

Sweetening Potential and Phytonutrient Constituents of Date Palm

OLORUNNADO Gabriel Babatunde, and IDENYI Sunday

Department of Science, School of Preliminary Studies, Kogi State Polytechnic Lokoja Nigeria

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ABSTRACT

Granulated sugar is rich in calorie with little or no nutritional value. Excessive consumption of sugar is dangerous to human health for example, its increase blood pressure, causes, hyperglycaemia, inflammation and diabetes. Also, date palm have a unique, sweet, caramel-like taste. It had been reported that date palm have low glucose contents but is rich in fructose, it is therefore less likely to spike the blood sugar level. In this research, the fruits of date palm (*Phoenix dactylifera*) was analysed for its phytochemical and Nutritional components in order to provide an up-to-date nutrient composition data and phytochemical potentials of these commonly grown and consumed fruits. The samples were collected from international market Lokoja Kogi state. The sample was extracted and analyzed for proximate values and mineral contents using the recommended method of the Association of Analytical Chemist. The result of the proximate analysis revealed that date palm contain 14% moisture, 11% ash, 5% lipid, 18% carbohydrate, 2% crude fibre and 0.53% protein. The samples were also screened for phytochemical properties using standard procedures. Alkaloids, terpenoid and saponins were found to be present in moderate proportion while flavonoid and tannin are detected in slight proportion. Phlobatanin was not detected in the sample. The phytochemical constituents show that apart from the nutritional value of date palm, it have a good health sustaining activities. The carbohydrate content of date palm detected in this research is nothing to be worried about despite the sweet taste therefore, date palm can serve as a potential sweetener without any side effect or damages that can arise as a result of consuming excess sugar.

Key words: Sweetener, Hyperglycaemia, Nutrients, Human health, phytochemicals

INTRODUCTION

Date palm tree (*Phoenix dactylifera L*) is considered as one of the oldest and most staple and ancient crops in southwest Asia and North Africa. It can grow in Australia, Mexico, South America, South Africa and United States (Bonner, 2008). The fruits are berry containing a single seed enclosed by a fibrous parchment like endocarp. Fleshly mesocarp and the fruit skin pericarp (Bonner 2008) (Baranowski, 1993). It varies in shapes, size and weight depending on the region and also in its organoleptic, physical and chemical characteristics. It is oblong in shape though certain varieties might reach near spherical shape. Date palm tree starts producing fruits at average 5 years with production rate of 500 to 600 kg/tree/year. According to FAO, <http://www.fao.org>, there are over 100 million date palm trees scattered on 13 million hectares worldwide.

Date palm (DP) fruits are thick layer pulp, edible, very sweet and delicious (Sharma *et al.*, 2019). Besides its nutritional value and in contrast to other major fruits commonly consumed by humans, DP is unique and characterised by certain distinct properties (Barreveld, 1993). One of the major characteristics that render DP exceptional is that it is the only fruit consumed at any of the three major stages of maturity such as khalal (fresh, hard ripe, color stage), rutab (crisp to succulent or ripe stage), or tamr (soft pliable, full ripe stage). Although newly ripened dates are preferred in many date producing countries, dehydrated dates are the common form available commercially and enjoyed globally. Date palm had been processed into Date nut bread, a type of cake that is very popular in the United States, especially around holidays. Dates are also processed into cubes, paste called 'ajwa, spread, date syrup or "honey" called "dibs" or rub in Libya, powder (date sugar), vinegar or alcohol. Vinegar made from dates is a traditional product of the Middle East. (Forbes *et al.*, 1971).



Figor 1: A date palm tree

Generally, fruits are one of the oldest forms of food known to man and they present an important part of human diet in almost any culture of the world. The basic nutritional importance of fruits like other plants assessed by their content of protein, carbohydrate, fats and oils, minerals, vitamins and water which are responsible for the growth and development in man and animals (Macrae, 2002). Apart from their nutritional benefits fruits also have beneficial effects such as anti-carcinogenic, anti-mutagenic, anti-viral and antibacterial impacts due to their biological active substances with anti-oxidant and anti-bacterial properties. An inverse relationship between consumption of fruits and their juice with cardio-vascular disease, arthritis and stroke has been established (Pulok, 2002). These properties are associated with the presence of biological active phytochemicals in plants which could serve as potential sources of drugs. Studies have shown that the most important bioactive constituents of plants include: alkanoids, flavonoids, tannis and phenotic compounds. These compounds were known to exhibits medicinal and physiological activities (Adesuyi, 2012) (De boer, 2014).

Statement of Problem

Sugar consumption is high across the globe especially in north and south America. Sugar consumption have exceeded the average intake recommendation in many part of the world, especially among the young and children (Moynihan and kelly 2014). According to WHO 2023, sugar has the capacity to raise the blood pressure and increase risk of obesity and diabetes. Excess sugar intake can also lead to other form of non communicable diseases which account for about 41 million out of the 56million deaths (73%) in 2017 (WHO, 2023)

Moreover, there is growing interest and concern among people from all walks of life about foods and their relationship to nutrition and heath (Cheng, 1998) (Deboer 2014). Fruits form part of balanced diet which the human body need and they are used in folk medicine for prevention and curing diseases. These reasons and the economic conditions in most parts of the developing countries led to the popularity of local fruits among consumers (Cheng, 1998). Among the fruits, dates have been claimed to promote bone health and aid in blood sugar control, but these effects have not been studied sufficiently.



Figure 2: Date palm fruits

Aim of the Study

The main aim of this research work is to carry out phytonutrients and proximate analysis on date palm (*Phoenix dactylifera*) fruits.

Objectives of the Study

The specific objectives of this project work are to:

- Prepare a crude extract of date palm fruits.
- Evaluate the phytochemical constituents of the date palm fruits extract.
- Determine the proximate content of date palm fruits.
- Compare the sugar and nutritional contents of date palm with the those of the granulated sugar

Significance of the Study

The importance of this project work is to analyze the proximate composition and the phytochemical analysis of date which enable the society to know their nutritional and phytochemical constituent to improve the cultivation of date palm, as well knowing it usefulness as food additive and the consumption.

MATERIALS AND METHOD

Apparatus used

Desiccator

Round bottom flask

Beaker

Crucible

Reagent Used

NaOH

HCL

H₂SO₄

FeCl₂

Wanger reagent

Petroleum ether

Distilled water

Collection and preparation of plant sample

The fruits were obtained from a vendor in Lokoja kogi state, Nigeria and were identify at the Kogi State Ministry of Agriculture. The fruits were thoroughly washed with distilled water and air dried at room temperature. These were then grinded into uniform powder manually and stored in air tight container prior to the commencement of the analysis.

Proximate analysis

The standard analytical procedures for food analysis were adopted for the determination of the moisture content, crude protein, crude fibre, percentage lipids, carbohydrate and ash.

Determination of moisture content

Two grammes of the sample were measured into the crucibles, dried in an oven at 105°C overnight. The dried sample was cooled in a desiccator for 30 min and weighted to a constant weight. The percentage loss in weight was expressed as percentage moisture content on dry weight basis (AOAC, 2006).

• Formular for calculation

$$\% \text{ moisture content} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Where, W₁ = weight of empty crucible

W₂ = weight of empty crucible + sample before oven drying

W₃ = weight of empty crucible + sample after oven drying

Determination of ash content

From the dried and ground sample, 2.00g was taken in triplicates and placed in pre-weighed crucibles and ashed in a muffle furnace at 600°C for 3 h. the hot crucibles were cooled in a desiccator and weighed. The percentage residual weight was expressed as ash content (Latimer, 2023).

• Formular for calculation

$$\frac{W_3 - W_1}{W_2 - W_1} \times 100$$

$$W_2 - W_1$$

Where, W_1 = weight of empty crucible

W_2 = weight of empty crucible + sample before incineration

W_3 = weight of empty crucible + sample after incineration

Crude lipid content determination

From the pulverized sample, 2.00g was used for determining the crude lipid by extracting the lipid from it for 5 h with (60 to 80°C) petroleum ether in a soxhlet extractor (Latimer,2023). 200cm³ of petroleum ether was transferred into a clean dry 250cm³ round bottom flask, couple with soxhlet extraction unit. Some amount of anti-bumping granules were added. An extraction thimbles was weighed as W_1 and 1-2g of the sample was added, weighed and label as W_2 the heating mantle was adjusted at heating rare of 40°C – 60°C the extraction was allowed to proceed for 8 hours. The thimble was then removed, dried to a constant weight at 70°C, it was weighed and recorded as (W_3)

- **Formular for calculation**

$$\frac{W_3 - W_1}{W_2 - W_1} \times 100$$

$$W_2 - W_1$$

Protein determination

The protien composition was determined using the combined method of Latimer, 2023 and Maehre, 2016. 2g of each sample (date palm,) was weighed into a conical flask, 10ml of distilled water was added to make the sample liquid.

The liquid solution of the sample was digested using AOAC 2018 manual.. it iwas heated with 30ml of 0.1 H₂SO₄ tetraoxosulphate (vi) acid . the solution was then diluted to 250ml distilled water. 10ml of 4% NaOH was added to the mixture with 4% H₃BO₃ followed by distliimg the mixture until a silver color is obtained.

this was then titrated against 0.1H₂SO₄ solution in a burette adding 1-2 drops of methyl red as indicator

The percentage protein composition can be calculated by the following expressions

Protein

$$\% \text{ protein} = V_a - V_b \times 4.26 \text{ where the conversion factor for fruits is 4.26}$$

Determination of crude fibre

Crude fibre dtermination was done according to the method of latimer,2023. 2g of each sample was weighed into a pre-weight beakers (four beakers).

50ml of 1.25% H₂SO₄ acid solution was added, the mixture was heated with continuous stiring for 30minutes and allowed to cool and settled. Distilled water added and allowed to settle then decanted. Decantation was repeated for six times consecutively to make the mixture acid free. 50ml of 1.25% of NaOH was added to each mixture and made up to 200ml with distilled water in the same sample and heated for 30minutes with continuous stiring. It was allowed to cool and settled. Distilled water was added and decanted for six time consecutively. The mixture was filtered with a filter paper and each was kept in an oven to dry until the water drain completely and weight was taken.

- **Formular for calculation**

$$\% \text{ crude fibre} = \frac{C_2 - C_3}{C_2} \times 100$$

W

$(C_2 - C_3)$ = the loss in weight on wasting

Where: C_2 weight of filter paper + sample

C_3 weight after drying

W weight of original sample

Carbohydrate determination

The carbohydrate content was calculated using the following formular:

Available carbohydrate (%), = $100 - [\text{protein}(\%) + \text{Moisture}(\%) + \text{Ash}(\%) + \text{fibre}(\%) + \text{crude fate}(\%)]$.

Phytochemical Analysis

Phytochemical contents determination was done using an official method of analysis of AOAC 2018

Sample preparation

Preparation of date palm with ethyl alcohol The finely grinded sample powder was taken, from the total extract 20gm of the sample powder was taken and 50ml of ethyl alcohol was added to that extract stirred it constantly for 30minutes and the solution was kept in room temperature for 24hours and then filtered. The filtered solution is again filtered with whatmann filter paper no. 3 and then it was stored at 4⁰C for further use.

Phytochemical screening: in every phytochemical analysis, ethyl alcohol is mainly used at standard to identify various residues in the extract.

Test for Alkaloids

To identify the presence of alkaloids in the extract 2ml of extract was taken and to that 2ml of wagner's reagent was added. A brownish precipitate formation was observed. This indicate the presence of alkaloids.

Favonoids:

To know the presence of flavonoids in the seeds, 2ml of extract was added to 2ml of 10% lead acetate. Yellowish green colour indicates the presence of flavonoids.

Test for Saponins

To 2ml of the extract was dissolved with 2ml of benedicts reagent, blue black precipitate indicates the presence of saponins.

Test for Tannins

To know the presence of tannins, 2ml of extract was treated with 0.1% of Ferric chloride, brownish green layer indicates the presence of tannins.

Test for Terpenoids

(Salkowski test): to identify the presence of terpenoids, 2ml of extract was dissolved with 2ml of chloroform and concentrated sulphuric acids carefully added to form layer. A reddish brown colour is observed which indicates the presence of terpenoids.

Test for Glycosides

Little quantity of the extract was hydrolysed with HCl solution and neutralized with NaOH solution. Few drops of fehling’s solution A and B were added, Red precipitate indicates the presence of glycosides.

Test for phlobatanins

To test the presence of phlobatanins, the extract was dissolved in distilled water and filtered. The filtrate was boiled with 2% HCl solution. Red precipitate shows the presence of phlobatanins.

RESULT AND DISCUSSION

Result

The result of the phytochemical screening of date palm is shown in table 1. from the table, Alkaloids, Terpenoid and Saponin are present in moderate proportion while Flavonoid, Tannin are present in slight proportion while Glycosides and phlobatanin were not detected.

Table 1: Result showing the phytochemical analysis of date palm

Phytonutrients	Observation
Alkaloids	++
Flavonoid	+
Tannin	+
Terpnoide	++
Glycosides	–
Saponin	++
Phlobatanin	–

Key: +++ highly present ++ moderately present

+ Slightly present – not detected

Table 2 below is the result of the proximate analysis carried out on date palm

Table.2: Result showing the proximate analysis of date palm.

Nutrients	Percentage composition
Moisture content	14
Ash content	11
Lipid	5
Carbohydrate	18
Crude fibre	2

Protein	0.53
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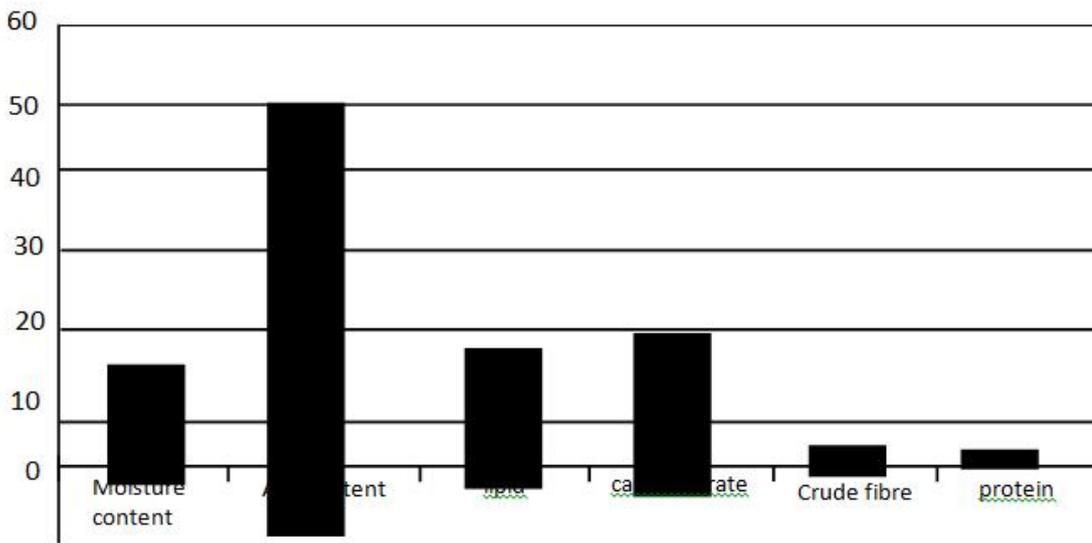


Figure 3: A Bar chart representing the proximate analysis of date palm

Table 3: the result of the Mineral Analysis of Date Palm

Minerals	Concentration (mg/100g)
Iron	11.30± 0.04
Calcium	1420.15± 5.05
Magnesium	8279.7± 1.65
Phosphorous	134.6± 2.10
Sodium	423.90± 2.60

Values are in standard error of mean

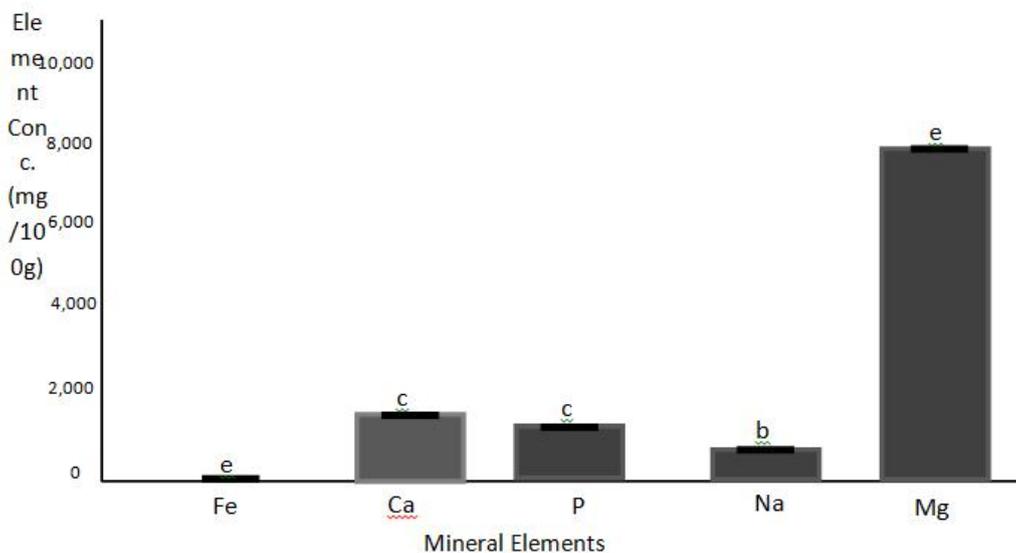


Figure 4.: the bar chat of the mineral composition of date palm sample

DISCUSSION

The results of the phytochemical screening of date palm extract are shown in table 1. From the table, Alkaloids, Terpenoid and Saponins and Tannin are present in significant proportion. Tannin and Flavonoid are present in slight proportion while phlobatanin was not detected.

The importance of alkaloids and saponins in various antibiotics used in treating common infections has been reported by Kubmarawa et al, 2008. Alkaloids have been reported to have antibacterial, analgesic and antispasmodic properties (Harbome, *et al*, 1973).

Its activities have been widely studied for their potential use in the elimination and reduction of human cancer cell lines (Liu *et al*, 2019).

Primarily, saponin in plant helps plant in defending against bacteria and protozoan. The presence of saponins has supported the usefulness of the fruits in managing inflammation. The inhibitory effect of saponins on inflamed cells and its ability of precipitating and coagulating red blood cells have been reported by just et al 1998.

Several health beneficial properties of dietary flavonoids have been recognised for their antioxidant and antiproliferative effects which may protect the human body from various diseases, such as cancers, cardiovascular and inflammatory diseases (Middleton *et al*, 2000).

Generally, the presence of these phytochemicals show that apart from the nutritional benefit derived from date palm, its have some medicinal value.

According to Sharma 2019, and Sheshadri, 1965, Date palm is a good source of polyphenols. Polyphenols are antioxidant compounds that protect the body from inflammation

Table 2 shows the nutritional value of date palm. The result revealed that date palm contain 14% moisture, 11% ash, 5% lipid, 18% carbohydrate, 2% crude fibre and 053% protein. The result on table 3 also indicate that date palm is rich in some valuable minerals for example, significant amount of calcium 1420.15mg/g, 8279.7mg/g, phosphorus 1134.6mg/g, sodium 423.90mg and 11.30mg were detected, but very low proportion of protein. The ash content in the sample is a reflection of the mineral content preserved in that sample. Fibre content of foods helps in digestion process and prevention for cancer (Saldanha, 1995). Crude fiber decreases the absorption of cholesterol from the gut in addition to delaying the digestion and conversion of starch to simple sugars, its also reduce the risk of stomach and colon cancer, an important factor in the management of diabetes (Cust et al., 2009).

The results also showed that date palm is a good source of carbohydrate which may give rise to good source of energy as an adult need about 400 to 500g carbohydrate intake as starch. The carbohydrate content of date palm is normal despite the sweet taste therefore, date palm can serve as a potential sweetener without any side effect or damage that can arise as a result of consuming excess sugar. According to Mirghani, 2021, date palm have low glycaemic index because it is rich in fructose therefore it is less likely to spike the blood sugar level.

CONCLUSION AND RECOMMENDATION

Conclusion

This research confirm that, date palm apart from its nutritional, mineral and phytochemical constituents can serve as a potential sweetener with no side effect. Meanwhile, granulated sugar contains calories but contain no nutrients e,g fat, protien, fiber and other micro nutrients USDA dietary guidelines limiting sugar intake of granulated sugar to 10% of daily calories (Sherreen Lehman, 2024) . Practically, date palm had been used as sweetener in “Kunu” (a local beverage made from tiger nut or millet in Nigeria) in place of sugar. Consumption of sugar has a lot of disadvantages for example its increase blood pressure, hyperglycaemia, inflammation and diabetes. The phytochemical properties exhibited by the studied fruits support the traditional

use in health maintenance. The result is also expected to guide the consumers in area of study, on the nutritional and health benefits of date palm and also to enlighten the people on the need to consume more of natural snacks. This study only provided a preliminary investigation but further studies will investigate the quantitative phytochemical properties, the anti-nutritive properties, heavy metal content and toxicity of the fruits.

Recommendation

Non communicable diseases like diabetes, obesity etc are the major leading diseases ravaging across the globe due to high consumption of sugar, date palm can be harness to produce sweetener in place of sugar to limit the rate of diabetes and unnecessary weight gain because of it low sugar content and some of its nutrients and antioxidants composition. Further research is also necessary especially to ascertain if date palm fruits can actually raise the blood glycaemic index.

REFERENCES

1. AOAC (2018) The Official Method of Analysis . 18th Edition Association of Official Analytical Chemists
2. Adesuyi, A.O., Awosanya, O.A., Adaramola, F.B. and Omeonu, A.I. (2012) nutritional and Phytochemical Screening of Aloebarbadensis. Current Research of Journal Biological Science. 4(1): 4-9.
3. Baranowski, R., Glenn, H. and Sivinski J.(1993). "Biological control of the Caribbean fruit fly (diptera: tephritidac). The florida entomologist. 76(2):245.
4. Barreveld, W.H, (1993) Date palm products. FAO Agricultural Services Bulletin No101. <https://www.fao.org/docrep/t0681e/t0681.e00.h>
5. Bonner, Franklin T. (2008). Chapter 4 storage of seeds (PDF) woody plant seed manual, USDA FS agriculture handbook 727. National seed laboratory, 5675 Riggins Mills Rd, dry branch, GA 31020. Retrieved 2008-06-21.
6. Cheng, J..T and Yang R..S (1998). Hypoglycaemic effect of guava juice in mice and human subjects. America journal of Chinese; 11:74-76.
7. De Boer, H..J. and Contingting, C. (2014). Medicinal plants for women's healthcare in southeast Asia: a meta-analysis of their traditional use, chemical constituents and pharmacology. Jonal of ehtnopharmacology. 151 (2):747-67.
8. Diab, K.A. and Aboul-Ela (2012). In Vivo comparative studies on antigenotoxicity of date palm (Phoenix dactylifera L). pits extract against DNA damage induced by N.Nitroso-N-methylurea in mice. Toxicology international. 19(3):279.2
9. Forbes, R.J (1971) Studies in Ancient Technology vol1. Netherlands E.J Brill Archived from the original on 17 march 2023. Retrieved 20 June, 2015
10. Pulok, K.M. (2002) Quality control of herbal drugs: An approach to evaluation of botanicals .Bussiness Horizon 2002, Botanical chemistry. ISBN: 8190078844,9788190078849.
11. Sharma. G.,Shar,ma, V., Mishra, T.(2019) A systematic review of the characteristics and therapeutic potential of the date palm fruit (phoenix dactylifera) BioTechnologia 100(2): 121-131. Doi 10.5114/bta.2019.85321.
12. Shereen Lehman, M.S. (2024) Granulated sugar nutrition facts and health benefits. Verywell fit. www.verywellfit.com
13. Kubmarawa,D., Mulu, K and Pumah, A.M.(2008) Phytochemical and Antibacterial Activity of Extract from Pakia Clapperotoniana Keay against Human Pathogenic Bacteria. *Journal of Medical Plants Research* 2(12)
14. Latimer, G.W., Kane.F.K., Beine, R.L (2023) Official Method of Analysis of AOAC International. DOI 10.1093/9780197610145.001.0001
15. Macrae, R. Robinson, R.K., Sadler, M.J. (2002). Encyclopaedia of food Science, food technology and nutrition. 2nd edition, academic press-London; 3358-3362.

16. Maehre, H.K., Edvinsen, G.K., Eilertsen, K.E., Elvevoll, E.O. Heat treatment increases the protein bioaccessibility in the red seaweed dulse (*Palmaria palmata*), but not in the brown seaweed winged kelp (*Alaria esculenta*). *Journal of Applied Phycology*. 28: 581-590
17. Middleton, E.J., Kandaswami, C. and Theoharides, T.C. (2000). The effects of plant flavonoids on mammalian cells: implications for inflammation, heart diseases and cancer. *Pharmacology*; 52:67-751.
18. Mirghani Osman Hyder (2021). Date fruits effect on blood glucose among patients with diabetes mellitus: a review and meta-analysis. *Pakistan Journal of Medical Science*. 37(4) 1230-1236. Doi 10.12669/pjms.37.4.4112.
19. Miller, C.J., Dunn, E.V. and Hashim, I.B. (2002). Glycemic index of 3 varieties of dates. *Saudi Medical Journal*. 23 (5):536-8.
20. Morton, J.F. (1987). *Guava. Fruits of warm climates*. Purdue University. Pp. 356-363.
21. Moynihan, P.J., Kelly, S.A., (2014) Effects on caries of restricting sugars intake. Systematic review to inform WHO guidelines. *Journal of Dental Research* 93(1): 1-18.
22. Seshadri, T.R. and Vasishta, K. (1965). Polyphenols of the leaves of *Psidium guajava*: quercetin, guaijaverin, leucocyanidin and amritoside. *Phytochemistry*. 4 (6): 989-92.
23. Liu, Y., Jiabo, M., Xu, L., and Liu, X. (2019) Discrimination of Cervical Cancer Cells Via Cognition Based Features. *Journal of Innovative Optical Health Sciences* 13 (1) Doi 10.1142/s1793545820500017
24. Walid Al-Shahib, Richard, J. and Marshall (2003). The fruit of the date palm: its possible use as the best food for the future. *International Journal of Food Sciences and Nutrition*. 54 (4): 247-259.
25. Waziri, M. and Akinniyi, J.A. (2011). Proximate Value and Mineral content of the shoot of *Borassus aethiopicum* Mart (Giginya). *Journal of Chemical Society of Nigeria*: 36(2): 10-14.
26. WHO 2023, World Health Organisation Reducing free sugars intake in adults to reduce the risk of noncommunicable diseases