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CHARACTERIZATION OF DIFFERENT DATE VARIETIES WITH SPECIAL REFERENCE TO THEIR ANTIOXIDANT POTENTIAL AND BIOEVALUATION TRIAL AGAINST HYPERCHOLESTEROLEMIA

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The study was aimed on nutritional comparison of different four varieties of date fruit including (Ajwa, Hallawi, Madjool and Shamran), exploration of their functional ingredients i.e. antioxidant profile (total phenolic contents) and dietary fiber with special reference to the hypo-cholesterolemic capacity of the functional ingredients. Considering the aforementioned essentials, all the four date varieties were analyzed comparatively. The results showed significant difference in moisture content, ash contents, protein value, fat contents, fiber contents and nitrogen free extract (NFE) contents of different date varieties ($p<0.05$). Maximum ash contents (3.23%), crude protein (2.89%) and crude fat (0.49%) contents were recorded in Ajwa while it showed a minimum content of NFE (91.36%) as compared to the other date varieties. Maximum moisture content (23.12%) was found in Hallawi. Hallawi showed minimum contents of Crude fiber (1.88%) while Madjool showed highest contents of crude fiber (2.41%). Mineral estimation showed that potassium was the predominant mineral and ranged from (480.3 to 852.15 mg/100g) in Ajwa and Hallawi, respectively. Total phenolic contents ranged from 238.89 mg/100 (Madjool) to 280.67 mg/100g (Hallawi) while the highest DPPH scavenging activity was observed in Madjool followed by Ajwa (72.15%), Hallawi (69.17) and the lowest was found in Shamran (61.18 %).Total flavonoid contents ranged from 96.05 mg/100 (Shamran) to 172.07 mg/100g (Ajwa) while the highest total flavonoid activity was observed in Ajwa (172.07 mg/100g) followed by Hallawi (157.07 mg/100g) and the lowest was observed in Shamran (96.05 mg/100g). Maximum content of Total dietary fiber (11.02 %) and soluble dietary fiber (3.0 %) was observed in Hallawi while in Ajwa (7.25%), Hallawi (8.02%) and Shamran (7.92 %) showed a significantly ($p\leq 0.05$) higher insoluble dietary fiber in comparison with Madjool (4.30%). In addition, the date variety was tested in the experimental mouse model to evaluate its maximum cholesterol lowering effect. It was observed that Ajwa and Hallawi could effectively inhibit cholesterol level, which was 110 mg / dl and 103 mg / dl, respectively. According to the above chemical characteristics and parameters, the results of Ajwa and Hallawi dates were almost the same, and the greatest potential of lowering cholesterol, LDL and TG in serum was found.

Keywords: Date varieties, Phytochemicals, Phytonutrients, Nutritional profile, Antioxidant potential

INTRODUCTION

Pakistan is naturally bestowed with broad range of fruits but during post-harvest handling conspicuous amount is wasted and inadequate quantity is processed (Ahmed and Ramaswamy, 2005). Date fruit have a higher status in Muslim community due to its use in Ramadan. A lot of date varieties are present in Pakistan but some important commercially available date varieties include Hallawi, Aseel, Begum Jangi, Muzafati, Khudravi, Rabai, Madjool, Shamran and Dhakki. In terms of demand and popularity Aseel, Dhakki, Hallawi and Begum jhangi of Khairpur, Dera Ismail Khan, Punjab and Makran are the best of all varieties grown in Pakistan. Saudi dates are very famous around the globe for their superior quality especially Safawi, Ruthana and most superior Ajwa (Baliga *et al.*, 2011).

In 2007-2008 date production around the globe was 6.9 million tons and Pakistan is in the list of top 10 countries, producing dates and during the year 2007-08 production of date palm (*Phoenix dactylifera*) in Pakistan was 557.6 thousand tones with most prominent cultivars including Dhakki, Aseel, Zahidi, Begum Jangi, Hallawi, Muzawati and Khudravi (GOP, 2008).

Importance of date in human diet is associated with its nutritional, health and economic value. On the other hand, dates are rich in disease preventing substances (Al-Farsi and Lee, 2008). Dates have both nutritional and medicinal benefits, and Arabs call them the "tree of life." Polyphenol concentration is higher in date nuts, with admirable nutrients,

which can improve blood lipoproteins and prevent oxidation. (Vinson *et al*., 2005). Higher amounts of carbohydrates present in dates (44-48%) consist of reducing sugars includes fructose and non-reducing sugars sucrose and due to higher amount of sugar content they are considered as excellent source of quick energy (Al- Shahib and Marshall, 2003). A momentous quantity of dietary fiber is present in dates. 100 g of dates fulfill about 50% of the RDA and researchers has revealed that adequate amount of dietary fiber (25-30g daily) lowers the occurrence of certain coronary diseases, diabetes and most important obesity which is a major heath threatening risk factor (Jain, 2013).

Dates contain about 9.6% dietary fiber from which 2.5% is soluble and 6.9% is insoluble fiber (Al-Farsi and Lee, 2008). Fat contents in date fruit ranges from 0.2 to 0.5%. The lower amount of fat in dates make them more beneficial for health as they reduce the chances of lipid accumulation in body and also the risk of CVDs. As compared to other fruits, higher amount of protein (2.3 to 5.6%) is present in date fruit. Dates also contain essential amino acids including lysine, alanine, glycine, glutamic acid etc. (Al-Farsi *et al.*, 2005).

Consumption of 100 grams of date can provide more than 15% of the recommended daily allowance for minerals. Date is a good source of antioxidants (Aml Shahib and Marshall, 2003). In this study, nutritional comparison of four varieties with different dates was reported.

MATERIALS AND METHODS

This research comprised of three phases, physiochemical and nutritional profiling of raw material, nutritional and functional evaluation of product developed and finally bio-efficacy study through rat modeling and human models. The proposal for the clinical trial was offer to Ethical Review Committee for the validation of the research work for ethical apprehensions as per the section of world health organization (WHO) Fathalla (2004) by following the previously established protocols of Gibney (2009).

***Procurement of raw materials*:** Four varieties of dates namely Hallawi, Shamran were collected from Date palm research institute, Jhang, Punjab, Pakistan, Madjool from Metro super store and Ajwa was imported from Saudi Arabia.

***Proximate analysis of date varieties*:** The percentage of moisture in each sample of dates was analyzed by the method given in AOAC (2000), method No. 920-36. Ash percentage was determined by using the method of sample incineration (as inorganic matter) given in the AOAC manual 2000. The crude fat percentage was analyzed through Soxhlet apparatus in accordance with the method given in AOAC (2000).

***Texture Profile Analysis*:** Texture profile analysis of date varieties was done according to the method given in Piga *et al*. (2005) by doing some modifications using texture analyzed having 5 kg load cell. Model of texture analyzer was TA-XT2 plus, stable Microsystems, Survey, UK). Data analysis was performed using texture expert version 4.0.9.0. Texture analysis of skin of date fruits from different verities was performed by using 2 mm needle probe for puncture test. Date samples were punctured to determine skin characteristics. Date samples were placed centrally on a heavy duty plate, for puncture test, from under the needle probe. Calibration of both load cells and the probe was done before test. Measurement of sample hardness by puncturing involved plotting force described in grams versus time described in seconds. For puncture test, maximum force (g) was used as an index of hardness and Fruit weight was recorded with top load balance.

***Fruit Weight*:** Fruit weight was analyzed by top load balance as described by Nadeem *et al.* (2011).

***Mineral Analysis*:** Mineral analysis samples were prepared by wet digestion. In the digestion flask, 0.5g dry sample was first digested with 10 ml HNO3 at 60-70ºC in 20 minutes using a hot plate, and then digested with 5 ml 60% $HClO_4$ at 190°C. until transparent color was obtained. After digestion, the sample was transferred to a 100 ml flask, distilled water was added twice, and then filtered by method of Duhan *et al*. (2002). Atomic absorption spectrophotometer was used to run the filtrate (Model: Varian AA-240). For each mineral to be analyzed, standard curves were obtained by first running the sample of known strength. These standard curves were used to determine the mineral components of each sample (AACC, 2000).

***Antioxidant potential of different date varieties*:** A known amount of date sample (20 g) with 200 mL of 80% methanol was extracted using an orbital shaker to prepare date extracts. The time period of 8 hours was given at room temperature. Two more subsequent extractions were made for remaining solids using same solvent i.e 80% methanol and extracts were then combined. The extract was concentrated at 45°C, under reduced pressure in a rotary evaporator. Concentrates were then refrigerated at a temperature (-4ºC) until further use. For antioxidant analysis of each sample, different antioxidant assays were used. The scavenging activity of free radicals in date samples was determined by 2,2-diphenyl-1-cortical water body assay using the method provided by Rabab *et al.* (2011) (Singh *et al*., 2012) for the analysis of total phenols using the Fulin Georgetown reagent method using an ultraviolet spectrophotometer (specd ® 200 plus Germany).

***Total flavonoids content (TFC)*:** 1mL of the extract solution containing 10mg of the extract was extracted in a 10 ml volumetric flask, then 5ml of distilled water was used and 0.3ml of $NaNO_2$ was taken at 5% of 5%. After 5 minutes, 0.6 ml AlCl3 was added to 10%. In another 5 minutes, added 2 ml NaOH 1 m, and used distilled water to complete the volume up to 10 ml. Absorbance was measured at 510 nm using a spectrophotometer (bio Tek instruments, VT, USA). The amount of TFC is calculated and reported in mg/100g of dry plant material, calculated and reported in terms of catechin equivalent (EC).

Sugar type: reducing sugar is determined by the method used by lane and Eynon, method number AOAC (2006). The reduction of sugar can reduce copper in Fehling solution, because they have aldehyde or free ketone group and are given insoluble brick red cup nitrogen oxide. By determining the unknown volume of sugar solution needed to completely reduce the calculated volume of Fehling solution, the sugar content in the date sample was analyzed.

***Statistical analysis*:** The data obtained were subjected to statistical analysis by using one way ANOVA to separate the means of different treatments.

***The therapeutic effect was studied by rat model*:** the biological function of Sprague Dawley rats was studied for 56 days. For bio-evaluation, date paste from 4 different varieties (Hallawi, Khudravi, Aseel and Ajwa) was probed to assess its hypo-cholesterolemic effect in rat model feeding trial of 8 week. 30 rats (male) of 8-9 weeks were purchased from University of Agriculture, Faisalabad and lodged in the research room for animal in the Department of Pharmacy, G. C. University, Faisalabad. For acclimatization purpose, basal diet was given to rats for one week and the environmental parameters were sustained such as temperature 23±2ºC and RH at a percentage of 55±5 with 12 hours day-night phase.

In the animal modeling, five groups of rats were shaped assigning 6 rats in each group. Simultaneous synchronization trial was held. In simultaneous synchronization trial, hypercholesterolemia was induced in 5 groups of rats through high cholesterol diet except control group.

At the end of (56^{th} day) of trial overnight fasted rats were decapitated and EDTA coated tubes were used for blood samples collection. Furthermore, the centrifugation was applied to separate the serum from blood for 6 min at the rate of 4000 rpm from centrifugation machine. The biochemical assessment of collected serum samples were carried out using Micro laboratory 300. Finally, the statistical approaches were applied to the results for a conclusion.

RESULTS AND DISCUSSIONS

The aims of the present research work included a comparison of nutritional characteristics of 4 different varieties of dates i.e. Hallawi, Shamran, Madjool, and Ajwa. All the four varieties were analyzed for their important physicochemical characteristics (fruit weight, texture, proximate composition, minerals), total sugar (reducing and non-reducing) and most importantly anti-oxidant potential.

***Physicochemical profile of dates*:** The quality of raw material is mainly assessed by its composition of proximate parameters. In which, water activity elucidated by food items can be described as their moisture percentage and is an estimate of the storage life of food. Residues left after analyzing moisture contents and estimation about the digestible proteins that are metabolically converted into the essential amino acids required for the maintenance of the body. Crude fat gives an estimate of fat contents that are an important part of our body insulating system and also engaged in many metabolic processes.

Dates do not contain an account-able proportion of fat but are important constituents to be analyzed. The sum of lignin and cellulose present in cell wall is summed up as crude fiber. The lower the amount of crude fiber the highest will be the amount of total dietary fiber which has the ability to absorb the cholesterol and glucose from the intestine and have important role in mitigating cholesterol levels.

***Proximate Profile*:** The mean values results regarding the proximate composition of four different date varieties are presented in Table 1. The ANOVA results showed significant difference in moisture content, ash, crude protein, crude fat, crude fiber and NFE contents of different date varieties at ($p<0.05$) significance level.

Present study showed that moisture contents of date fruit ranged from 20.07to 23.12%. It was observed that Hallawi dates contained highest moisture contents (23.12%) followed by Ajwa (22.91%), Shamran (1.84%) and Madjool (20.07%). According to the results, the ash contents of date fruit ranged from 1.84 to 3.23%. It was observed that Ajwa dates contained highest ash contents (3.23%) followed by Madjool (3.03%), Hallawi (1.92%) and Shamran (1.84%). Ash contents in the present research work are in close agreement with the results of Elleuch *et al*. (2008).

Results of crude protein contents for date fruit ranged from 1.85 to 2.89%. It was observed that Ajwa dates contained highest crude protein contents (2.89%) followed by Shamran (2.77%), Hallawi (2.43%) and Madjool (1.85%). Elleuch *et al*. (2008) and Ismail *et al*. (2006) reported almost same values for protein i.e. 2.1-3% and 2.3-2.7%, whereas crude fat ranged from 0.21 to 0.49 %. The maximum percentage of crude fat was observed in Ajwa (0.49%) followed by Hallawi (0.48%), Shamran (0.34%) and minimum was observed in Madjool (0.21). The results of the present study are in accordance with the result of Sahari *et al*. (2007).

According to the results, the crude fiber contents of date fruit ranged from 1.88 to 2.41%. It was observed that Madjool dates contained highest crude fiber contents (2.41%) followed by Ajwa (2.03%), Shamran (1.99%) and Hallawi (1.88%). These values were in the range of 1.0-2.7%, the range observed by Al-Harrasi *et al*. (2014). Likewise, the NFE values in four different date varieties ranged from 91.36 to 93.29%. The peek values of NFE were observed in Hallawi (93.29%) trailed by Shamran (93.06%), Madjool (92.5%) and Ajwa (91.36%) as shown in Table 1.

***Textural profile analysis*:** The results for textural profile analysis are presented in table 2. The results of ANOVA showed that there was a significant difference in the maximum puncture strength of different varieties at the significant level ($p = 0.05$).

In this study, the maximum strength of puncture test of different date varieties ranged from 30.43g to 39.32g. In

Table 1. Mean values of proximate profile of date varsities.

Varieties	Proximate analysis					
	Ash (%)	Moisture (%)	Fat (%)	Fiber (%)	Protein (%)	NFE (%)
Ajwa	3.23±0.05[a]	22.91±0.01[b]	0.49±0.01[a]	2.03±0.03[b]	2.89±0.02[a]	91.36±0.12[d]
Hallawi	1.92±0.04[c]	23.12±0.02[a]	0.48±0.03[b]	1.88±0.06[d]	2.43±0.01[c]	93.29±0.15[a]
Madjool	3.03±0.03[b]	20.07±0.03[c]	0.21±0.01[d]	2.41±0.01[a]	1.85±0.04[d]	92.50±0.14[c]
Shamran	1.84±0.19[d]	22.11±0.01[b]	0.34±0.02[c]	1.99±0.05[c]	2.77±0.03[b]	93.06±0.14[b]

texture analysis, it was observed that the hardness index was the largest puncture force recorded in shamlan (39.32g), followed by ajwa (37.30g), machol (35.41g), and the lowest was recorded in hallawi (34.20g).

Table 2. Mean values of textural profile analysis of date varsities.

Varieties	Peak force (g)
Ajwa	37.30 ± 0.03[b]
Hallawi	34.20 ± 0.01[d]
Madjool	35.41 ± 0.01[c]
Shamran	39.32 ± 0.02[a]

***Fruit Weight analysis*:** The results for fruit weight analysis of different date varieties were presented in Table 3. The ANOVA results showed highly significant differences for fruit weight among different date varieties at ($p<0.05$) significant level.

In the present study, the fruit weight of different date varieties ranged from 7.02 to 10.41g. The highest fruit weight was recorded for Madjool (10.41g) followed by Shamran (8.24g), Hallawi (7.70g) and the lowest was recorded in Ajwa (7.02g). The values were within the range (6.5 to 10.6g) reported by Al-Shahib and Marshal (2003). Nadeem *et al*. (2011) reported a higher value of fruit weight for different date varieties.

Table 3. Mean values of Fruit weight analysis of date varsities.

Varieties	Fruit Weight (g)
Ajwa	7.02 ± 0.01[d]
Hallawi	7.70 ± 0.01[c]
Madjool	10.41 ± 0.01[a]
Shamran	8.24 ± 0.01[b]

***Mineral profile*:** The results for minerals sodium, calcium, iron, magnesium, potassium and zinc were presented in Table 4. The ANOVA results showed highly significant difference among the date varieties for sodium, calcium, iron, magnesium, potassium and zinc at ($p<0.05$) significance level. It was observed that date variety Hallawi contained highest sodium contents (11 mg/100g) followed by Ajwa (9.02 mg/100g), Shamran (6.9 mg/100g) and Madjool (1.9 mg/100g). Calcium contents were found highest in Shamran date variety (195.30 mg/100g) followed by Ajwa (189 mg/100g), Hallawi (162.02 mg/100g) and Madjool (72.34 mg/100g). Iron contents in different date varieties ranged from (1.92 to 5.35 mg/100g). It was observed that date variety Hallawi contained highest iron contents (5.35 mg/100g) followed by Shamran (4.2 mg/100g), Ajwa (3.21 mg/100g) and the lowest were found in Madjool (1.92 mg/100g). Magnesium contents in different date varieties ranged from (52.31 to 148 mg/100g). It was observed that date variety Ajwa contained highest magnesium contents (148 mg/100g) followed by Shamran (56 mg/100g), Madjool (53.64 mg/100g) and the lowest were found in Hallawi (52.31 mg/100g). Potassium contents were ranging from (480.3 to 852.15 mg/100g). It was observed that date variety Hallawi contained highest potassium contents (852.15 mg/100g) followed by Shamran (841 mg/100g), Madjool (701 mg/100g) and the lowest were found in Ajwa (480.3 mg/100g). Zinc contents in different date varieties ranged from (1.33 to 1.78 mg/100g). It was observed that date variety Shamran contained highest zinc contents (1.78 mg/100g) followed by Madjool (1.45 mg/100g), Hallawi (1.42 mg/100g) and the lowest were found in Ajwa (1.33 mg/100g). The obtained results are similar to the earlier findings of Assirey (2014), who reported that different varieties of date fruit contain highest amount of potassium ranged from 289.6-512 mg/100g, calcium 123-187 mg/100g, magnesium ranged between 56-150 mg/100g and sodium ranged from 4.9-8.9 mg/100g. Nasir *et al*. (2015) has evaluated that date fruit contains potassium (713 mg/100g), magnesium (64.2 mg/100g), copper (0.24 mg/100g) and selenium (0.31 mg/100g), respectively.

In another study, the results were in compliance with the present outcomes carried out by Vinita and Punia (2016) who

Table 4. Mean values of mineral contents in date.

Varieties	Sodium	Calcium	Iron	Magnesium	Potassium	Zinc
Ajwa	9.02±1.05[b]	189.00±0.99[b]	3.21±0.02[c]	148.00±0.02[a]	480.13±2.91[d]	1.33±0.01[d]
Hallawi	11.00±1.02[a]	163.02±1.04[c]	5.37±0.01[a]	52.31±0.02[d]	852.15±2.95[a]	1.42±0.02[c]
Madjool	1.90±1.04[d]	72.34±0.95[d]	1.92±0.01[d]	53.64±0.02[c]	701.00±2.15[c]	1.48±0.01[b]
Shamran	6.90±1.02[c]	195.30±0.95[a]	4.2±0.01[b]	56.00±0.02[b]	841.30±2.21[b]	1.78±0.01[a]

narrated mineral composition for Hallawi and Khudravi. Maximum values of potassium 853.33, calcium 159.66 mg, magnesium 53.33 mg, iron 5.34 mg and zinc 1.41 mg for Hallawi per 100 g of dates were assessed.

***Total Phenolic Contents*:** The total phenolic contents (TPC) among different date varieties are presented in Table 5. The ANOVA results showed highly significant difference among the date varieties for TPC at ($p<0.05$) significance level. Total phenolic contents in different date varieties ranged from (238.89 to 280.67 mg/100g). Results showed that date variety Ajwa contained highest total phenolic contents (280.67 mg/100g) followed by Hallawi (254.2 mg/100g), Madjool (245.87 mg/100g) and the lowest in Shamran (238.89 mg/100g). The results of this study, different date varieties of phenolics are based on those of Al Farsi and Lee (2008) and goliet et al., 2005, who reported phenols from *Phoenix dactyliffera* in the range of 193.7 mg fresh date. (100 g) to 239.5 mg dry date (100 g). Saleh *et al.* (2011) reported the number of TPCS in three quality date varieties in Saudi Arabia (Ajwa, Sukari, Harar). According to him, the concentration of polyphenols depends on the diversity of dates and extraction solvents.

Table 5. Total phenolic contents of different date varieties.

Varieties	TPC (mg/100g)
Ajwa	280.67±0.05[a]
Hallawi	254.23±0.04[b]
Madjool	245.87±0.04[c]
Shamran	238.89±0.04[d]

DPPH radical scavenging activity: DPPH radical scavenging activities in different date varieties ranged from (61.18 to 79.00 %) and are presented in table 6. It was observed that date variety Madjool exhibited the highest antioxidant activity (78.00 %) followed by Ajwa (72.15%), Hallawi (69.17) and the lowest were found in Shamran (61.18 %). Results of the present research work are in accordance with Anjum *et al.* (2012) who reported DPPH scavenging activity of three Pakistani date varieties in methanol extract. It was observed that date variety Karbalane contains highest antioxidant activity (90.965%) followed by Dora (89.79%) and Dhaki (85.75%).

Table 6. Mean values of DPPH analysis of different date varieties.

Varieties	% DPPH Scavenging
Ajwa	72.15±2.70[b]
Hallawi	69.17±2.54[c]
Madjool	78.00±1.62[a]
Shamran	61.18±2.62[d]

***Total Flavonoid Contents*:** The total flavonoid contents (TFC) among different date varieties presented in Table 7. The ANOVA results showed highly significant difference among the date varieties for TFC at ($p<0.05$) significance level. Total flavonoid contents in different date varieties ranged from (103.23 to 172.07 mg/100g). Results showed that date variety Ajwa contained highest total flavonoid contents (172.07 mg/100g) followed by Hallawi (157.07 mg/100g), Madjool (131.00 mg/100g) and the lowest in Shamran (96.05 mg/100g).

Table 7. Total flavonoid contents of different date varieties.

Varieties	TFC (mg/100g)
Ajwa	172.07±0.02[a]
Hallawi	157.07±0.04[b]
Madjool	131.00±0.04[c]
Shamran	96.05±0.04[d]

***Sugar profile*:** The mean results of sugar profile for different date varieties were presented in Table 7. ANOVA results for total sugar, reducing sugar and non-reducing sugar contents were found highly significant among the date varieties at ($p<0.05$). Total sugars in different date varieties ranged from (68.41 to 82.50 %). The Reducing sugars contents in different date varieties ranged from (62.31 to 76.58 %). It was observed that date variety Hallawi exhibited the highest reducing sugars (76.58%) followed by Shamran (75.28 %), Ajwa (71.5 %) and Madjool (62.31 %).

Non-reducing sugars in different date varieties ranged from (3.7-6.1 %). It was observed that date variety Madjool exhibited the highest non-reducing sugars (6.1%) followed by Hallawi (5.92 %), Shamran (5.16%) and Ajwa (3.7 %). The trend for the total sugar, reducing sugar and non-reducing sugar contents were found from highest in Hallawi variety and followed by Shamran, Ajwa and the lowest in Madjool. Findings of present research work regarding reducing, non-reducing and total sugar contents are almost similar to the results of Nadeem *et al.* (2011b).

Table 8. Mean values of sugar profile.

Varieties	Total sugars %
Ajwa	75.20±0.87[c]
Hallawi	82.50±0.82[a]
Madjool	68.41±0.68[d]
Shamran	80.44±0.90[b]

Dietary fiber: The results for total dietary fiber of different date varieties were presented in Table 8. The results showed highly significant difference in total dietary fiber among different date varieties at significant level ($p<0.05$). Total dietary fiber in different date varieties ranged from (7.17 to 11.02 %). It was observed that date variety Hallawi contained the highest total dietary fiber (11.02%) followed by Shamran (9.32 %), Ajwa (8.42 %) and the lowest were found in Madjool (7.17 %). The results for soluble dietary fiber of different date varieties are presented in Table 8. The results showed highly significant difference in soluble dietary fiber among different date varieties at ($p<0.05$).

Soluble dietary fiber in different date varieties ranged from (1.40 to 3.0 %). It was observed that date variety Hallawi contained the highest total dietary fiber (3.0%) followed by Madjool (2.87 %), Shamran (1.40 %) and the lowest were found in Ajwa (1.17 %). The results for in-soluble dietary fiber of different date varieties are presented in Table 8. The results showed highly significant difference in in-soluble dietary fiber among different date varieties at ($p<0.05$).

In-soluble dietary fiber in different date varieties ranged from (4.30-8.02 %). It was observed that date variety Hallawi contained the highest total dietary fiber (8.02) followed by Shamran (7.92 %), Ajwa (7.25 %) and the lowest was found in Madjool (4.30 %).

Table 9. Total dietary fiber, soluble dietary fiber and insoluble dietary fiber contents of different date varieties.

Varieties	TDF
Ajwa	8.42 ± 0.07^{c}
Hallawi	11.10 ± 0.05^{a}
Madjool	7.17 ± 0.05^{d}
Shamran	9.32 ± 0.05^{b}

***Bioefficacy study results*:** Bio-efficacy trial was also done using rat models to check the hypolipidemic impact of date paste using simultaneous synchronization trial and at the end of the study, blood samples were taken to check the hypocholesterolemic perspective of date paste from different varieties.

***Total Cholestrol*:** Value of total cholesterol ranged from 82.56 mg/dL to 147.23 mg/dL in all six treatments. Higher value (147.33±0.57 mg/dL) of total cholesterol was found in T_1 (high cholesterol induced group). Value of LDL ranged from 26.23±0.57 mg/dL to 91.76±0.98 mg/dL in all six treatments. Higher value (91.76±0.98 mg/dL) of LDL was found in T_1 (high cholesterol diet). Value of HDL ranged from 38.76±1.15 mg/dL to 83.56±1.15 mg/dL in all six treatments. Higher value (83.56±1.15 mg/dL) of HDL was found in T_5 (high cholesterol diet + Ajwa date variety). Value of total triglyceride ranged from 68.29±0.44 mg/dL to 109.57±1.15 mg/dL in all six treatments. Higher value (109.57±1.15 mg/dL) of total triglyceride was found in T_1 (high cholesterol diet) as shown in fig. 1, 2, 3 and 4.

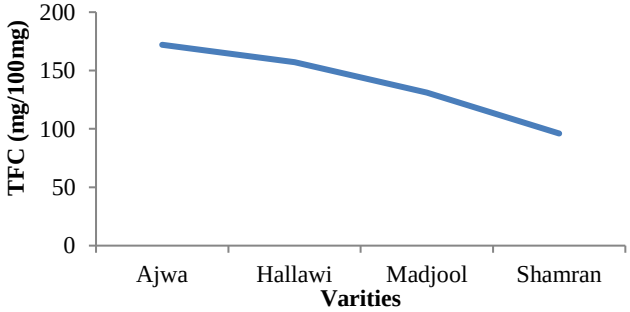

Figure 1. Total fat contents in animal blood.

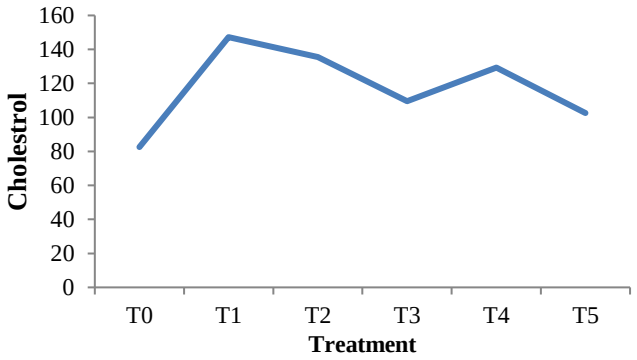

Figure 2. Total cholesterol contents in animal blood.

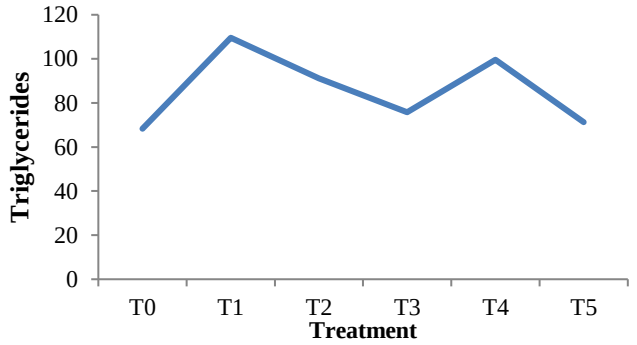

Figure 3. Triglycerides in animal blood.

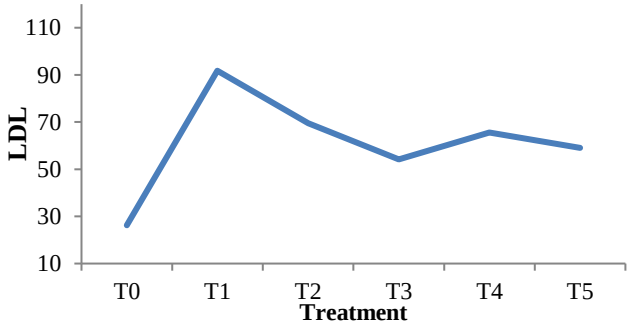

Figure 4. Low density lipoprotein (LDL) contents in animal blood.

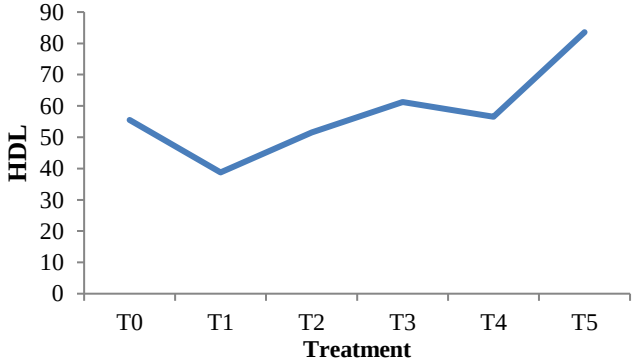

Figure 5. High density lipoprotein (HDL) contents in animal blood.

***Conclusion*:** Occurrence of chronic diseases is increasing day by day. At the same time consumer is getting much concerned about their medications and they are diverting towards natural plant based medication. It is a matter of interest that many important phytochemicals are found present in plants that are wasted and have therapeutic potential. One such plant is date palm that have long been wasted in our country but now the researchers have done advances regarding the chemical composition and enlightening an array of phytonutrients of functional and nutraceutical worth in this commodity. Considering the aforementioned essentials, the nutritional profile of date fruit of different varieties was analyzed in present study. For this purpose, four different commercially available date varieties (Ajwa, Hallawi, Madjool and Shamran) were selected and analyzed for their physico-chemical and nutritional profile. According to the outcomes of the present investigations, date variety hallawi and ajwa found best among these. It was concluded that out of the four different date varieties, variety Hallawi had maximum contents of total dietary fiber, total phenolic contents, total sugar, potassium and iron contents as compared to other three varieties.By having a look on the results of this research work, we can conclude that date have a high amount of dietary fiber, total phenolic contents, total flavonoid contents and low amount of crude fiber, low amount of fatwhich make them suitable for hypercholesterolemic and hyperlipidemic patients. It is also a good source of micro and macro minerals and has a low amount of sodium and high amount of potassium. All of these characteristics are in favor of patients of CVD. A very minute concentration of sodium was present in Ajwa and Hallawi that make them suitable for hypertensive patients. A strong antioxidant potential with regard to TPC and TFC was also observed in Ajwa, Hallawi and Madjool. In bio-evaluation trial, Hallawi and Ajwa showed highest potential to lower the total cholesterol, triglycerides and LDL while helped to increase the HDL or good cholesterol. So there should be an extensive research to explore this potential because much of the Pakistani date varieties go in waste and it would be a good initiative.

***Conflicts of Interest*:** Authors have no conflict of interest regarding this study

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