International Journal of Scientific Research and Engineering Development-– Volume 6 Issue 2, Mar-Apr 2023

Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

Comparative Analysis of Antioxidant and Nutrient Characteristics of Different Almond Types

Mubeen Asad*, Jawad Aamir**, Asia Latif***, Mustansar Ali****

*Institute of Food and Nutritional Sciences, PMAS Arid Agriculture, Rawalpindi, Pakistan

Email: Asadmubeen101@gmail.com

** Institute of Food and Nutritional Sciences, PMAS Arid Agriculture, Rawalpindi, Pakistan

Email :Jawadaamir002@gmail.com

*** Institute of Food and Nutritional Sciences, PMAS Arid Agriculture, Rawalpindi, Pakistan

Email: Asia.latif@uaar.edu.pk

**** Institute of Food and Nutritional Sciences, PMAS Arid Agriculture, Rawalpindi, Pakistan

Email : Mustansar.ali312@outlook.com

----------**********----------

Abstract:

Almonds are widely recognized for their valuable nutrients, including essential amino acids, lipids, carbohydrates, minerals, vitamins, and phytochemicals, making them an excellent source of energy and essential components for growth and health. Almonds are also known for their antioxidant properties, which can help prevent diseases and promote better health. However, different almond cultivars may have varying nutrient and antioxidant characteristics, which could affect their potential health benefits. In this study, we compared the antioxidant and nutrient characteristics of three different almond cultivars: Kaghzi, Katha, and American. The samples were collected from a farm and analyzed for their physicochemical properties. The results showed that Kaghzi almonds had the highest antioxidant activity, as well as the highest mineral content, fiber, ash, total sugars, and fatty acids, compared to the other two cultivars. Kaghzi almonds also had the highest carbohydrates content, while American almonds had the highest protein content. On the other hand, Katha almonds had the lowest values for most of the analyzed parameters. The high antioxidant activity and nutrient content of Kaghzi almonds suggest that they may offer the most significant health benefits among the three cultivars analyzed. The findings could be useful for developing almond-based food products with enhanced nutritional and antioxidant properties. Overall, this study provides valuable insights into the potential health benefits of different almond cultivars and highlights the importance of considering the nutrient and antioxidant characteristics of almonds when selecting or using them for dietary or food purposes**.**

Keywords: Almonds, Antioxidant, Nutrient, Physicochemical Analysis,

----------**********----------

I. INTRODUCTION

The dry fruits are edible seeds and nuts, rich inanamazing quantity of nutrientssuch as lipids, proteins, dietary fibers, vitamin and minerals. The utilization of these nuts and edible seeds is choice of all age groups in the society.Pakistan is a major producer of dry fruits with substantial phytochemical content, including almonds, walnuts, raisins, pine nuts, and pistachios [1]. Almond plant is wide spread in tropical regions of the world. The fruit is fit for human consumption, tasting slightly acidic. The wood is quite waterproof and is utilizedin making canoes. The different parts of almond plant are utilized in conventional medicine for various purposes such as leaves, barks and roots.

Almond, (*Prunusdulcis* Mill) ranks among top tree nut in manufacturing and are well known for it cash crop characteristic. the most widely consumed tree nuts worldwide and the best at producing tree nuts. It is a member of the *Rosaceae* family, which also contains almonds, prunes, raspberries, and apples, pears, and apricots [2].The geographical distribution of some wild species of almond spread from countries of Central Asia to Syria and Turkey in to the range of Mountains of Caucasus in to Iraq and then reaches to the countries where Hindukush and Karakoram Mountain ranges exist

Besides its oil, Almond is additionally part of culinary functions. It is part of conventional cuisines and sweet dishes. “Badamkahalwa” is a well-known dish in Indo-Pak subcontinent. Numerous almond dishes are available like almond butter, almond oil, beaten almonds, almond milk, almond biscuits and desserts etc.[3,4].

There are two varieties of the Almond(*Prunusamygdalus* L.) the one with completely pink flora, *Amygdaluscommunis,* var. dulcis, producing candy Almond (*Prunusamygdalus* L.); the other, A *Communis*, var. Amara, with flora slightly larger, and the petals nearly white towards the pointers, deepening into rose at the base, producing sour Almond[5].The sweet almond is extra famous for apparent motives. Just as the olives are processed, the almonds also produce both oil and food and each of these are produced from the farmer with little attempt and effort.The sour almond can be differentiated from the sweet almond by the presence of a compound known as ‘Amygdaline’. Upon hydrolysis, amygdaline splits into glucose and the chemicals, benzaldehyde and hydrocyanic acid (HCN).The salt of HCN, that's known as cyanide, is toxic[6].

Almond is considered as valuable food commodity both nutritionally and medicinally. Further, the consumption of almond is related to reduced risk of cardio vascular diseases due to presence of low density lipoprotein (LDL) and cholesterol lowering impact. Almonds produce such health benefits because of the presence of Vitamin E [7]. The utilization and consumption of almonds are also

considered to be linked with the perfections in the serum lipid profiles. The role of almonds as lipid modulator can be defined by their impact on the lipid parameters [8].

Being phytochemically rich, it is regarded as excellent source of bioactive components. Among all, amino acid profile and protein contents aren't great source of essential amino acids but also provides material for better growth and energy. Presence of essential nutrients in almonds ensures better health and prevention fromdiseases. For various nutrients almonds are considered as good source of fats, carbohydrates, minerals, vitamins and phytochemicals.

Almond oil extraction is hand-crafted, carried out in associations by automated pressers and produces the partly removed fat almond flour that is produced for animal feed world widely. BAF offers nutritive consequences, primarilybecause of elevatedcontents of protein (48 g/100g) whereas (6 g/100g) [9].Among these all nutrients, lipids extend about 48-67% of total kernel dry weight [10]and detailed fatty acids profile provide an information about dominancy of monounsaturated and polyunsaturated in almond oil. Among unsaturated fatty acids from almond, linolenic and linoleic as essential fatty acid provide basis for better health. Behind fatty acids, second most important component in almonds are carbohydrates which are also major source of energy after fat, varying in a range of 20-22% [11]. Almonds are considered to be the good source of dietary fibers that promote the growth of intestinal microflora and prevent from constipation and have cholesterol lowering effect. Sufficient amounts of minerals such as calcium, magnesium, iron, phosphorus, potassium zinc, manganese and selenium are part of almonds.

There are different kinds of almonds being cultivated in Pakistan including Makhdoom, Parbat, Non-pariel, Waris, Shalimar, Nepulus ultra and Texas, Merced, Jordanolo, Katha, Drake and Afghanistan seedling etc. Previously, it was grown particularly in Baluchistan province but, with the introduction of early ripening types, this has now turn out to be possible to develop the crop in relatively dry regions of Pothwar tract in the areas where ever soil irrigation is available. All of these varieties are of upmost importance and are generally consumed. However very less work was reported on comparative nutritional and phytochemical characteristics of these varieties in Pakistan.

So, taking into account all of the nutritional and phytochemical characteristics of almonds, the following goals were set for the present study:

- To compare the nutritional profiles of different almond types.
- Evaluation of selected almond samples' total flavonoid content, total phenolic content, and antioxidant activity
- Determination of fatty acid composition of almond oil

II. MATERIALS AND METHODS

The Department of Food Technology at PMAS-AAUR in Pakistan is where this study was conducted. Comparing the antioxidant and nutrient characteristics of different almond types was the goal of this study.

3.1 Collection of Sample

Samples of Kaghzi, Katha and American cultivars of almonds were collected from the farm and brought to the laboratory, the shell of almonds was broken and kernel were stored in air tight containers.

3.2 Preparation of Sample

To avoid rancidity, the almond fruit was dried for 60 minutes at 40°C. Samples were ground into a coarse powder with a grinder and kept until analysis in an airtight container.

3.3 Proximate Analysis

3.3.1 Moisture Contents

AOAC [12]method was used to assess the total moisture contents Method number is 934.O6. Formula used for calculation involves weight of sample before and after drying:

Percentage of moisture=$\{(W_1-W_2)/W_1\} \times 100$

W_1 = before drying weight of sample

W_2 = after drying weight of sample

3.3.2 Fat Contents

Method No. 954.02 of AOAC [12]was used to find the total fat contents in the sample. Briefly about 10g dried sample was put in the thimble and extracted and in Soxhlet flask which was weighed before inside which extraction of sample was done. with the solvent hexane (B.P 40-60 °C) in pre weighed Soxhlet flask. After the completion of extraction procedure, the solvent was recovered and flask which contained the fat was oven dried until constant weight was obtained. Following formula was used to calculate fat contents:

Crude fat %=

(weight of fat/ weight of sample) ×100

3.3.4 Crude Fiber

Fiber contents were determined by treating the fat removed sample with 1.25% H_2SO_4 and1.25% NaOH solution. AACC [13]method was used. After the treatment residues were dried in oven. Then sample were weighed and burned, after that samples were placed inside the muffle furnace at 545- 600C.

Percentage fiber was calculated by following formula:

%Crude fiber =

$$\frac{\text{Decrease in weight on ignition in grams}}{\text{sample weight in grams}} \times 100$$

3.3.5 Ash Contents

Ash content was found out by method of

AOAC [12]. Method No. 940.26.was used:

Ash% = (ash weight/ sample weight) ×100

3.3.6 Crude Protein Content

Crude protein contents of dried almond powder were determined by the use of Kjeldhal apparatus as described by AOAC [12]method no.920.15. Kjeldhal only estimates the nitrogen content of the sample. To find the protein content nitrogen value is to be multiplied by factor of 6.25. For digestion purpose, 2 gm of the digestion mixture composed of $FeSO_4$, $CuSO_4$,K_2SO_4 with 5:10:100 parts respectively along with concentrated Sulphuric acid. Than filtered the digested sample and made volume up to 250 ml. took 10 ml out of the sample diluted and extract it into 4% boric acid with 40% Sodium Hydroxide and at last titrated by using H_2SO_4 (N/10) to an end point of light pink color.

$$N\% = \frac{\text{Volume of 0.1 used sulfuric acid x Volume of dill. x 0.0014}}{\text{Sample weight (g) x Vol. of dill. taken (ml)}} \times 100$$

% Protein = Nitrogen % × 6.25

3.3.6 Total Carbohydrates

Total carbohydrates will be estimated by difference of mean values according to [14]formula given:

100-(Sum of percentage of Crude lipids +Crude proteins+ Ash +Moisture+ Crude fiber)

3.4 Determination of Mineral Profile

Minerals contents in dried almond samples was carried out according method number 956.52 AOAC[15]with some modifications. Mineral contents like iron, magnesium, calcium in dried almonds was measured against their standard curves of known concentration by atomic absorption spectrophotometer. Assessment of potassium and sodium were carried out by flame photometer using wet digested food sample solutions against standard solutions of 20, 40, 60, 80 and 100 milli-equivalent/L. whereas phosphorus detection was carried out by spectrophotometer.

3.5 Determination of Sugar Contents

All types of almonds were examined for sugar content, including reducing and non-reducing sugars as well as total sugar content, using the Lane and Eynon titration method and Fehling's solution, according to AOAC [12] method No. 925. 36.

$$\text{Total sugars} = \frac{4.95\times250(\text{Dilution factor})\times2.5}{\text{weight of sample}\times\text{titre}\times10}$$

$$\text{Reducing sugars} = \frac{4.95 \times 250(\text{Dilution factor})}{\text{weight of sample} \times \text{titre} \times 10}$$

Non reducing sugars =

Total sugars –Reducing sugars

3.6 Determination of Fatty Acids Profile:

Fatty acid methyl esters were prepared according to [16]. The fatty acid content was analyzed by gas chromatography equipped with a CP -Wax 52 CB column (50 ×0.25mm, 0.2µm). 40 ml of oil sample were mixed with 1 ml of the Na- ethylate solution (0.5 g Na-methylate + 80 ml methanol + 20 ml isooctane) and esterified. Before injecting into the GC, 0.25 ml of isooctane was added, and the tube was thoroughly agitated.After that, 0.5 cc of the upper phase was collected, and once it had become clear, it was injected into the GC using a tiny injector. Helium was utilized as the carrier gas, with a pressure of 0.069 Mpa, and a flow rate of 30 ml/min in a GC with a FID detector, injector, and injector temperature of 250 C.The oven was set to 80°C for 4 minutes before being raised to 175°C. The temperature will be raised to 215°C after holding at this level for 20 minutes.The temperature was then steadily raised to 240°C and remained there for 10 minutes after remaining at that temperature for 2 minutes. The relative retention times of the standards were compared to identify the peaks, and the results were represented as a percentage of the peak areas.

3.7 Phytochemical Analysis

3.7.1 Preparation of Extract

For extraction, almond was prepared in the form of a fine dried powder and was be extracted by using 50ml of methanol for 60 minutes at 25◦C [17]. After that, the extract was passed through Whatman No. 4 paper and dried at 40°C by evaporation. The samples' flavonoid and phenolic contents, DPPH radical scavenging activity, ABTS, and reducing power were all examined after they had been redissolved in water at a concentration of 20 mg/ml.

3.7.2 Total Phenolic Contents

By utilizing the Folin-Ciocalteu reagent and the method described in [18], the total phenolic contents were calculated. A spectrophotometer was used to measure the absorbance at 765 nm. Milligram Gallic acid equivalent (GAE)/gram of dry extract was used to express the results.

3.7.3 Total Flavonoids Contents

The amount of total flavonoids was determined using the aluminum chloride colorimetric method, as explained by[17]. As a benchmark, quercetin was used. Quercetin equivalents in mg/g of dry extract were used to express the results.

3.7.4 Determination of Total Antioxidant Activity

DPPH radicals (610-5 mol/L) were present in 2.7 ml of methanolic solution, which was combined with various concentrations of almond extracts (0.3 ml). The combination was rapidly shaken before being allowed to stand for 60 minutes in the dark to achieve stable absorption values. By measuring the absorbance at 517 nm, it was possible to calculate the reduction of DPPH. Using the following formula, the radical scavenging activity (RSA) was estimated as a percentage of DPPH discoloration:

%RSA =[(ADPPH-AS)/ADPPH] ×100

Where

AS = absorbance of the solution when the solution extract added at a particular level

ADDPH = absorbance of the DPPH solution [19].

3.7.5 ABTS Radical Scavenging Activity

The method outlined by [20] was used to measure ABTS scavenging activity. The interaction of ABTS solution with potassium persulfate in the dark for 12 to 16 hours resulted in ABTS radical cation (ABTS+). The absorbance of this solution at 734 nm was lowered with ethanol to 0.7 0.05. Next 2ml of the ABTS+ solution and 0.3ml of the diluted sample extract were combined, and absorbance was measured exactly 6 minutes later. The following formula was used to determine the sample's scavenging capacity:

ABTS scavenging activity$=\frac{\text{Abs control}-\text{Abs sample}}{\text{Abs control}}\times 100$

3.8 Statistical Analysis

Statistical analysis was conducted by using standard statistical tools and procedures [21].

III. RESULT AND DISCUSSION

4.1 CHEMICAL ANALYSIS OF DIFFERENT VARIETIES OF ALMOND

4.1.1 Comparison of Moisture Contents of Different Varieties of Almond

Moisture is the most important component of the dry fruits. The storage life of the dry fruits decreases as the percentage of moisture increases. The data regarding the moisture contents of the different varieties of almond is presented in Table 1 (Figure 4.1). In various almond varieties of moistureresult have significant difference ($p < 0.05$). The maximum moisture contents were found in Kaghzi (6.6 %) whereas minimum moisture content was fund in Katha 3.

The difference in moisture contents may be attributed to different climatic conditions, varieties, soil conditions and harvest conditions. The scores of recent research are parallel with the answers of [22],who examined that almond have moisture contents 5.8 to 7.3

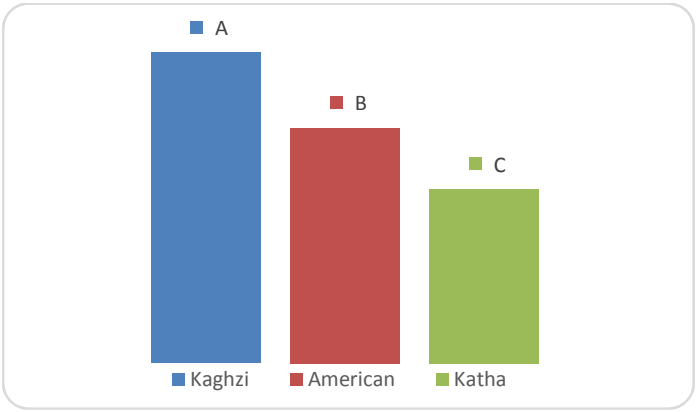
4.1.2 Comparison of Protein

In different almond varieties have considerable more protein showing by previous and recent research and results are significant variation (P<o.o5) showed in figure 4.2. Results shown in table depicted that highest protein contents were found in American almond variety (24.6%), followed by the Kaghzi (22.5%) and minimum was found in Katha (16%).

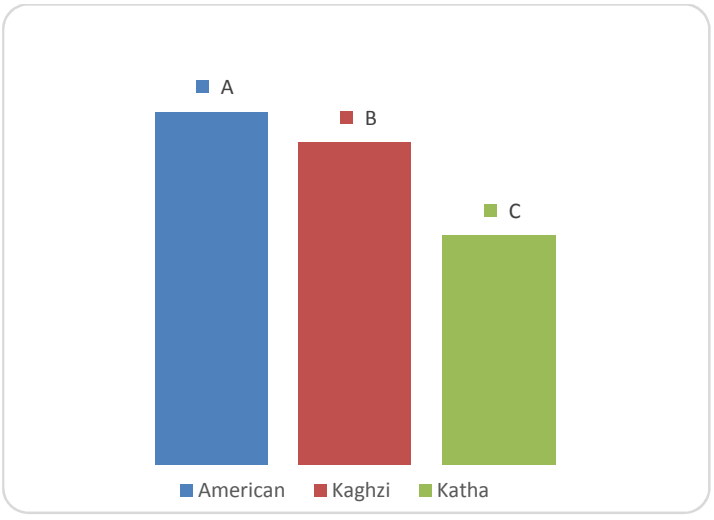
The results of recent study are in line with scores as shown by [22]someone determined the American almond is slightly higher in protein than Kaghzi almond. He also studied that some samples of Almond have protein 20.3 to 23.8%. These properties are may be due to their genetic makeup and environmental conditions.

4.1.3 Comparison of Crude Fat

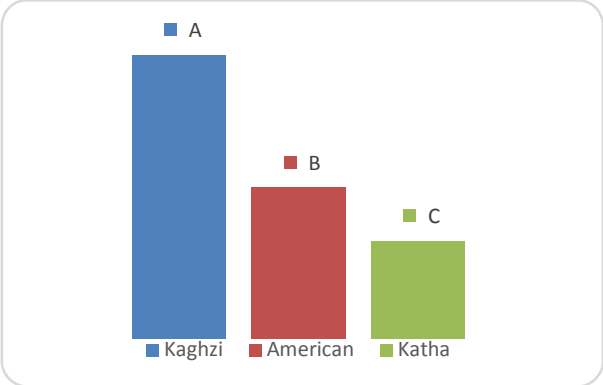
In International marketoil of the Almond ranks amongst the main 20 essential oils. Variety of food commodities utilizes almond oil as ingredient which utilizes almond oil widely for the preparation of products like beverages, cosmetic items and bakery products. Research has proven the antimicrobial effect of almond oil against disease causing microbes including saprophytic and pathogenic species showing its potential to be used as disinfectant.



Comparison of the moisture contents of various almond varieties is shown in Figure 4.1.



Comparison of the protein content of various almond varieties is shown in Figure 4.2.



Comparison of the fat content of various almond varieties is shown in Figure 4.3.

The data pertaining the crude fat of different almond varieties are presented in Figure 4.3. The data shownsignificant variance in the crude fat values among the different almond varieties.The high fat content 56.8% was found in Kaghzi almond which is significantly different among other almond varieties as American and Katha almond which showed lowest fat content as 50.8 % and 48.4 % respectively. The findings of present study have conformity with results as revealed by [23]who studies the Almond have fat 52 to 54.6%.

4.1.4 Comparison of Carbohydrates

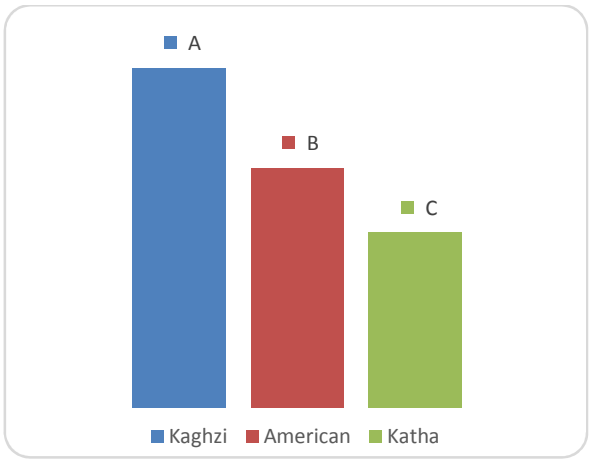
The results after the analysis for carbohydrates among different varieties of almond are presented in Figure 4.4.Carbohydrate contents shown significant variation amongst different varieties of almond. The high carbohydrates 16.3% was found in Kaghzi almond which is significantly different among other almond varieties, American and Katha almond which showed lowest carbohydrates percentage as 11.5% and 8.4% respectively. The results of present research are cnear to the readings as revealed by [24]who reported that almond have carbohydrates 4. 9 to 10.6%.

4.1.5 Comparison of Crude Fibre

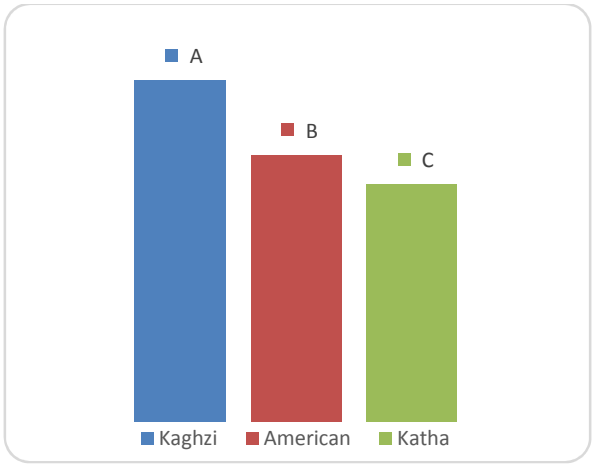
The statistics obtained by examination of different varieties of almond is presented in Figure 4.5. Crude Fibrecontents had shown clear significant difference in the fiber contents among different almond varieties. The high fiber content 10.5% was found in Kaghzi almond which is significantly different among other almond varieties as American and Katha which showed lowest fiber percentage as 8.2 % and 7.3 % respectively. The findings of recent research are similar with results as revealed by [24]who studies the almond have fiber 7.1%.

4.1.6 Comparison of Ash

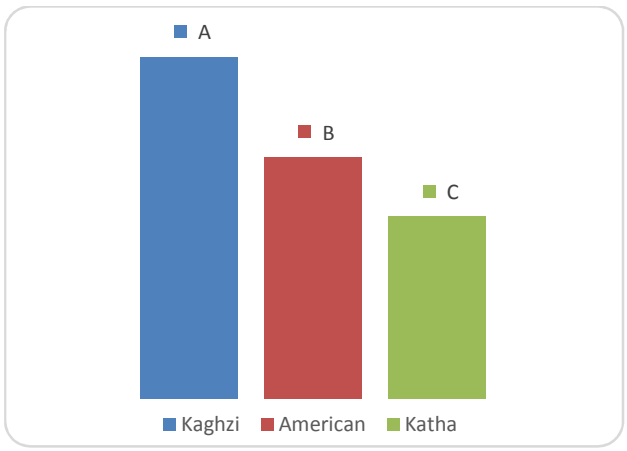
The statistical analysis showed the ash of the different almond varieties are shown in Figure 4.6. The results shown that there is significant difference in the ash percentage of different almond varieties. The highest ash content 7.5% was found in Kaghzi almond which is significantly different among other almond varieties as American and Katha almond which showed lowest ash percentage as 5.3 % and 4 % respectively.



Comparing the Carbohydrate content of various almond varieties is shown in Figure 4.4.



Comparing the Fiber content of various almond varieties is shown in Figure 4.5



Comparison of the ash content of various almond varieties is shown in Figure 4.6.

The findings of this project wereclose to the values calculated by [23], determined the almond have ash 8.8%.

4.1.7 Comparison of Total Sugars

The figures regarding the total sugars % among the different varieties of almond is depicted in Figure 4.7. The results indicated that there is significant difference in the total sugars percentage of almond varieties. The high value of total sugars 4.2% was found in Kaghzi almond which is significantly different among other almond varieties and lowest ash percentage 2.3 % was in Katha. Results of this study was in line with the results of [25]determined the almond have total sugars 5.1%.

4.1.8 Comparison of Minerals mg/100g

Varieties of almond analyzed for mineral contents which results are presented in Figure 4.8. The results of ash analysisindicatedsignificant

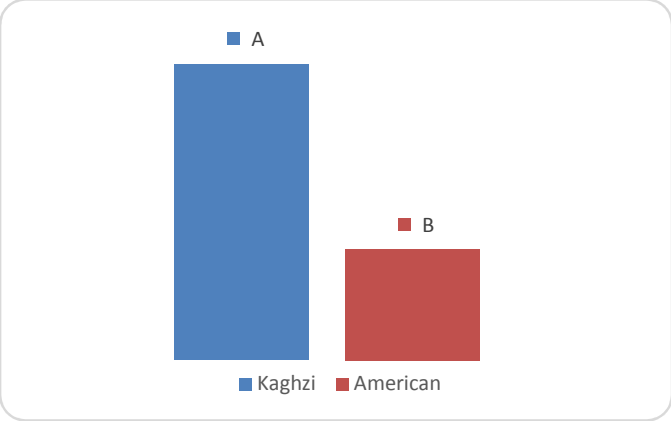
variation among almond varieties. The maximum mineral contents 166.6 mg was found in Kaghzi almond which is significantly different among other almond varieties and lowest 88 mg was found Katha almond. The data of recent study are in line with results as revealed by [23]who studies the almond have mineral contents 148mg/100g.

4.1.9 Comparison of Fatty Acids % of Different Varieties of Almond

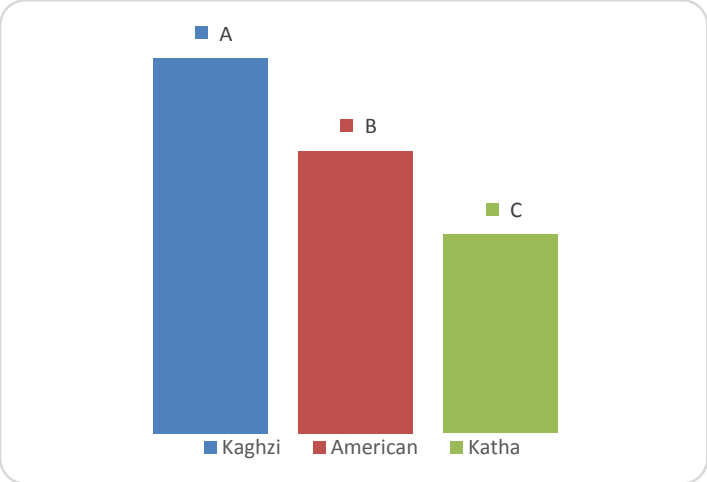
The data regarding the fatty acids of the different almond varieties is presented in Figure 4.9. The data revealed that there is significant difference in the fatty acids percentage of almond varieties. The high fatty acid 0.6% was found in Kaghzi almond which is significantly different among other almond varieties as American and Katha almond which showed lowest fatty acids percentage as 0.4 % and 0.3 % respectively. This data of this study analysis showed closeness with result shown by [24]studies the Almond have fatty acids 1%.

4.2 Comparison of DPPH of Different Varieties of Almond

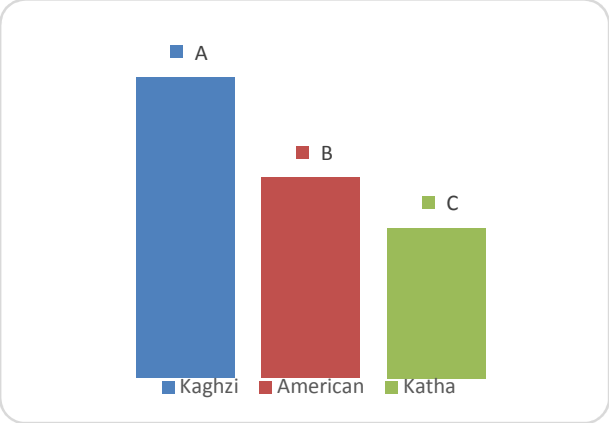
Antioxidants refer to any substances which have ability to prevent or stop the process of oxidation.



Comparison the Total sugar content of various almond varieties is shown in Figure 4.7.



Comparison of the minerals content of various varieties of almond is shown in Figure 4.8.



Comparison of fatty acid content of various almond is shown in Figure 4.9.

Almonds pay an important role in scavenging of free radicals, as a chelating agent, single remover of oxygen radicals [26]. Synthetically manufactured antioxidants are not much appreciated and herbs and nuts are the recommended alternate source of antioxidants.

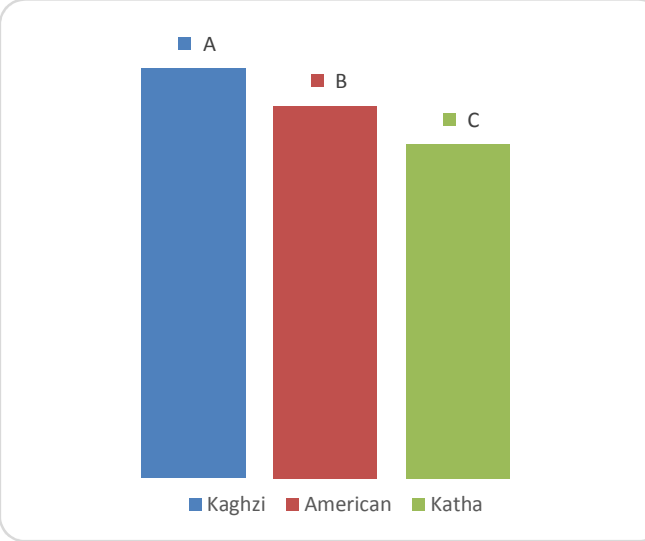
Plants contain many chemical compounds which have good antioxidant activity.The data regarding the antioxidant activity of different varieties among almond is shown in Figure 4.10. Analysis of different varieties of almonds showed significant difference. The maximum antioxidant activity 45.4% by methanol extract was found in Kaghzi almond which is significantly different among other almond varieties which show lowest antioxidant activity as well as American almond and Katha almond 41.3% and 37% respectively. Many aromatic plants and nuts, especially almond seeds are popular due to their many remedial properties like antifungal, antimicrobial and antidiabetic properties. The antioxidant activity of almond oil may be because of high linoleic concentration [27].

The results of recent study have conformity with results as revealed by [28]who studiedand reported that total phenolic contents in the food are responsible for the antioxidant activity. Thus higher contents of phenolic compounds in the sample will result in higher activity of antioxidants.

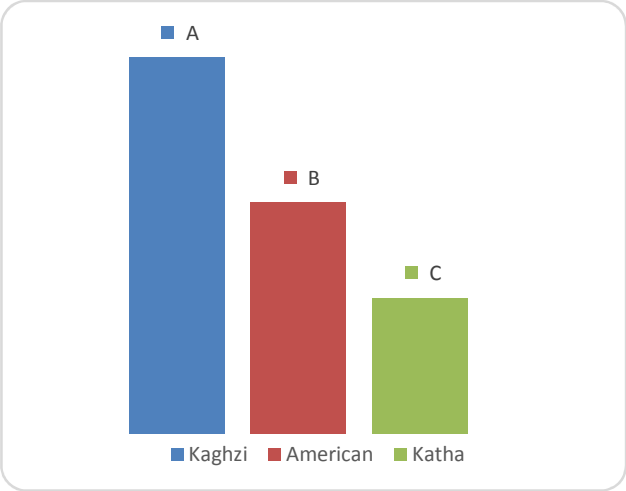
4.3 Comparison of ABTS % of Different Varieties of Almond

Different varieties of almond of ABT values regarding data shown in Figure 4.11. The results dipected that there is significant difference in the ABTS values of different varieties of almond. The high ABTS value 47.3% by ethanol extract was found in Kaghzi almond which is significantly different among other almond varieties which show lowest ABTS values as well as American almond and Katha almond 44.1% and 42% respectively.

This present study is in line with the finding of [18]who research almond extract for reducing power using methanol as extracting solvent is higher plant extract potential vary within varieties due to variation in genetic makeup various verities well due to maturity factors. Recent study result showing that antioxidant ability of almond extracts falls considerably in relation to varieties analysis.



Comparison of the antioxidant content of various almond varieties by DPPH method is shown in Figure 4.10.



Comparison of the antioxidant content of different varieties of almond by ABTS method is shown in Figure 4.11.

4.4 Comparison of Total Phenolic Contents of Different Varieties of Almond

The results of total phenolic contents wereshown in Figure 4.12. It was find that the ethanol extract of different varieties of almond shows a significant difference which contains 0.3 mg/g among the other almond varieties which shows lowest total phenolic contents as well as American almond 0.2 mg/g and Katha almond 0.1 mg/g respectively.

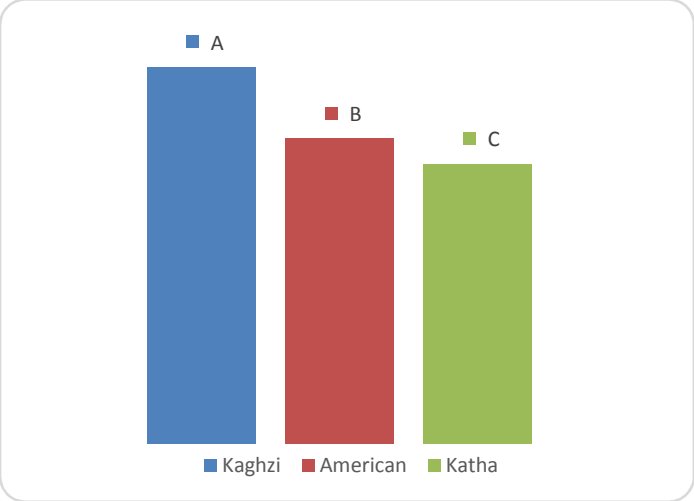
Free radical scavengers, chain breakers, complexes of metal ions that promote oxidation, and inhibitors of singlet-oxygen production are all components of natural antioxidants[3].

4.5 Comparison of Total Flavonoid Contents of Different Varieties of Almond

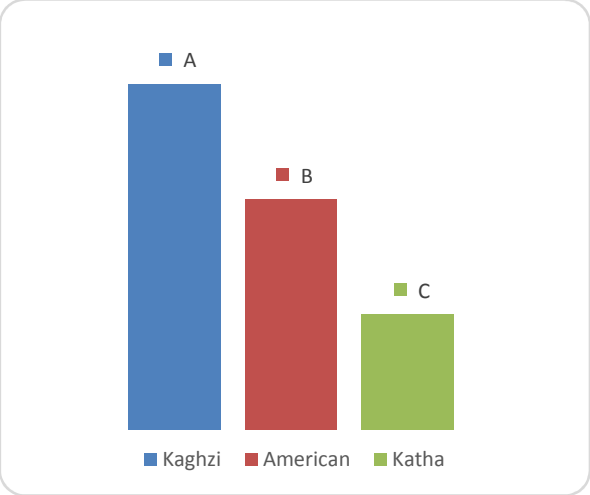
The data on the flavonoid content of various almond types from various regions are shown in Figure 4.13. The data shown that there is significant difference in the flavonoid contents of almond varieties. The high flavonoid contents 22.6 µg was found in Kaghzi almond which is significantly different among other almond varieties as well as American almond 18.3 µg and Katha almond 16.8µgindividually.

The current findings are consistent with the research score of [28]who studied food systems; flavonoids can act as free radical scavengers and dismiss the radical chain reactions that occur during the oxidation of triglycerides. Additionally, flavonoids appear to maintain a variety of

biological activities, including antioxidant, anti-inflammatory, and vasodilatory effects. While the presence of these natural plant foods has been thoroughly examined in fruits and vegetables, whole grains and tree nuts have received less attention.



Comparison of Total Flavonoid Contents of various Varieties of Almond is shown in Figure 4.13.



Comparison of the Total Phenolic Contents of Various varieties of Almond is shown in Figure 4.12.

SUMMARY

The almond fruit belongs to stone fruit family grown all over the world and renowned for its valuable nutrients. Amino acid profile and protein contents is not only great source of essential amino acids but also provide material for better growth and energy. Presence of essential nutrients in almonds ensures better health and prevention from diseases. For various nutrients almonds are considered good source of fat, carbohydrates, minerals vitamins and phytochemicals. Among these all nutrients, lipids extend about 48-67% of total kernel dry weight [10]and detailed fatty acids profile provide an information about dominancy of monounsaturated and polyunsaturated in almond oil. Among unsaturated fatty acids from almond,

linolenic and linoleic as essential fatty acid provide basis for better health. Behind fatty acids, second most important component in almonds are carbohydrates.

Keeping in view the health benefits and nutritional aspects this study was carried out, Samples of different cultivars of almonds i.e. Kaghzi, Katha and American were collected from the farm and brought to the laboratory, the shell of almonds were broken and kernel were stored in air tight containers for future physicochemical analysis.

Physicochemical analysis among different almond varieties was carried out. The Kaghzi almond showed higher water contents (10.5%) are significantly different than the other almond varieties like Americana and Katha almond which showed moisture contents as 8.2 % and 7.3 % respectively. American almond showed higher protein contents 24.6 % which is significantly different than the Kaghzi and Katha almond which showed protein contents as 22.5% and 16% respectively.

Kaghzi almond showed higher fat content 56.8 % which is significantly different than the Americana and Katha almond which showed fat contents as 50.8 % and 48.4 % respectively. The high carbohydrates 16.3% was found in Kaghzi almond which is significantly different among other almond varieties, American and Katha almond which showed lowest carbohydrates percentage as 11.5% and 8.4% respectively. The high fiber content 10.5% was found in Kaghzi almond which is significantly different among other almond varieties as American and Katha which showed lowest fiber percentage as 8.2 % and 7.3 % respectively.

The high ash 7.5% was found in Kaghzi almond which is significantly different among other almond varieties as American and Katha almond which showed lowest ash percentage as 5.3 % and 4 % respectively. The high value of total sugars 4.2% was found in Kaghzi almond which is significantly different among other almond varieties as American and Katha almond which showed lowest ash percentage as 3.7% and 2.3 % respectively.

The high mineral contents 166.6 mg was found in Kaghzi almond which is significantly different among other almond varieties as American and Katha almond which showed lowest minerals contents as 125 mg and 88 mg respectively. The high fatty acid 0.6% was found in Kaghzi almond which is significantly different among other almond varieties as American and Katha almond which showed lowest fatty acids percentage as 0.4 % and 0.3 % respectively.

The high antioxidant activity 45.4% by methanol extract was found in Kaghzi almond which is significantly different among other almond varieties which show lowest antioxidant activity as well as American almond and Katha almond 41.3% and 37% respectively. The high ABTS value 47.3% by ethanol extract was found in Kaghzi almond which

is significantly different among other almond varieties which show lowest ABTS values as well as American almond and Katha almond 44.1% and 42% respectively.

Kaghzi almond shows a significant difference which contains 0.3 mg/g among the other almond varieties which shows lowest total phenolic contents as well as American almond 0.2 mg/g and Katha almond 0.1 mg/g respectively. The high flavonoid contents 22.6 µg was found in Kaghzi almond which is significantly different among other almond varieties as well as American almond 18.3 µg and Katha almond 16.8 µg respectively.

This study showed that the Kaghzi almond variety is over all best variety according to nutritional properties. Kaghzi almond contain more antioxidant and oil than other varieties.

LITERATURE CITED

1. Freitas, J.B. and Naves, M.M.V., Chemical composition of nuts and edible seeds and their relation to nutrition and health. *Revista de Nutrição*, vol. *23*(2), pp.269-279, 2010.
2. Esfahlan, A.J. and Jamei, R., Properties of biological activity of ten wild almond (Prunus amygdalus L.) species. *Turkish Journal of Biology*, vol. *36*(2), pp.201-209, 2012.
3. Amarowicz, R., Pegg, R.B., Rahimi-Moghaddam, P., Barl, B. and Weil, J.A., Free-radical scavenging capacity and antioxidant activity of selected plant species from the Canadian prairies. *Food chemistry*, vol. *84*(4), pp.551-562, 2004.
4. Davis, P.A. and Iwahashi, C.K., Whole almonds and almond fractions reduce aberrant crypt foci in a rat model of colon carcinogenesis. *Cancer letters*, vol. *165*(1), pp.27-33, 2001.
5. Porsani, J.L., Walter Filho, M., Elis, V.R., Shimeles, F., Dourado, J.C. and Moura, H.P., The use of GPR and VES in delineating a contamination plume in a landfill site: a case study in SE Brazil. *Journal of Applied Geophysics*, vol. *55*(3-4), pp.199-209, 2004.
6. Zohary, D., and Hopf, M., Domestication of plants in the Old World: the origin and spread of cultivated plants in West Asia. *Europe, and the Nile Valley Oxford University Press, New York*. 2000.
7. Kalita, S., Khandelwal, S., Madan, J., Pandya, H., Sesikeran, B. and Krishnaswamy, K., Almonds and cardiovascular health: a review. *Nutrients*, vol. *10*(4), p.468, 2018.
8. Phung, O.J., Makanji, S.S., White, C.M. and Coleman, C.I., Almonds have a neutral effect on serum lipid profiles: a meta-analysis of randomized trials. *Journal of the American Dietetic Association*, vol. *109*(5), pp.865-873, 2009.
9. Guimarães, R.D.C.A., Favaro, S.P., Viana, A.C.A., Braga Neto, J.A., Neves, V.A. and Honer, M.R., Study of the proteins in the defatted flour and protein concentrate of baru nuts (Dipteryx alata Vog). *Food Science and Technology*, vol. *32*, pp.464-470, 2012.
10. Kodad, O. and Socias i Company, R., Variability of oil content and of major fatty acid composition in almond (Prunus amygdalus Batsch) and its relationship with kernel quality. *Journal of agricultural and food chemistry*, vol. *56*(11), pp.4096-4101, 2008.
11. Nanos, G.D., Kazantzis, I., Kefalas, P., Petrakis, C. and Stavroulakis, G.G., Irrigation and harvest time affect almond kernel quality and composition. *Scientia Horticulturae*, vol. *96*(1-4), pp.249-256, 2002.
12. AOAC. Official Method of Analysis. 17th ed., Association of Official Analytical Chemists. Arlington, VA. USA. 2000.
13. AACC. Approved Methods of American Association of Cereal Chemists. American Association of Cereal Chemists Inc., St. Paul. Minnesota. U.S.A. 8th. ed. 1, 1525 P. 2000.
14. Besbes, S., Blecker, C., Deroanne, C., Drira, N.E. and Attia, H., Date seeds: chemical composition and characteristic profiles of the lipid fraction. *Food chemistry*, vol. *84*(4), pp.577-584, 2004.
15. AOAC. Official Method of Analysis. 18th ed., Association of Official Analytical Chemists. Arlington, VA. USA. 2005.
16. Yıldırım, A.N., San, B., Koyuncu, F. and Yıldırım, F., Variability of phenolics, α-tocopherol and amygdalin contents of selected almond (Prunus amygdalus Batsch.) genotypes. *J Food Agr Environ*, vol. *8*, pp.76-79, 2010.
17. Barreira, J.C., Ferreira, I.C., Oliveira, M.B.P. and Pereira, J.A., Antioxidant activity and bioactive compounds of ten Portuguese regional and commercial almond cultivars. *Food and chemical toxicology*, vol. *46*(6), pp.2230-2235, 2008.
18. Sfahlan, A.J., Mahmoodzadeh, A., Hasanzadeh, A., Heidari, R. and Jamei, R., Antioxidants and antiradicals in almond hull and

shell (Amygdalus communis L.) as a function of genotype. *Food Chemistry*, vol. *115*(2), pp.529-533, 2009.

19. Barros, L., Baptista, P. and Ferreira, I.C., Effect of Lactarius piperatus fruiting body maturity stage on antioxidant activity measured by several biochemical assays. *Food and chemical Toxicology*, vol. *45*(9), pp.1731-1737, 2007.
20. Re, R., Pellegrini, N., Proteggente, A., Pannala, A., Yang, M. and Rice-Evans, C., Antioxidant activity applying an improved ABTS radical cation decolorization assay. *Free radical biology and medicine*, vol. *26*(9-10), pp.1231-1237, 1999.
21. Steel, G. D., Torrie, H., & Dickey, D. Pinciples and Procedures of Statistics A Biometrical Approach. 3rded.McGraw Hill Book Co., NY. USA. 1997.
22. Aslantas, R., Guleryuz, M. and Turan, M., Some chemical contents of selected almond (Prunus amygdalus Batsch) types. *Cahiers Options Méditerranéennes*, vol. *56*, pp.347-350, 2001.
23. Barbera, G., Di Marco, L., La Mantia, T. and Schirra, M., Effect of rootstock on productive and qualitative response of two almond varieties. In *I International Congress on Almond 373*, pp. 129-134, May. 1993.
24. Oduro, I., Larbie, C., Amoako, T.N.E. and Antwi-Boasiako, A.F., Proximate composition and basic phytochemical assessment of two common varieties of Terminalia catappa (Indian Almond). *Journal of Science and Technology (Ghana)*, vol. *29*(2), 2009.
25. Kester, D.E., Gradziel, T.M. and Grasselly, C., Almonds (Prunus). *Genetic Resources of Temperate Fruit and Nut Crops vol. 290*, pp.701-760, 1991.
26. Bureau, A., Lahet, J.J., Lenfant, F., Bouyer, F., Petitjean, M., Chaillot, B. and Freysz, M., Optimization of a model of red blood cells for the study of anti-oxidant drugs, in terms of concentration of oxidant and phosphate buffer. *Biomedicine & pharmacotherapy*, vol. *59*(7), pp.341-344, 2005.
27. Takeoka, G.R. and Dao, L.T., Antioxidant constituents of almond [Prunus dulcis (Mill.) DA Webb] hulls. *Journal of Agricultural and Food Chemistry*, vol. *51*(2), pp.496-501, 2003.

