

Extraction Of Bio-Active Compounds From Date Fruits Of District Khairpur Mirs, Sindh, Pakistan

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ABSTRACT

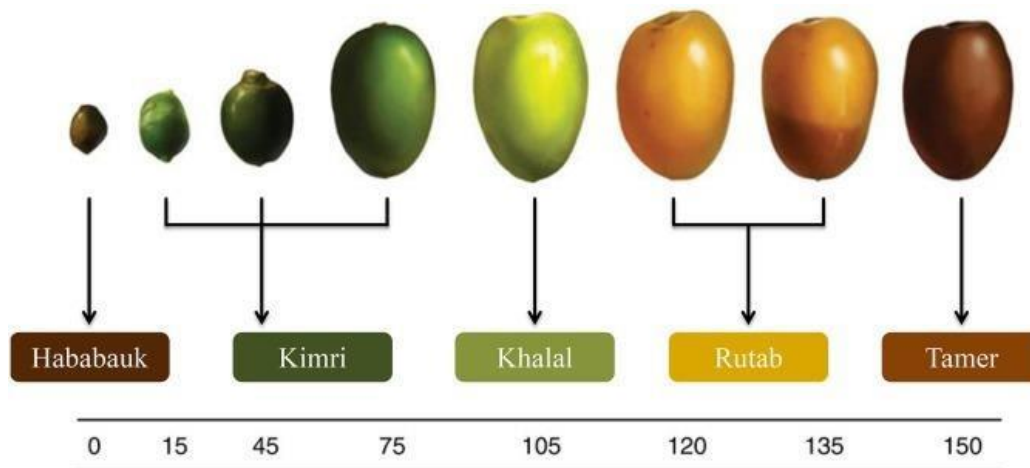
Date fruits are widely cultivated in the world and are rich sources of antioxidants, sugars and fibers, vitamins and fatty acids. The purpose of current work was to measure physical and chemical characteristics of ten date fruits i.e. Dadhi wari, Dally wari, Zardi, Asul khurmo, Hawa wari, Noori, Rukan, Aseel, Karbala wari and Toto, which are commonly grown in Pakistan. The physical parameters such as colour, size, moisture, weight, and pH of were measured during hababuk, kimri or jimri, khalal, rutab and tamar stages of date cultivars, which increased towards the ripening stage. Chemical evaluation of date flash revealed that carbohydrate and flavonoids were predominant in ripened stage in all date varieties.

Keywords: Spectrophotometer; Date fruit; Carbohydrates; Flavonoids

1. Introduction

The Tree of date (*Phoenix Dactylifera* L.) remained popular food constituent in Arabic countries and Africa since last 5000 years. Besides that its cultivation can be found in Mexico, Australia and the United States (Chao and Krueger, 2007; Al-Harrasi et al., 2014; Hazzouri et al., 2015). The meaning of *dactylifera* is finger-bearing and came from Greek word *dactylus*, “finger,” and the Latin *ferous*, “bearing” (Ashraf and Hamidi-Esfahani, 2011). It belongs to *Arecaceae* family and consists of about more than 2,500 species, which are natively from tropical areas of Middle East or South Africa (Siddiq et al., 2013; Eoin, 2016). It is known as Desert bread (Simon, 1978) as people travelling through deserts consume it as food. The tree of date can grow 21–23 m long, with 4–6 m growing leaves. (A. H. Jatoti et al., 2024). There are more than 100 million trees of dates are cultivated round the world from which approximately 90% are in Middle East. From the religious point of view, it is sacred tree (Porter, 1993) for muslims and stated in Holy Quran many times (Ghnimi et al., 2017, Selim et al., 2012) whereas, Christians, celebrate Easter Sunday with palm leaves (Zohary et al. 2012). The date palm production is increasing worldwide and reached about 8.06 million metric tons by 1.149 million hectare of land (FAO, 2013). Date fruit is one of the most nutritious foods available and is rich in carbohydrates content, proteins, fibers, fats, various vitamins and minerals (Zaid et al., 2002).

Date fruit goes through five growing stages to become edible, however the growth of date tree depends upon the genotype of date variety, environment and soil composition etc. The various growing stages of date fruit (Figure 1) are Hababouk; it is the first stage and comprises of five weeks after fertilization (Shomer, 1998, Baliga 2011). Kimri is second growing stage, which takes nine to fourteen weeks and is longest growing stage. The third stage is known as Khalal in which fruit is almost grownup with change in color of date cultivars. This stage is comprises on three to five weeks, during this stage date fruit acquires maximum weight and size. Rutab is the fourth developing stage and is also known as soft ripening phase. During Rutabe stage, sugar content increases with decrease in moisture content. The last or fifth stage is called Tamar, this stage is referred as ripened stage because date fruit is completely mature and edible in this stage (Camara, 1994, Kearney, 1906),(W. B. Jatoti et al., 2024)



Online ISSN

3007-3197

Print ISSN

3007-3189

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Figure.1. The five growth stages of a date fruit (Al-Mssallem et al., 2013).

2. Materials and Methods.

2.1. Sampling

The samples of ten date fruit cultivars, i.e. Aseel, Rukan, Dally wari, Toto, Karbala wari, Asul khurmo, Hawa wari, Noori, Zardi and Dadhi wari, collected during different phases of ripening from various places of Khairpur District, Sindh, Pakistan see map (Figure 2a and 2b).

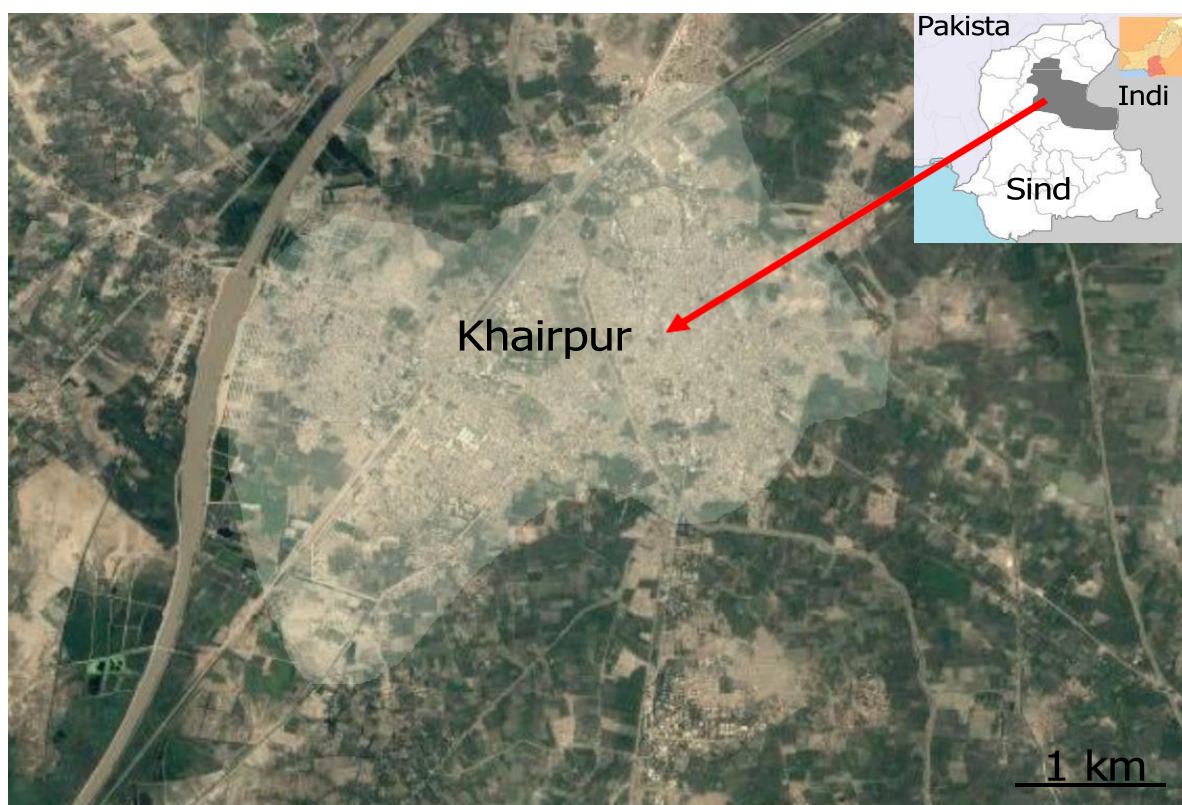


Figure 2a Area of study



Figure 2b Sampling of date cultivars

2.2. Physical parameters analysis

The samples cleaned, washed with distilled water and dried to measure physical parameters. The size was calculated with Vernier caliper, weight was measured by using weight balance, pH meter was used to determine pH of date cultivars and moisture was determined by difference between fresh date fruit weight and dried date fruit weight (Cunningham and Sobolewski, 2011),(Kamboh et al., 2021).

Moisture content (%) = $(W_1 - W_2) / W_t$

Where, W_1 is weight of date fruit before drying, W_2 is weight of date fruit after drying and W_t is total weight.

Samples were dried in an Oven at temperature 80- 85°C for overnight (Horwitz and Latimar, (2007). Then dried samples minced by using mortar passel to obtain fine powder. In the end, prepared samples were run on CECIL CE9500 Double Beam Spectrophotometer, which was first calibrated at zero (Sultana et al., 2015).(A. H. Jatoi et al., 2023)

3. Results and Discussions

3.1. Physical parameters measurement of date fruit varieties in first ripening stage

The colour of all date cultivars remained green during first growing stage. The maximum length (4.5 cm) and weight (24.51g) found in Dally wari. Highest moisture content in Dadhi wari (84.51 %) and lowest (47.53) in Toto and (5.3 maximum) pH in Rukan measured during first developing stage of date fruit (Table 1).

3.2. Physical parameters measurement of date fruit varieties in second ripening stage

In second stage of ripening (Kimri), the physical parameters of date cultivars changed slightly such as Rukan, Toto, Asul Khurmo and Zardi changed their color from green to light yellow. Similarly, length of all varieties also been increased during this progressing stage i.e. length of Dally wari raised to (4.8cm highest) and length of Toto changed to (3.4cm minimum) Maximum weight was observed in Dally wari (35.75g) and minimum in Rukan (24.96g). The moisture content was also found higher than the first stage ranging between (85.33% in Asul khurmo) and (71.59% in Toto) followed by Aseel (82.50%) and Hawa Wari (82.58%). An increasing pH trend also followed by all date fruit cultivars. Similarly, highest pH measurement found (6.0 in Hawa Wari) and least (4.6) calculated in Asul khurmo and Zardi (Table 2)(Shaikh et al., 2024)

3.3. Physical parameters measurement of date fruit varieties in third ripening stage

Our observed results regarding color in third ripening stage (Khalal) reveals all date fruit varieties obtained light yellow color. Length of date fruit slightly increased in this ripening stage, amongst all the greater (5.1cm length) and smaller (3.7cm) recorded in Dally Wari and

Toto correspondingly. A gradual increase in weight and decrease in percentage of moisture in date fruit cultivars noticed during Khala stage. The peak value of weight (47.98g) was retained by Dally wari and bottom value measured (31.52g) in Rukan. Date fruit varieties found to be not as rich as in previous ripening stages with respect to moisture. Moisture analysis resulted maximum level (64.09%) in Noori and minimum (53.34%) in Zardi. Equal percentage of moisture seen in Dally wari (57.80%) and Toto (57.97%). The pH at this stage of all date varieties ranged from (5.2 in Dally wari) to (6.2 in Dadhi wari) The increasing trend in pH stage wise shows that variation takes place from acidic medium to neutrality, for details of physical parameters measurement during khalal stage see (Table 3).

3.4. Physical parameters measurement of date fruit varieties in fourth ripening stage

In fourth ripening stage (Rutab), all date fruit cultivars changed their color to yellow except Hawa wari and Noori, which remained light yellow in color. In Rutab stage majority of date fruit i.e. dadhi wari, Dally wari, Toto etc. are edible. Length of some date cultivars slightly increased is concerned, Dally wari raised from (5.1cm) to (5.3cm). Similarly, variation in weight also observed during Rutab stag. The highest weight in Zardi (40.26g) and lowest in Aseel (28.55g) measured at fourth ripening stage. This variation in weight amongst date fruit varieties at during Rutab stage reveals that increasing maturity decreases water content, which causes decrease in weight. The decrease in water content may be due to transformation of water into sugar as chemical reaction in the presence of light. The moisture measurement reveals that maximum of water was contained by Noori (66.56) and minimum (56.82) by Rukan at fourth growing level. The pH range was still in acidic medium i.e. (5.4 to 6.3). The obtained pH values are described in (Table 4).

3.5. Physical parameters measurement of date fruit varieties in fifth ripening stage

The physical properties of ten date cultivars completely changed in all aspects in the fifth stage (Tamar). The change in colors of all cultivars individually are: Noori and Zardi acquired red colour, Hawa wari and Dadhi wari yellow whereas all other date cultivars possessed dark brown colour. Dally wari maintained largest (5.3cm) length; similarly, Toto reduced length to (3.3cm). Weight in all date varieties reduced in Tamar stage whereas, maximum (35.28g) in Dally wari and minimum (27.87g) recorded in Karbala wari. Similarly, like weight moisture content also lowered in this stage of ripening. Asul khurmo accumulated high moisture (69.66 %) and Noori (57.22%), which is lowest of all at tamar stage. During this last stage of maturity, pH remained acidic. The pH of Asul Khurmo, Hawa wari and Zardi was high and identical i.e (6.6) whereas lowest was recorded in Dally wari (5.5) see (Table 5).

4. Chemical Parameter Analysis of Date Fruit Varieties

The Chemical characteristics of date fruit i.e. total carbohydrates, reducing and non-reducing sugars and flavonoids measured in five growing stages.

4.1. Carbohydrate Content Comparison Among Date Fruit Varieties in Five Ripening Stages

Ripen fruit of date is rich source of carbohydrate and a 100g consumption provides (75g) 18% of daily carbohydrates requirement (Jasim Ahmed et al. 2013). Ripen date fruit is used as sugar,

Online ISSN

3007-3197

Print ISSN

3007-3189

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jam preparation, preparation of date candies, coconut and roasted nuts. To acquire uniqueness, its pate may coated to the chocolates. Dates are used to prepare, sauces, fruit yogurt and deserts (Siddique et. al. 2014). Carbohydrates content was measured by using Double Beam Spectrophotometer. The maximum concentration of carbohydrates at first growing stage, found in Hawa wari (484.4 mg/g) and minimum in Karbala wari (190.3 mg/g). The trend of increasing or decreasing carbohydrate content was not retained by same varieties in progressive maturity levels such as in second stage of ripening, Asul Khurmo leads by accumulating higher concentration of carbohydrates (636.2 mg/g) whereas, Toto with (344.3 mg/g) acquired the least concentration. An ongoing rise in total carbohydrates measured in all date cultivars at third ripening stage i.e. Asul Khurmo (763.0 mg/g), Rukan (463.6 mg/g) accumulated higher and lower concentration of carbohydrate respectively. Dally wari with highest accumulation of carbohydrate (884.5 mg/g) remains at top of ten date cultivar in fourth stage of ripening whereas, Rukan (693.9 mg/g) with lowest content at lost. In fifth stage, which is also known as soft or ripened stage, highest concentration (884.2 mg/g) found in Zardi and lowest (670.9

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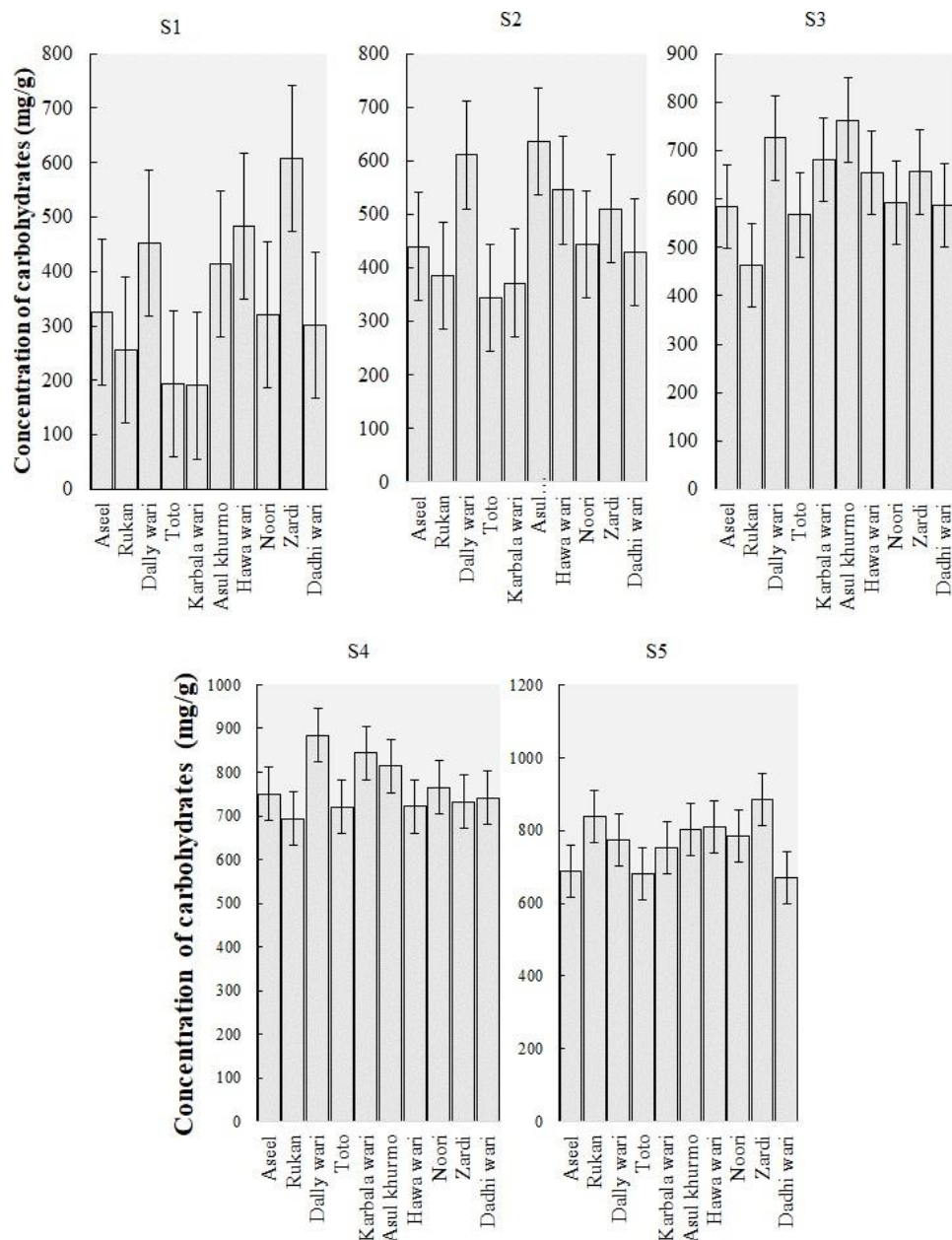
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mg/g) measured in Dadhi wari. A graphical representation of these results given in (Figure 3).



S1= Stage 1, S2= Stage 2, S3= Stage 3, S4= stage 4, S5= Stage 5.

Figure.3. Carbohydrate variation among date fruit varieties in five ripening stages.

4.2.Reducing Sugar content Comparison among Date Fruit Varieties in Five Ripening Stages

The concentration of reducing increases towards maturity level of date fruit. Our analytical outcomes shows that maximum reducing sugar found in (233.3 mg/g), (374.1 mg/g), (736.5 mg/g) in Zardi at first, third and fifth ripening stages respectively. Similarly, (389.6 mg/g) in Dally wari second stage, (534.0 mg/g) in Karbala wari in fourth stage imparted highest content of reducing sugar (See figure 4).

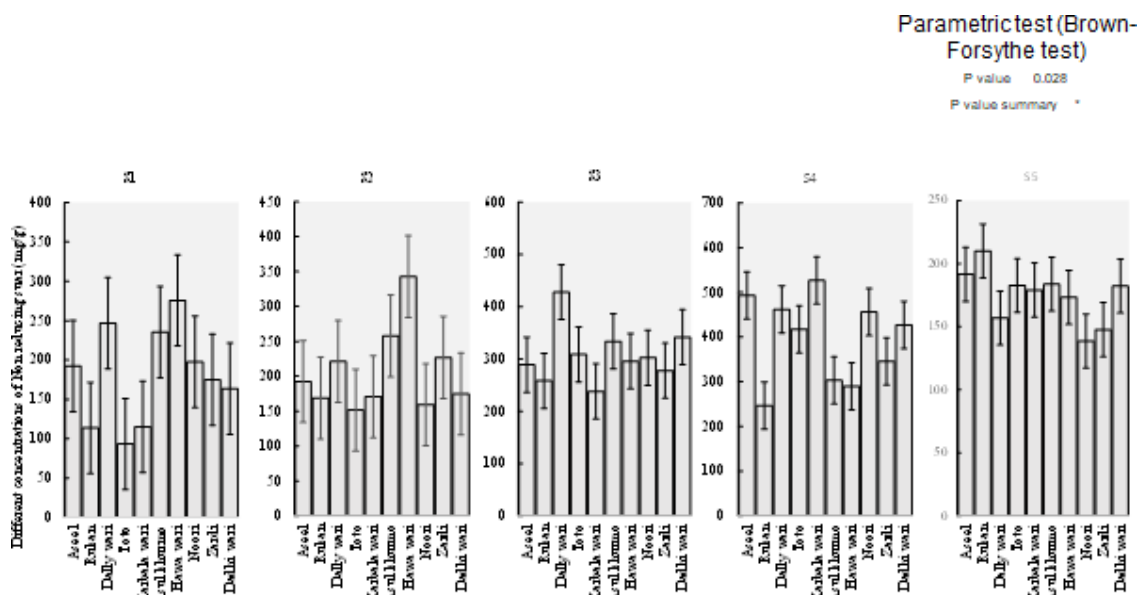


Figure.4. Reducing sugar variation among date fruit varieties in five ripening stages

4.3.Non-Reducing Sugar Comparison among Date Fruit Varieties in third Stage

The amount of non-reducing sugar alters depending genotype of cultivar during growing levels. Our spectrophotometric measurements shows high non-reducing sugar content maintained by Hawa wari (275.7 mg/g) in first and second (342.7 mg/g) matuturity stages. Experimental results at third ripening stage reflects increase in non-reducing sugar content in all varieties but Karbala wari accumulated highest amount (457.0 mg/g). During fourth growing stage, level of non-reducing sugar slightly lowered in all date cultivars, which may be because of increase in reducing sugar during this stage. However maximum (402.5 mg/g) in Dally wari and minimum

accumulation was found in Toto and Noori (298.6 mg/g) and (299.3 mg/g) sequentially. The mode of decrease further retards in fifth stage where highest value of non-reducing sugar content (210.1 mg/g) detected in Rukan. The comparative results are shown in (Figure 5).

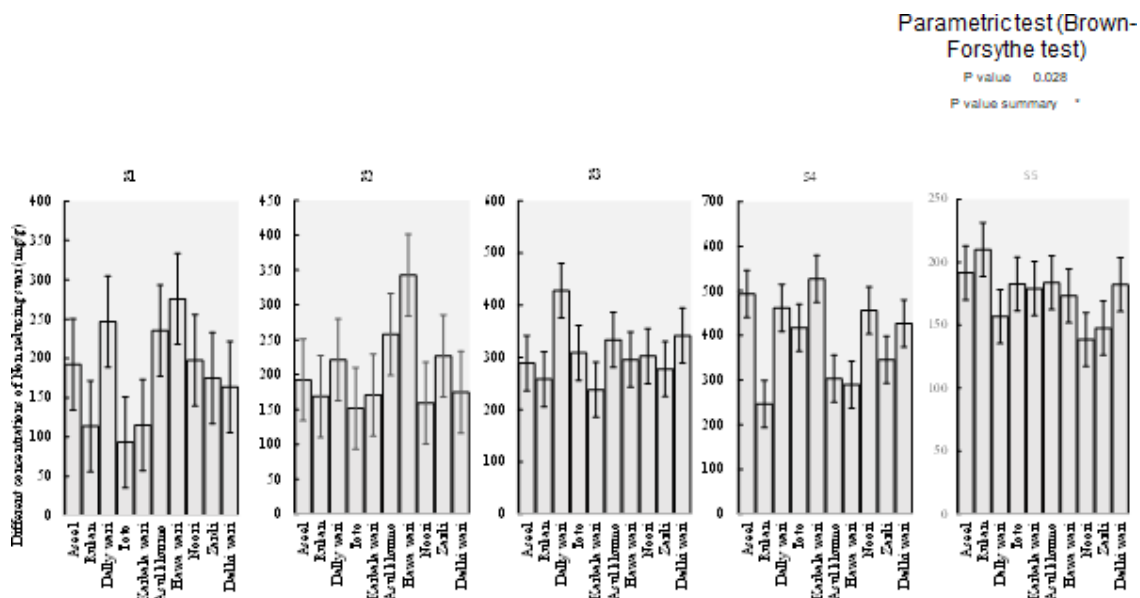


Figure.4. Non-reducing variation among date fruit varieties in five ripening stages.

5. Flavonoid Content Comparison Among Date Fruit Varieties in Five Ripening Stages

Flavonoid are available in most of the commonly consumed fruits. They are beneficial for human health such as antioxidants, protect cancer and cell damage, improve immune system (Biglari et al. 2008). They possess antitumor properties and are good for heart. Our flavonoid analysis revealed that dates are containing sufficient quantity of flavonoids, which were measured by spectrophotometer. During first stage of maturity, Asul khurmo (83.33 mg/g) whereas, in second (94.82 mg/g) and third stage (118.48 mg/g) Zardi contained highest concentration of flavonoids. Dadhi wari (178.64 mg/g) in fourth, Noori and Zardi, both (448.48 mg/g) in fifth stage of ripening accumulated highest concentration amongst ten date cultivars (Figure 5).

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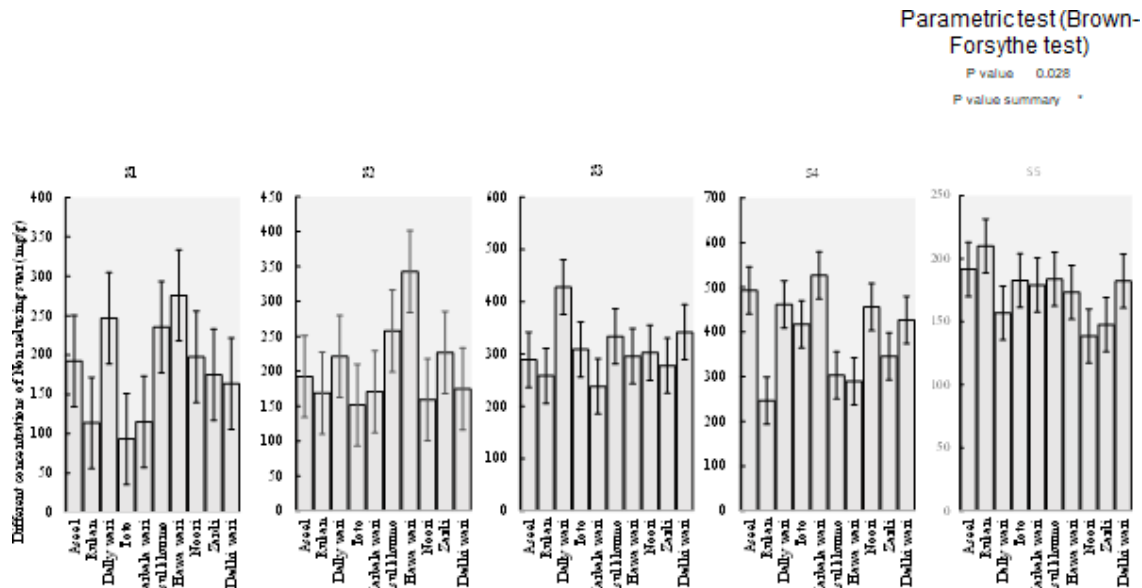


Figure.5. Flavanoids variation among date fruit varieties in five ripening stages.

6. Conclusion

Dates are widely consumed both as fresh and in dried form. They are rich source of carbohydrates and variety of phytochemicals i.e. flavonoids. These phytochemicals are useful health constituents, impart microbial properties, work as anti-tumor, anti-cancer and improve immune system. Our findings about ten commonly growing date cultivars in Pakistan reveals that physical parameters e.e. size, weight, pH increases towards mature level whereas high moisture content measured during third and fourth ripening stages. These varieties found to be rich in carbohydrate and flavonoid content in last two ripening stages. Therefore, due to its nutritional and functional properties dates can be referred as nutritious food, which can play vital role in human health and nutrition.

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© Hazzouri, K.M., Flowers, J.M, Visser, H.J, Khierallah, H.S.M., Rosas, U.,

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3007-3197

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3007-3189

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