study.

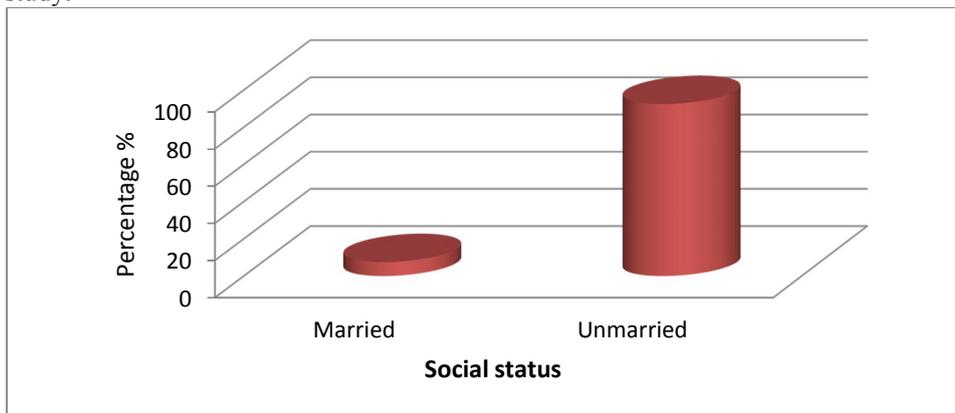


Fig 2: Social status of the study sample.

Specialization: -

Specialization of the research samples are illustrated in Fig (3). It is noted that there is a discrepancy in the study specialization of the research sample. It was noted that the percentage of specialization among female students was 27.5%, general administration 15%, food and nutrition 25%, psychology 20%, geography 10% and Islamic studies 2.5%.

The levels of the study:-

The levels of the study sample are presented in Fig (4). Results was found to the number of students in the study sample was highest at 27.5%, followed by the second level (22.5%), the fifth level (17.5%), the third and fourth level (10%), the eighth level (7.5%) and the ninth (5%).

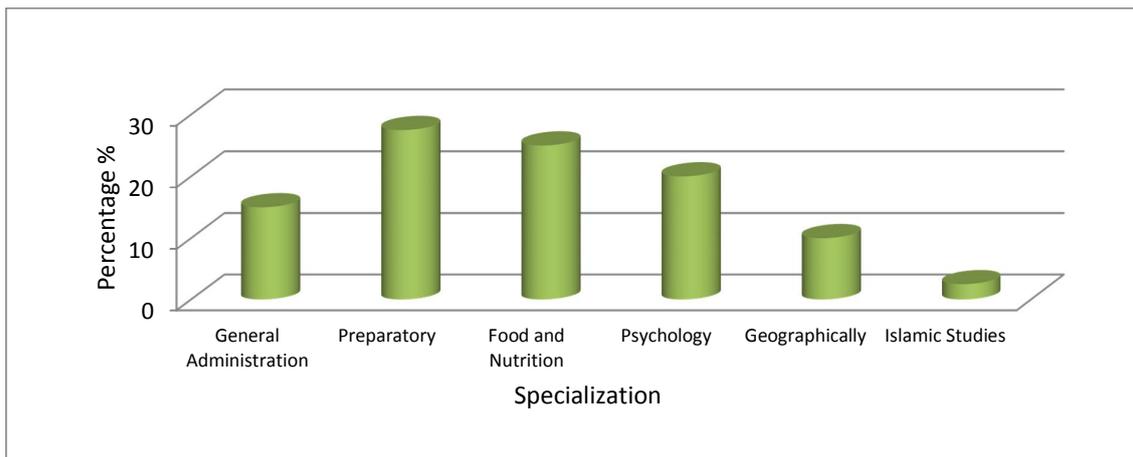


Fig 3: Specialization of study sample

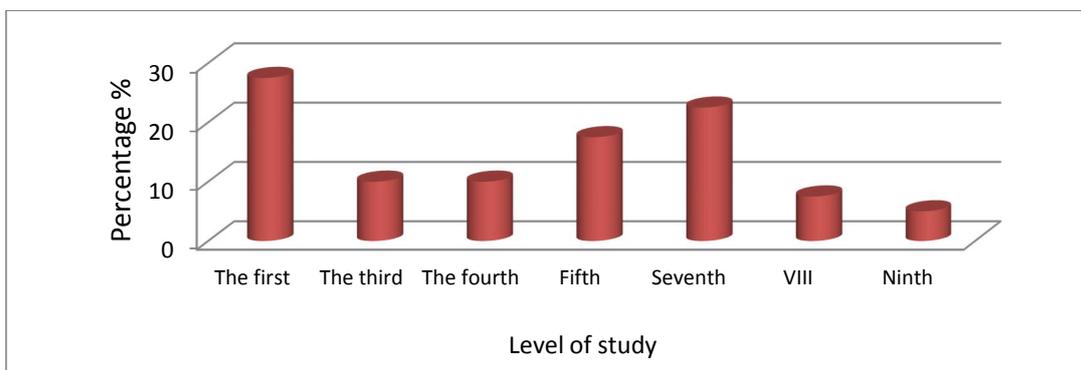


Fig 4. The levels of the study sample

Utilization of medicinal herbs: -

Utilization of medicinal herbs of the study samples are presented in Fig (5). Utilization of medicinal herbs by 60% of the research sample. On the other hand, it was found that 40% of the sample did not use medicinal herbs. This is due to the importance of medicinal plants in the treatment of some health problems and the use of medicinal plants as an alternative to chemotherapy.

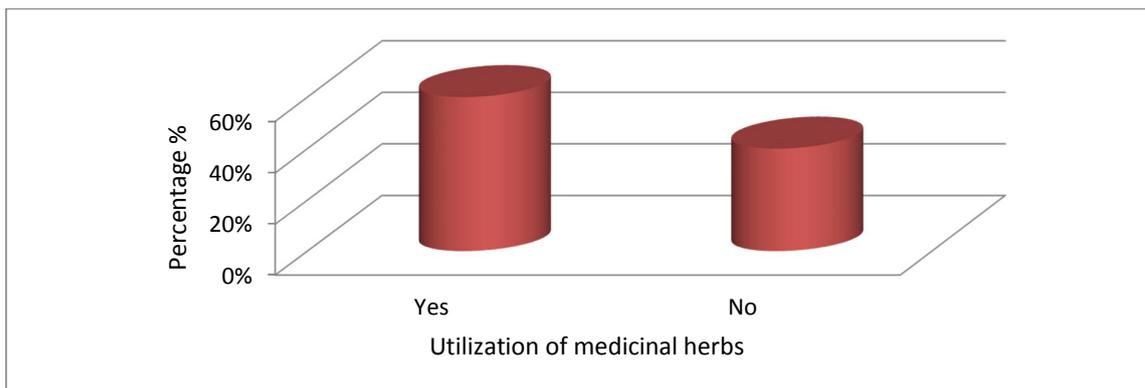


Fig 5: Utilization of medicinal herbs of the study sample

Food diversity in diets: -

Dietary diversity of diets in the study samples are shown in Fig (6), the results showed a diversity of food in diets by 75% of the research sample, while 25% of the study sample ate one type of food

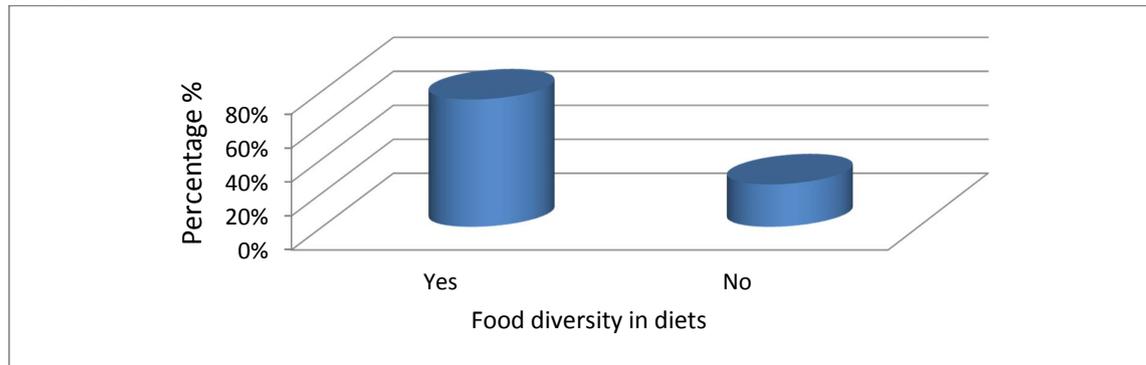


Fig. 6. Food diversity in diets of the study sample

Utilization of whole grains in daily food:

Utilization of whole grains in daily food of the study samples are illustrated in Fig (7). The results showed that 37.5% of the research sample used whole grains in daily food, while 72.5% of the sample did not use whole grains in daily food, which may lead to the deficiency of some nutrients and antioxidants important for health and safety of the body. Quinoa seeds rich in nutritious and antioxidants, bread fortification with quinoa grain to raise the bread content of nutrients and antioxidants, which is an alternative or supplement to the research sample.

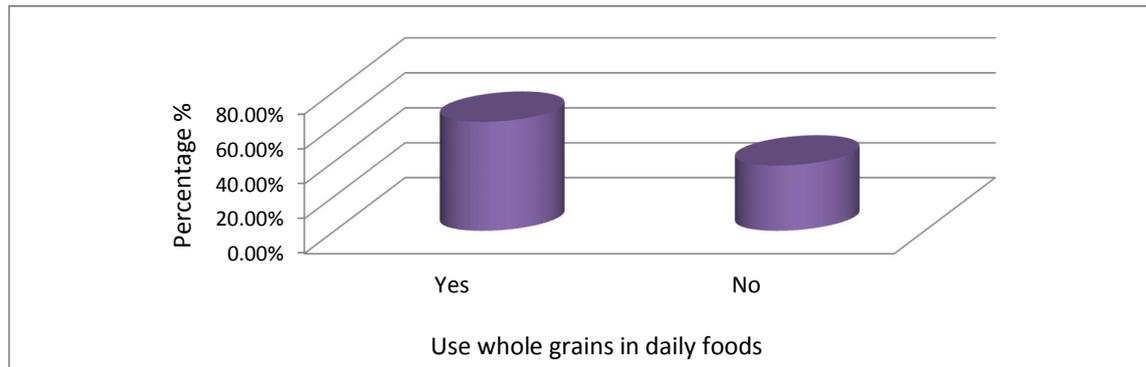


Fig 7: Utilization of whole grains in daily foods of the study sample

Previous knowledge of quinoa seeds:

Previous knowledge of quinoa seeds of the study samples are shown in Fig (8). The results showed that 22.5% of the research sample knew quinoa seeds and their nutritional importance, while 77.5% of the research sample did not know anything about quinoa seeds.

Utilization of quinoa seeds: -

Utilization of quinoa seeds of the study samples are shown in Fig (9). The study showed that 10% of the research sample uses quinoa seeds in their diets, while 90% of the research sample does not use quinoa seeds in their food due to the lack of awareness and knowledge of the students of King Abdulaziz University in Jeddah

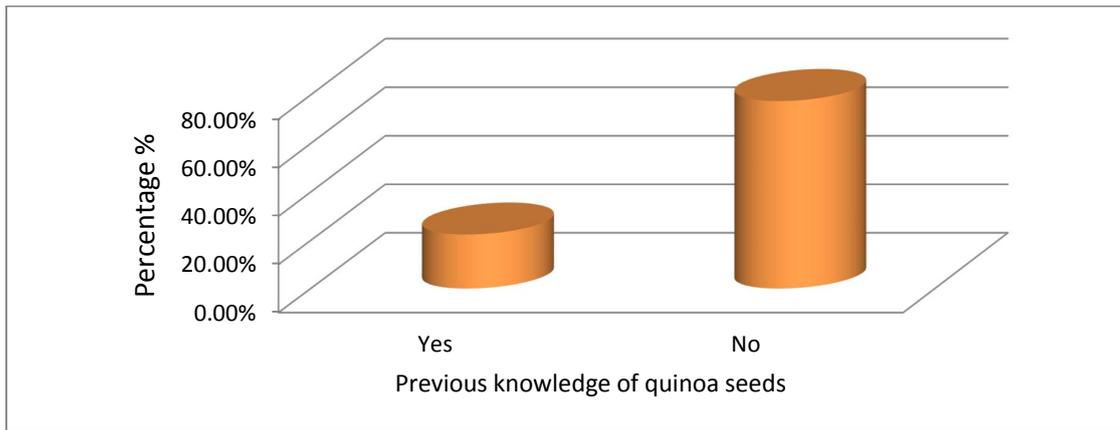


Fig 8: Previous knowledge of quinoa seeds of the study samples.

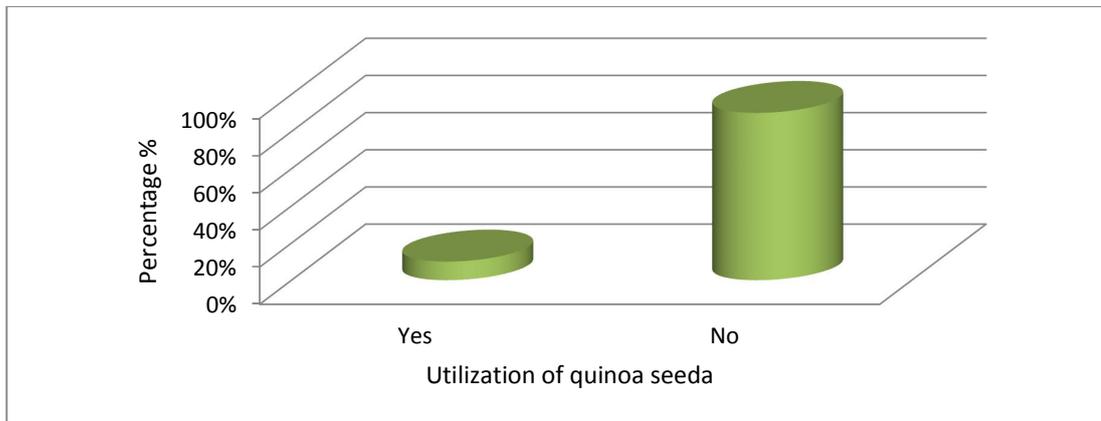


Fig 9: Utilization of quinoa seeds of the study sample

Knowledge the effect of quinoa seeds on health of the study samples are shown in Fig (10). The study showed that 92.5% of the students of King Abdulaziz University in Jeddah do not know the impact of the use of quinoa seeds on health, while 7.5% of female students know the importance of quinoa seeds and their impact on health.

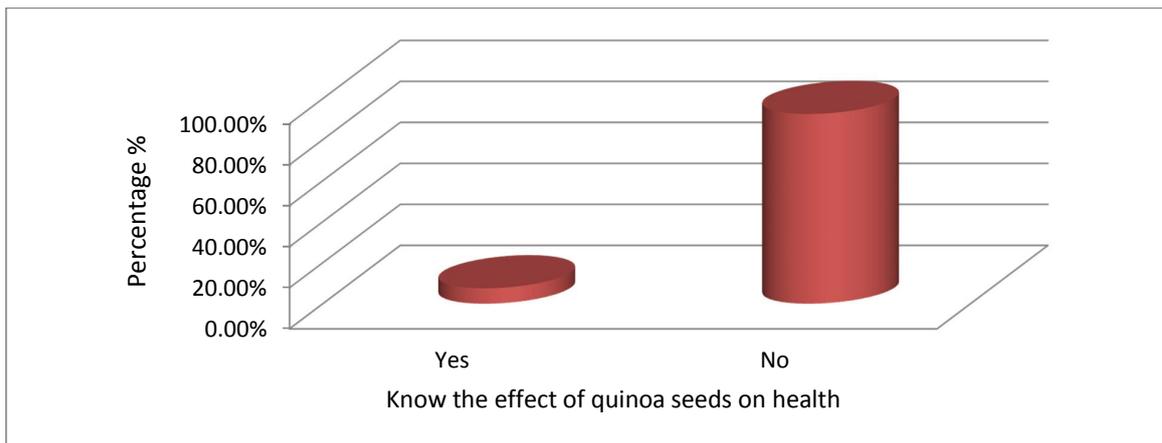


Fig. 10: Knowledge the effect of quinoa seeds on health of the study samples.

Utilization of quinoa products of the study samples are presented in Fig (11). The study showed that 7.5 percent of the students of King Abdul Aziz University in Jeddah use quinoa seeds,

2.5 percent of students use quinoa seed oil, 2.5 percent use seeds and quinoa oil. On the other hand, the study showed that 87.5% do not have quinoa seeds and products (quinoa seed oil).

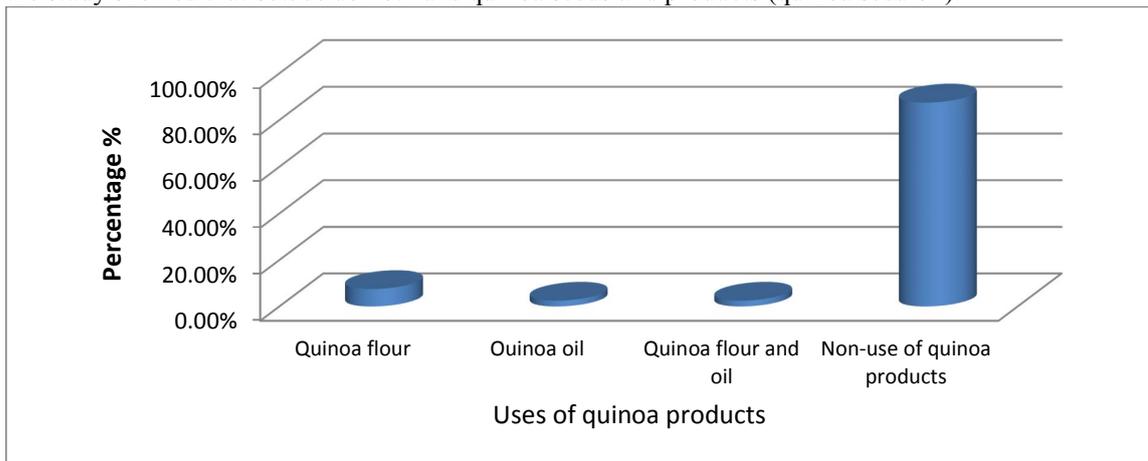


Fig. 11: Utilization of quinoa products of the study samples.

Knowledge of containment quinoa seeds of essential amino acids of the study samples are presented in Fig (12). The study showed that 100 percent of the students of the King Abdulaziz University in Jeddah are don't know that the quinoa seeds to contain the essential amino acids of the human body.

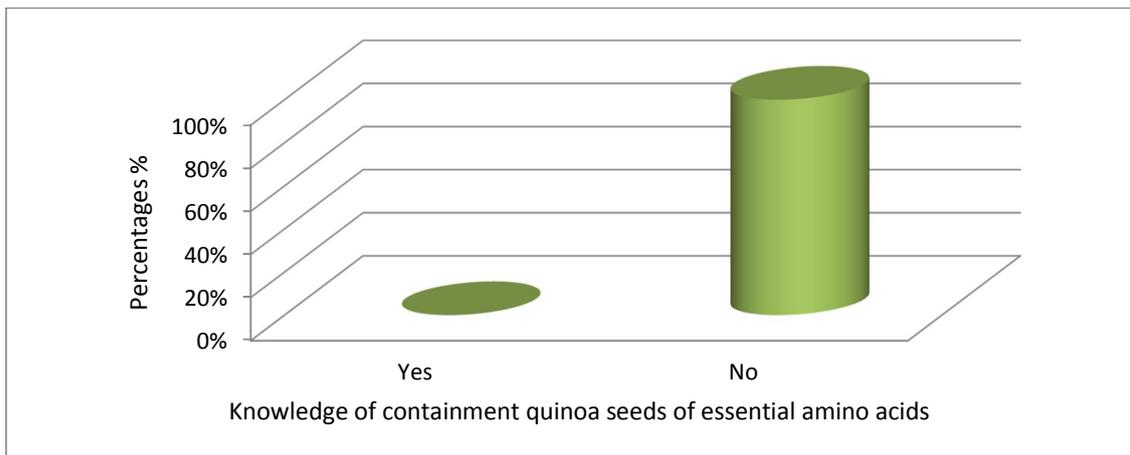


Fig. 12: Knowledge of containment quinoa seeds of essential amino acids of the study samples.

Knowing that quinoa seeds are gluten free of the study samples are presented in Fig (13). The study showed that 90 percent of the students of King Abdulaziz University in Jeddah do not know that quinoa seeds are gluten free, while 10 percent of the students know that quinoa seeds do not contain gluten-allergens in some people.

Utilization of quinoa seeds to reduce weight of the study samples are shown in Fig (14). The study showed that 97.5 percent of the students of King Abdulaziz University in Jeddah do not know that quinoa seeds are used to lower weight, while 2.5 percent of students use quinoa seeds to reduce their weights.

Utilization of quinoa seeds to reduce cholesterol and sugars of the study samples are shown in Fig (15). The study showed that 100 % of the students of King Abdulaziz University in Jeddah do not think quinoa seeds are used to reduce cholesterol and blood sugar.

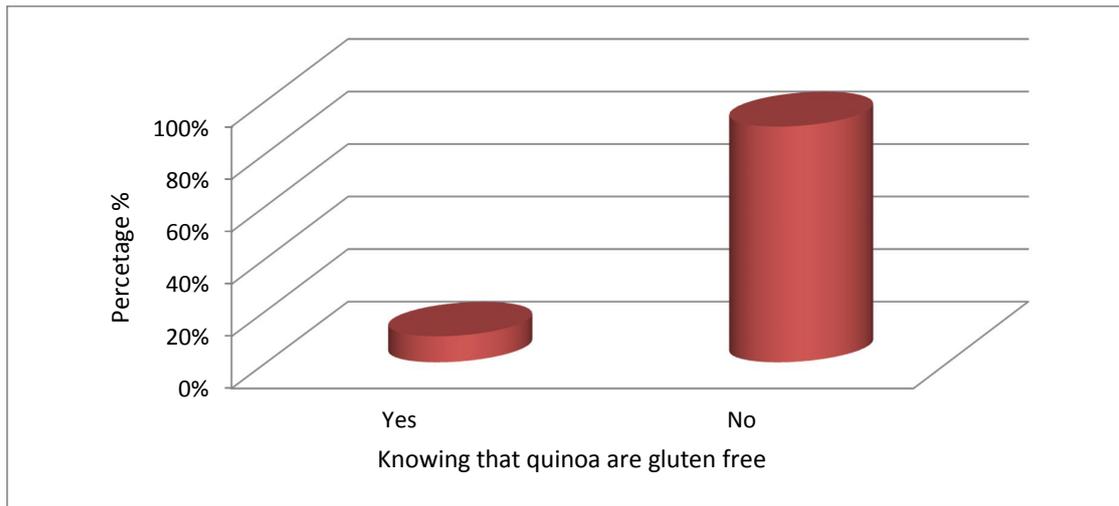


Fig. 13: Knowing that quinoa seeds are gluten free of the study samples.

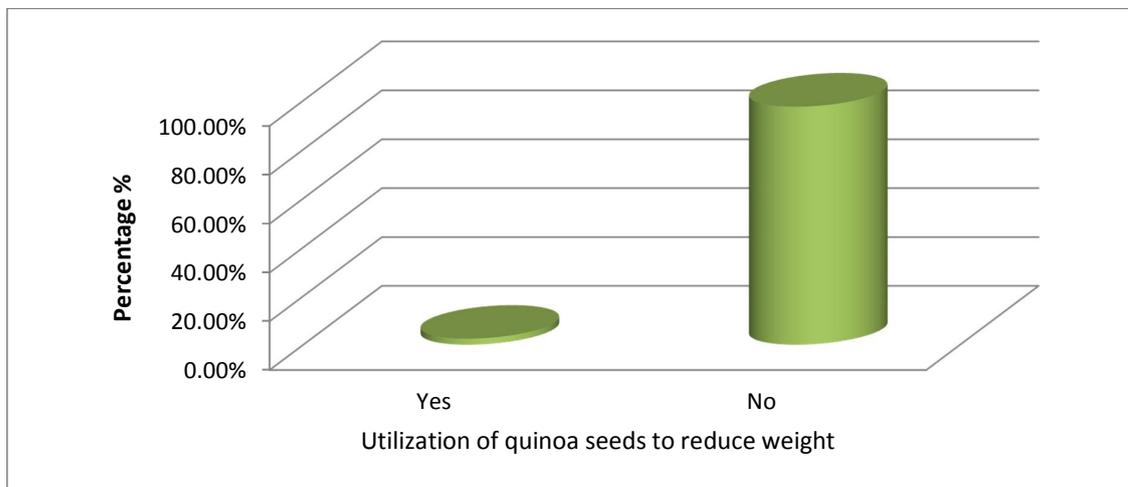


Fig. 14: Utilization of quinoa seeds to reduce weight of the study samples.

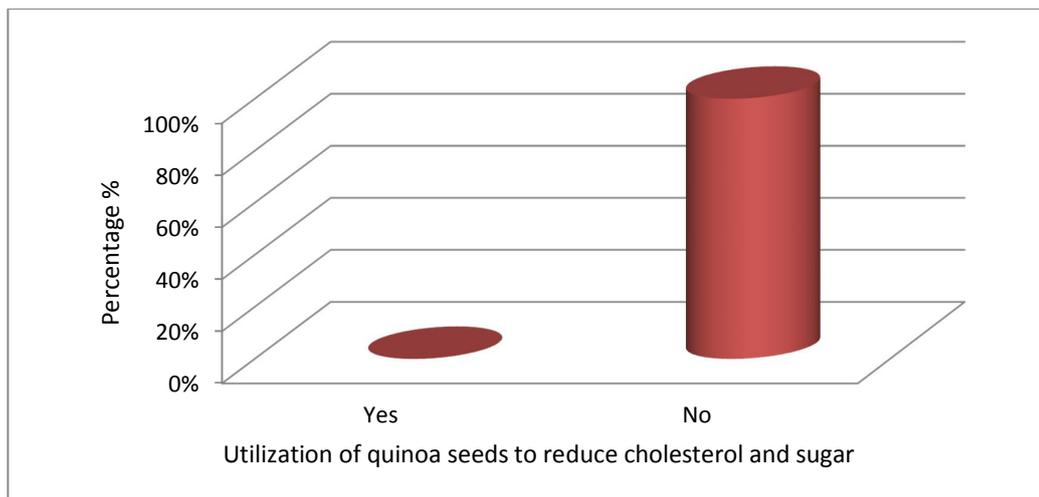


Fig. 15: Utilization of quinoa seeds to reduce cholesterol and sugars of the study samples.

Sensory evaluation

The sensory assessment of the salad prepared with added quinoa seeds were shown of the study samples are shown in Fig (16). The general acceptability of the record of salad with of quinoa seed by the students of King Abdulaziz University in Jeddah were excellent 40% from the study samples, very good at 32%, good at 17.5% and accepted at 7.5%.

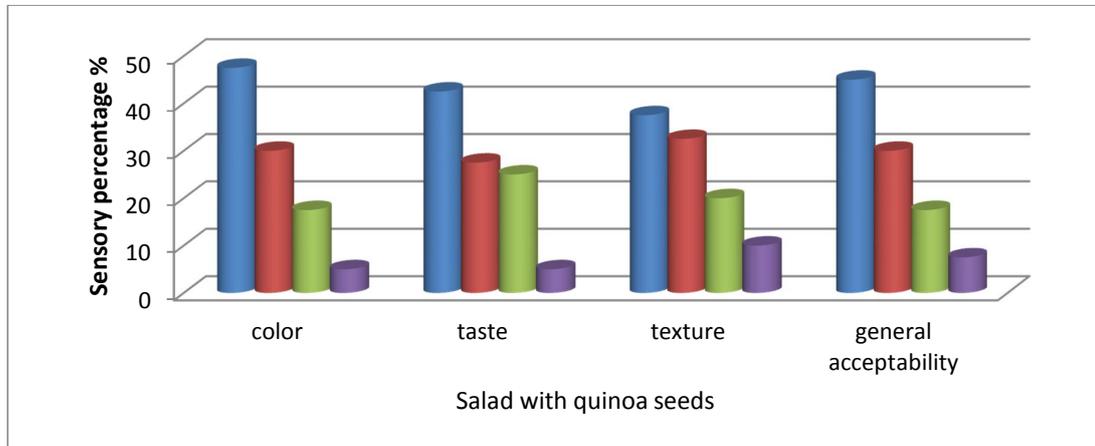


Fig. 16: The sensory attributes of the salad prepared with added quinoa seeds.

The sensory assessments of the rice cakes fortified with added quinoa flour were shown of the study samples are presented in Fig (17). The general acceptability of the record of rice cake with of quinoa seed by the students of King Abdulaziz University in Jeddah were excellent 40% from the study samples, very good at 33%, good at 18% and accepted at 9%.

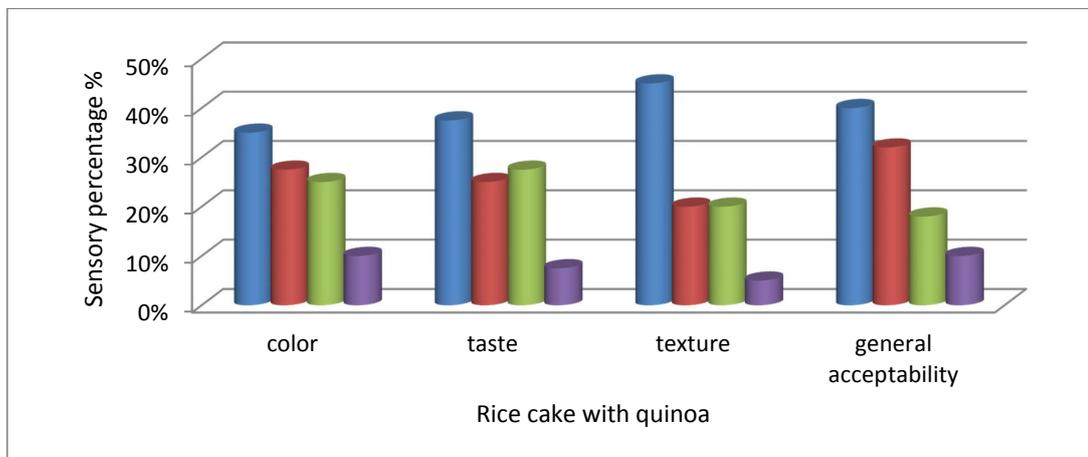


Fig. 17: The sensory attributes of the rice cakes fortified with added quinoa flour.

Conclusion

It is clear from the study that King Abdulaziz University students have insufficient awareness of the importance and nutritional value of quinoa seeds and their uses.

This is due to the lack of prior knowledge of quinoa among the students of King Abdulaziz University, the unavailability of quinoa seeds in Arab markets, and the lack of a suitable environment for the cultivation of quinoa in Saudi Arabia.

Recommendations

Increasing food education for quinoa seeds and the way they are used and prepared. Use quinoa seeds or quinoa flour in daily food to contain the nutrients necessary for public health.

Quinoa products more nutritional and therapeutic value, having essential amino acids, essential vitamins, fibers, omega-3, and minerals and it is nutritionally beneficial human

Use quinoa seeds for high-pressure patients, because quinoa seeds reduce the levels of fatty acids and triglycerides in blood.

Use quinoa seeds in weight loss as it helps to reduce the level of triglycerides in the blood and a little cholesterol.

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