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سعادة أ. د. رئيس تحرير المجلة المصرية للدراسات المتخصصة المحترم

جامعة عين شمس، كلية التربية النوعية، القاهرة، مصر

تحية طيبة وبعد،،،

يسر **معامل التأثير والاستشهادات المرجعية للمجلات العلمية العربية (ارسيف – ARCIF)**، أحد مبادرات قاعدة بيانات **"معرفة"** للإنتاج والمحتوى العلمي، إعلامكم بأنه قد **أطلق التقرير السنوي التاسع للمجلات للعام 2024**.

ويسرنا تهنئتكم وإعلامكم بأن **المجلة المصرية للدراسات المتخصصة** الصادرة عن **جامعة عين شمس، كلية التربية النوعية، القاهرة، مصر، قد نجحت في تحقيق معايير اعتماد معامل "ارسيف Arcif"** المتوافقة مع المعايير العالمية، والتي يبلغ عددها **(32) معياراً**، وللاطلاع على هذه المعايير يمكنكم الدخول إلى الرابط التالي: http://e-marefa.net/arcif/criteria/

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كما صُنفت مجلتكم في **تخصص العلوم التربوية** من **إجمالي عدد المجلات (127)** على المستوى العربي ضمن الفئة **(Q3)** وهي الفئة الوسطى ، مع العلم أن **متوسط معامل "ارسيف" لهذا التخصص** كان **(0.649)**.

وبإمكانكم الإعلان عن هذه النتيجة سواء على موقعكم الإلكتروني، أو على مواقع التواصل الاجتماعي، وكذلك الإشارة في النسخة الورقية لمجلتكم إلى معامل **"ارسيف Arcif"** الخاص بمجلتكم.

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Chemical, Physical and Sensory Evaluation of Burdekin Plum Fruits (Pleiogynium solandrei) products

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Abstract

The Burdekin Plum Fruit (Anacardiaceae) is one of the plant remedies with a longstanding history for its curative properties for various ailments and it is one of the richest natural sources of health for human beings. This study aims to Determination of the physico-chemical composition of Burdekin Plum Fruit, evaluation of antioxidant and preparation of functional food products using Burdekin Plum Fruit jams and nectars, the results showed high levels of antioxidants, phenols and flavonoids, high protein and mineral content, vitamin C and high free radical scavenging activity.

Keywords: Burdekin Plum Fruits, Chemical Composition, Physical properties, Burdekin Plum jams and nectars.

ملخص:

العنوان : التقييم الكيميائي ،الفيزيائي والحسى لمنتجات فاكهة البرقوق البورديكين

المؤلفون : اقبال محمود محمد ، هالة راشد عطايا ، هبه عاطف بيومى صالح ، حكمات رمضان منصور يوسف

برقوق بورديكين (Anacardiaceae) أحد العلاجات العشبية ذات التاريخ الطويل، لخصائصه العلاجية لمختلف الأمراض. وهو أحد أغنى المصادر الطبيعية لصحةالأنسان تهدف هذه الدراسة إلى تحديد التركيب الفيزيائي والكيميائي لبرقوق بورديكين، وتقييم مضادات الأكسدة وإعداد منتجات غذائية وظيفية باستخدامة مثل (مربي ونكتار).وأظهرت النتائج أرتفاع محتواه من مضادات الاكسده والفينولات والفلافونويد بجانب أرتفاع محتواه من البروتين والاملاح المعدنيه وفيتامين ج وكان لديه نشاط عالي لمكابحه الجذور الحره

الكلمات الدالة : فاكهة برقوق بورديكين، التركيب الكيميائي، الخواص الفيزيائية، مربى ونكتاربرقوق البوردكين

Introduction

As the global demand for natural and functional food products is growing steadily, there are many opportunities for utilising native plants for a sustainable functional food market (**Richmond *et al,*2019)**. Peaches are considered one of the fruits that contain a very high percentage of nutrients because they are rich in biologically active substances. It also contains various antioxidants, including flavonoids, vitamin C, and pectin (**Hooshmand *et al,* 2009).** It grows naturally in habitats in Australia. The natural environment with moist soil and a moderate climate is considered suitable for growing plums, and it has a very large area. The indigenous people have used plums as food and medicine for thousands of years **(John *et al,* 2019)**.

It helps them follow a diet rich in fiber and carbohydrates, and this diet helps reduce the risk of diabetes, obesity, and heart disease. The reason is that the original Australian plum can provide consumers with health benefits such as antibacterial and antioxidant properties. There are many types of australian Peaches, and the most important of these types is the Burdkin Plum Fruit, the reason is that the Burdekin Plum Fruit can provide consumers with health benefits such as antibacterial and antioxidant properties **(Richmond *et al,* 2019).**

The Burdekin Plum Fruit *Pleiogynium solandri (Anacardiaceae)*, is an evergreen tree indigenous to tropical and subtropical regions, it is known in arabic as gambozia and is cultivated in Egypt as an ornamental plant, which has many synonyms as *Pleiogynium timorense* and *Pleiogynium cerasiferum* (**Said *et al,* 2015).**

The family *anacardiaceae* is a member of the flowering plant order sapindales and contains about 80 genera. There are 870 species in the family characterized as deciduous or evergreen trees, shrubs and woody vines which contain resin ducts in the bark and that exude resins and gums and the fruits of this family are drupes that are fleshy .The family includes one of the most

well known fruit in the world, the mango (*Mangifera indica)*, and the equally well known cashew nut (*Anacardium occidentale)* and pistachio nut (*Pistacia vera*) which have edible fruits and also used in preparation of jellies, jams, and preserves. Many studies have reported on produce functional foods from fresh fruits of Burdekin Plum Fruit to utilise perishable seasonal fruits. They provide nutritional properties and diet diversification to people all throughout the world, and can provide consumers with health benefits, such as antibacterial, antioxidant and anticancer properties (**Sarma *et al*, 2023** and **Li *et al*, 2024)**.

But it is known that the Burdekin Plum Fruit was eaten throughout eastern Queensland. James Murrells, a seaman who survived the shipwreck of the Peruvian in 1846, lived with the Aboriginal tribes at Cape Cleveland, near Townsville, until 1863. He recorded that the Burdekin Plum Fruit was eaten by the tribes in the area and it was called gowan gowan or oolooboo. While, the fruits can be eaten raw when ripe, today they are more frequently used in making jam **(Rozefelds *et al*, 2016).**

While, more research is need to fully explore and confirm these potential benefits, the Burdekin Plum Fruit remains a promising fruit for both nutritional and medicinal purpose. Accordingly, this study aimed utilize the Burdekin Plum Fruit and its natural compounds as antioxidants and Preparation of functional food products.

2- MATERIALS AND METHODS

1.Materials:

1-a-Raw materials

Burdekin Plum Fruit (*Pleiogynium timoriense*) was obtained from Horticulture are research institute , agricultural research center, ministry of agriculture. Sucrose and citric acid were brought from the local whole sale market.

1-b-Preparation of extract

Preparation of Burdekin Plum Fruit extract for Physical properties and chemical composition.

Burdekin Plum Fruit was ripe fruits free from blemishes were harvested from trees, fruits were rinsed with tap water and cloth dried, cored and vacuum-packed in polyethylene bags and stored at18 before use. Then, they were analyzed according to the method described by **(Chen *et al*, 2024).**

2.Methods

2-a-Physical properties and chemical composition

Total soluble solids (TSS), Total solids (TS), pH value, acidity (% malic acid), moisture, ash, crude protein, crude lipid, crude fiber, total sugars, reducing sugars and non-reducing sugars of Burdekin Plum Fruit were determined according to the methods described in**(A.O.A.C, 2005).**Vitamin C (Ascorbic acid) was quantitatively determined by 2, 6-dichlorophenol indophenol dye method according to **(Ranganna, 1977).** Total antioxidant capacity was carried out according to the method described in **(Hu *et al*, 2003).** All analyses were done in triplicates and results were expressed on average basis**.**

2-b-Mineral content of Burdekin Plum Fruits

Mineral content was determined according to **(A.O.A.C, 2005)** using atomic absorption spectrophotometer (Perkin–Elmer, Model 3300, USA).

2-c-Analysis of total phenol and total flavonoid contents

Total phenols was determined according to the method of **(Singleton and Rossi, 1965)** and total flavonoids was measured using colorimetric assay developed by **(Sathishkumar *et al*, 2013)** as described in **(Muthukumaran *et al*, 2018).**

2-d-Viscosity and Texture measurement

Viscosity, was measured at 25 ± ºC using Brookfield viscometer model DV-III Rheometer using spindle No. 7 for

Burdekin Plum jam and Burdekin Plum nectar. The viscosity was expressed as centipoises **(Sathishkumar *et al*, 2013)**.

Texture measurement, was shear force (Lb/Sqin) was measured by determination the firmness of fresh and dehydrated plums samples using testing machine model No. AIM.339.3 (Larga, florida 33543, UISA) equipped with AIM desktop micro-computer (A65-50 series), SERIAL No. 91488012. Each sample was sheared with special cutter (1.0 mm thickness and 6.5 mm wide), then firmness was measured according to the method described by **(Greaves *et al*, 1982).**

2-e-Rehydration ratio

The method recommended by **(Von-Loesecke, 1955)** was used. Ten grams of dried fruit were placed in 600 ml beaker and a definite volume (100 ml) of tap water was added, covered by watch glass. Boiling was brought within 3 minutes and continued for 30 min. The contents were then transferred to a buchner funnel and left for one minute before weight.

Rehydration ratio was expressed as the ratio between the drained weight of the rehydrated sample and the weight of dehydrated sample according to the following equation:

$$\text{Rehydration ratio} = \frac{Weight\ of\ rehydrated\ fruits}{Weight\ of\ dehydrated\ fruits}$$

2-f-Fractionation and identification of phenolic compounds of the Burdekin PlumFlesh samples by HPLC.

Identification and quantitative analysis of phenolic compounds in all Burdekin Plum Flesh tested samples were carried out by HPLC according to the method described by **(Park *et al*, 1998).**

A HPLC agilent 1200 series was equipped with quaternary pump, auto sampler, solvent degasser, column compartments ET at 35°C, multi wavelength detector set at 330 nm, 280 nm for detection of flavonoid compounds and phenolic compounds,

respectively. The column used for fractionation Zorbax OD. 4.6x250 mm and the flow rate was 1 ml/min.

2-g--Production of jam and nectar from Burdekin plum Flesh.

2-g-I- Production of jam.

Burdekin Plum Fruit were cut into small cubes. The cubes were cooked (100 ºC for 5 min.) in batches of 2 kg of Burdekin plum fruit Flesh with 250 ml of water in open steel kettles with manual stirring. Sucrose was added to fruit in a ratio 1.25:1 (w:w) with continuous heating and stirring to give to total soluble solids content of 68% in the jam, citric acid was added as 3gm/kg of sucrose during cooking. Jam was cooled up to 80 ºC, poured into jars and sealed, then stored for 9 months at room temperature (25ºC). The analysis was carried out every 2 months. **(Ali, 1998).**

2-g-II - Production of nectar:

After preparation, Burdekin Plum Flesh and Plum fruits (Each type of fruit separately) were cut into small cubes and the juice was mechanically extracted with a blender by adding water. Sugar was added to raise TSS to 16%. The nectar temperature was elevated to 82 ºC for 2 minutes then it was bottled in sterilized glass bottles, tightly closed , pasteurized at 90 ºC for 2 minutes and immediately cooled with current tap water according to the method described by **Dyab, (2003).**

Burdekin Plum jams and nectars were stored for 6 months at room temperature (25±5°C) and in the refrigeration (4±1°C).

All samples were analysed for physical, chemical, and microbiological properties at zero time and every 2 months till the end of storage period .The sensory evalution was carried out at zero time.

2-g-III - Storage conditions:

All dried, jam and nectar samples were stored 0-6 months

under the following conditions:

- **Temperature**: Dried and jam samples stored at room temperature (25 ºC ±2), nectar stored away in refrigeration at 6 ºC.
- **Relative humidity**: It was average 85% in the refrigerator and 68% in the storage at room temperature.
- **Packaging**: Dried fruits were packaged in polyethylene. While jam in glass jars and nectar in glass bottles.

2-g-IV- Sensory Evaluation

Sensory evaluation of the jam and nectar samples were conducted as described by **(Iwe, 2002).**

Statistical analysis for Sensory evaluation

The obtained data from all the analyses were exposed to the analysis of variance in the study by using IBM SPSS Statistic 19.0 software (IBM Corporation, Somers, NY, USA). Duncan's multiple range tests at ($p \leq 0.05$) level were used to compare between means.

Statistical analysis

Results were presented as mean ±SE and analyzed by one-way analysis of variance (ANOVA) and Duncan's test ($P \leq 0.05$) were used to establish the significance of differences. The result was performed using the SPSS software version 26 program.

3-Results and Discussion

1. Physical properties of Burdekin plumFruit, Burdekin Plum jam, and Burdekin Plum nectar

A physical property of Burdekin Plum Fruit was determined of viscosity, firmness and rehydration ratio.Table (1) showed that the viscosity were determined for Burdekin plum fruit, Burdekin Plum jam, and Burdekin Plum nectar. The results showed that the viscosity of Burdekin Plum Fruit was 24.0 cm^2/s while was 42.80 cm^2/s for Burdekin Plum jam. The results of

viscosity was 36.0 Burdekin Plum nectar. Those results were in agreement with the results reported by (**Pathare *et al*, 2013 and Li *et al*, 2016).**

Table (1): Physical properties of Burdekin Plum Flesh , Burdekin Plum jam, and Burdekin Plum nectar cultivars

Properties / samples	Viscosity cm^2/s	Firmness(N)	Rehydration ratio%
1- Burdekin Plum Fruits	24.0±0.07	28.29±0.21	1.33±0.18
2- Burdekin Plum Jam	42.80±0.13	---	2.04±0.06
3- Burdekin Plum Nectar	36.0±0.03	32.68±0.10	---

Mean± standard error of three independent determinations

The same table illustrated that also the firmness of Burdekin Plum Flesh cultivar firmness was high, and showed that rehydration ratio of Burdekin Plum Flesh was1.33% and 2.04 %, respectively. These results are in agreement with those reported by **(Mai et al, 2021 and Chen et al, 2023)**, who found that firmness N of the Burdekin Plum Flesh were ranged from approximately 28.5-42.0 N .

2. Chemical composition of Burdekin Plum Flesh on (dry weight basis%)

There are many factors affecting the chemical composition of Burdekin Plum Fruit such factors can be related to variation in type and organic compounds of the soil , climatic and environmental conditions such as light intensity, temperature ,water availability, and as well as its changes during storage **(Pott *et al*, 2020).**

The chemical composition of Burdekin Plum Fruit was determined and the obtained results are shown in Table (2). The moisture content 76.8 g/100 g FW and is slightly relatively high than that reported **(Chen *et al*, 2023),** who reported The moisture content ranged from approximately 67 to 74 g/100 g FW, while lower than the reported by **(Pottet *et al*, 2020)** who found that moisture content usually around 85% or higher).

Protein and fat were relatively low 0.7 g/100 g FW and 1.3 g/100 g FW.Those results were in agreement with the results reported by **(Chen *et al,* 2023).**who found that Protein and fat were ranging between 0.5–1.7 g/100 g FW and 0.6–1.8 g/100 g FW, respectively.

As for the dietary fiber content the results agreed with (**Chen *et al,* 2023)** who recorded that The dietary fiber content ranged from approximately 6 to 10 g/100 g FW, However, it was considerably higher than that in cultivated plums, mangos and grapes (1–2%) **(Brand-Miller *et al,* 1998)**. It is noteworthy that, Burdekin Plum Fruit can be considered an excellent source of fiber as one serving can provide more than 6 g dietary fiber **(Dhingra *et al,* 2012)**.

The pH and titrimetric acidity values were 3.2 and 3.5%, respectively. Those results were in agreement with the results reported by **(Chen *et al,* 2023)** who found that pH ranged from 2.8 to 3.8% and recorded that the acidity value ranged from 2.9 to 4.6%.

It could be also noticed from the same table that the total soluble solids were 10.9% **(Chen *et al,* 2023)** gave similar result of the total soluble solids being 10.7 to12.5%. An increase in TSS in fruits is usually correlated to a better (sweeter) taste **(Bhagyalakshmi *et al,* 2002).**This is caused by soluble sugars generated by hydrolysis of polysaccharides including pectin and starch **(Yashoda *et al,* 2006 and Magwaza *et al,* 2015).**

Burdekin Plum Fruit has higher quantities of vitamin C than a majority of other fruits 53.3 mg/100g , These result is in accordance with those reported **(Savic *et al,* 2021 and Li *et al,* 2024)**. But vitamin C levels change seasonally, with the maximum levels of vitamin C observed in the fruit during the hot summer months, suggesting that temperature influences ascorbic acid production during fruit growth (**Li *et al,* 2024).**

Table (2): Chemical composition of Burdekin Plum Flesh on (dry weight basis%)

Properties	Burdekin Plum Flesh
Moisture	76.8 ±0.12
Ash	1.3 ±0.15
Protein	0.7 ±0.10
Fat	1.3 ±0.07
Crude fiber	6.7 ±0.21
Total carbohydrates	13.2 ±0.62
Total sugars	50.7 ±0.31
Reducing sugars	43.1 ±0.11
Non-reducing sugars	7.6 ±0.13
T.S.S.	10.9 ±0.33
pH	3.2 ±0.18
Total acidity	3.5 ±0.22
Vitamin C mg/100g	53.3 ±0.41

Mean± standard error of three independent determinations

Minerals content of Burdekin Plum Flesh (mg/100g)

Minerals are an essential part of the human diet and crucial for maintaining a condition of good health. They are vital for the functionality of vitamins and enzymes and partly also influence each other in their roles. An imbalanced relation of the individual minerals plays a major role with regards to cancer and heart attacks. Minerals contribute to the overall positive influence of Burdekin Plum Flesh **(Li *et al*, 2024).**

From table (3), it could be noticed that the concentration of potassium, calcium, magnesium and phosphorus were 561.42, 341.28 , 96.21 and 68.95 mg/100g , respectively. The sodium gave a low content of 55.07 mg/100g. Magnesium is in bones, soft tissue and in all compartments of cells performing many cellular reactions and involved in at least 300 enzymatic steps in metabolism , and serves several metabolic functions and plays an important role in the production and transport of energy. It is also helpful in muscle contraction and relaxation. This mineral is involved in protein synthesis and participates in the functioning of certain enzymes **(Strain *et al*, 2009 and Pohl *et al*, 2013).** On the other hand Phosphorous is critically important and is mostly

found in bone with some in soft tissue and in the phospholipids of erythrocytes and plasma lipoproteins (**Strain *et al*, 2009).**

As for the micro elements, iron was the highest component (18.23 mg/100g) followed by zinc (7.63 mg/100g), manganese (3.68 mg/100g) and the lowest was copper (2.96 mg/100g) . The present data were in agreement with the results of **(Fyfe *et al*, 2020).**

Table (3): Minerals content of Burdekin Plum Flesh on (dry weight basis mg/100g).

Elements	Concentrations
Macro Elements	
K	561.42±0.06
Ca	341.28±0.21
Mg	96.21±0.13
P	68.95±0.11
Na	55.07±0.19
Micro and Trace Elements	
Fe	18.23±0.23
Zn	7.63±0.26
Mn	3.68±0.15
Cu	2.96±0.14

Mean± standard error of three independent determinations.

3. Total antioxidant composition on (dry weight basis mg/100g)

It is well known that the antioxidant activity of plant chemicals is responsible for their protective activity against inflammatory diseases, cancer, cardiovascular diseases and diabetes **(Al-Sayed *et al*, 2010).**

Results obtained are showed in table (4) we can see basic Burdekin Plum fruit antioxidant composition parameters on fresh weight basis had higher content of total phenoles 163.59 mg/100g, total flavonoides 93.16 mg/100g, total carotenoid 2.13 mg/100g, total antihocyanin 42.53 mg/100g and antioxidant capacity 82.87% while antioxidant activity with DPPH was 79.47% **(Netzel *et al*, 2006).**

As for the antioxidant composition parameters on dry weight basis had content of total phenoles , total flavonoids , total carotenoid , total antihocyanin and antioxidant activity with DPPH were 1020.87 , 632.82,13.42 ,309.18 mg/100g , and 68.31% respectively. The present data were in agreement with the results of (**Netzel *et al*, 2006 and Al Sayed *et al*, 2010)** who indicated that the Burdekin Plum Fruit is a potential source of antioxidant compounds. This finding, is important from a nutritional point of view, because the extract may induce beneficial health effects due to its high antioxidant properties, and thus may be used as a dietary supplement for the prevention of chronic diseases.

Table (4): Total antioxidant composition on (dry weight basis mg/100g)

Properties	Burdekin Plum Flesh
Total phenols	1020.87±0.19
Total flavonoids	632.82±0.08
Total carotenoids	13.42±0.12
Total anthocyanin	309.18±0.06
Total antioxidant capacity %	82.87±0.10
Antioxidant activity DPPH %	68.31 ±0.16

Mean±standard error of three independent determinations

4. Fractionation and identification of phenolic compounds in Burdekin Plum Flesh by HPLC(mg/100g)

Phenolic compounds are the principle antioxidant constituents of natural products and are composed of phenolic acids and flavonoids that act as potent radical terminators **(Kahkonen *et al*, 1999).** The antioxidant activity of phenolic compounds is due to their redox properties, which can play a major role in neutralizing free radicals, quenching singlet oxygen or decomposing peroxides **(Rice-Evans and Miller, 1996).**

The phenolic compounds of Burdekin Plum Flesh were separated and identified by HPLC by many scientists **(Johnson *et al*, 2022)** Found 30 phenolic compounds in the Burdekin plum flesh and seed extracts **(Raoof *et al*, 2020)** Found10 phenolic compounds in the seeds of Burdekin Plum Flesh but **(Raoof *et al*,**

2020) Found17 phenolic compounds in the bark of Burdekin Plum Flesh, while **(Chen *et al*, 2024)** Found12 phenolic compounds in the puree, leather and stored leather of Burdekin Plum Flesh.

Results in Table (5) showed the phenolic compounds (mg/100g) of Burdekin Plum Flesh ethanolic extract by high performance liquid chromatography (HPLC). In the present study 26 phenolic compounds were detected confirming that the Burdekin Plum Flesh extract is a natural source of antioxidant compounds.

The major components of Burdekin Plum Flesh were chlorogenic acid (22.91),catechin (19.16), pyrogallol (18.8),and protocatechuic (17.22 mg/100g). The results were in agreement with **(Johnson *et al*, 2022 and Chen *et al*, 2024).**

The antioxidant activity of Burdekin Plum Flesh may be attributed to the presence of a variety of phenolic compounds in quite high concentration. These include flavonol glycosides, flavonol aglycones.

Phenolic acids and hydrolysable tannins. All of these natural metabolites have been reported to have high free-radical scavenging activity **(Netzel *et al*, 2006).** Further testing is required to determine the toxicity, bioavailability and *in vivo* bioactivity of Burdekin Plum Flesh total extract as well as its isolated compounds **(Al Sayed *et al*, 2010).**

Table (5) :Fractionation and identification of phenolic compounds in Burdekin Plum Flesh by HPLC(mg/100g)

Compounds (mg/100g)	Burdekin Plum Flesh
Pyrogallol	18.8±0.21
Gallic acid	12.80±0.11
4-Amino benzoic acid	10.7±0.61
Protocatechuic	17.22±0.91
Oleuropein	14.3±0.23
3-Hydroxy tyrosol	11.5±0.17
Chlorogenic acid	22.91±0.16
Epi- catechin	15.8±0.18
Catechin	19.16±0.31

Catechol	7.3±0.25
Caffeine	12.8±0.31
P-OH-Benzoic acid	3.8±0.17
Vanillic acid	12.6±0.43
Caffeic acid	16.3±0.24
p-Coumaric acid	13.8±0.31
Ferulic acid	10.1±0.16
Iso Ferulic acid	9.1±0.19
Resveratrol	9.9±0.09
Ellagic acid	3.3±0.24
E-vanillic acid	13.4±0.18
Alpha Coumaric acid	5.6±0.25
Benzoic acid	8.9±0.36
Coumarin	7.82±0.34
Salycilic acid	3.7±0.23
Cinnamic acid	12.2±0.17

Mean± standard error of three independent determinations

5. production of functional products from Burdekin Plum Fruit

Burdekin plum Fruit has gained more attention over the last decade due to its reputable, medicinal, pharmaceutical health benfits and food properties this have led to suggest potential utilization in processed food product.

Currently, there is an increasing interest in the use of Burdekin Plum Fruit in food processing industries. Burdekin Plum Fruit is presently used for manufacuring of different fruit and milk based functional food like jam,jelly,candy, beverages,ice cream, yoghurt etc.. **(Rozefelds *et al,* 2016).**

In the course of our study on Burdekin Plum Fruit products , we deal with the production of functional Burdekin plum nectars and jams with high therapeutic and nutritional value .The samples were analyzed to evaluate the quality attributes and storage efficiency by determining the physical, chemical and microbial properties.

Results concerning processing are cited in tables (6-14).

6-a. Chemical composition percent of Burdekin Plum jam and nectar

The chemical properties are important in jam and nectar products because it affects their shelf life and plays an important role in the flavor attribute thus affecting the quality of the products.

Table (6) showed there results of chemical composition of Burdekin Plum jam and nectar (on dry weight basis) the moisture, ash, protein, fat, Crude fiber, total carbohydrates, total sugars, reducing sugars, T.S.S., total acidity ,total antioxidant , total phenolics and total flavonoids values were 37.39% , 2.85 , 2.35 ,1.18, 4.55, 62.48, 57.70 , 34.12 , 68.80, 2.60, 30.32 ,12.43 and 19.23 % respectively for Burdekin Plum jam while Burdekin Plum nectar values were 80.20%, 2.39, 2.28 , 1.45, 5.36, 60.90, 52.51, 43.80, 21.50, 3.46, 45.22, 14.53 and 22.64% respectively.

Table (6): Chemical composition percent of Burdekin Plum jam and nectar samples on (dry weight basis g/100g)

Parameters (%)	Burdekin Plum jam	Burdekin Plum nectar	F	P value
Moisture	37.39	80.20	11.70	<0.001
Ash	2.85	2.39	30.11	<0.001
Protein	2.35	2.28	19.0	<0.001
Fat	1.18	1.45	79.43	<0.001
Crude fiber	4.55	5.36	17.78	<0.001
Total carbohydrates	62.48	60.90	11.00	<0.001
Total sugars	57.70	52.51	12.32	<0.001
Reducing sugars	34.12	43.80	03.21	<0.001
Non-reducing sugars	23.58	8.71	19.11	<0.001
T.S.S.	68.80	21.50	12.21	<0.001
Ph	3.30	4.62	14.48	<0.001
Total acidity	2.60	3.46	02.78	<0.001
Total antioxidant	30.32	45.22	13.34	<0.001
Total phenolics	12.43	14.53	31.25	<0.001
Total flavonoids	19.23	22.64	19.14	<0.001

*Data were expressed as mean ± SD, P ≤0.05 is significant

data having the same letter in the same variable are statistically similar

6-b.Effect of storage period on pH values of Burdekin Plum jam and nectar samples

pH and acidity are important parameters in food quality because it reveals the spoilage and the fermentation of food. Table (7) showed the pH values of Burdekin Plum jam and nectar samples during storage for 6 months. A non- significant slight increase could be observed in pH values of all samples during storage for (6 months) **Rozefelds *et al*, 2016).**

These results were noted for both storage temperature (room and refrigeration). It could be noticed that no fermentation occurred indicating a preservative effect of Burdekin Plum jam and nectar samples. Burdekin Plum jam had a pH of 3.30 that reached 3.34 at ambient temperature and 3.32 in the refrigeration after 6 months of storage .The same trend was noticed for the pH of nectars as for the pH of jams. The storage did not affect the pH value that was nearly constant at approximately 4.6 in all nectar tested samples and under different storage conditions.

Table (7): Effect of storage period on pH values of Burdekin Plum jam and nectar samples

pH of Burdekin Plum jam and nectar samples							
Storage period Samples	Zero time	Room temp.			Refrigeration		
		After 2 month	After 4 months	After 6 months	After 2 month	After 4 months	After 6 months
Jam	3.30Aa ±0.14	3.30Aa ±0.21	3.33Ab ±0.32	3.34Ac ±0.51	3.30Aa ±0.14	3.31Ab ±0.26	3.32Ab ±0.82
Nectar	4.61Aa ±0.17	4.62Aa ±0.53	4.63Ab ±029	4.64Ac ±0.27	4.61Aa ±0.34	4.62Aa ±0.24	4.63Ab ±0.34

Different letters denote statistical significance (P≤0.05)

6-c. Effect of storage period on TSS of Burdekin Plum jam and nectar samples.

TSS was non significantly affected during storage (6 months), only slight increase was observed in all samples either at room temperature or in the refrigeration table (8).

The TSS were around 68.80% in all jam samples and reached 68.82 % (6 months) after recording an initial value of

68.84% at room temperature and it was nearly constant at approximately 21.50% in all nectar tested samples and under different storage conditions.

Total soluble solids are one of the important quality attributes usually measured as an indicator of quality. The increase in TSS during storage is probably due to conversation of insoluble constituents to soluble ones i.e inversion of polysaccharides into simple soluble molecules **(Vidic *et al*, 2014**).

Table (8): Effect of storage period on TSS values of Burdekin Plum jam and nectar samples

TSS of Burdekin Plum jam and nectar samples							
Storage period Samples	Zero time	Room temp.			Refrigeration		
		After 2 month	After 4 months	After 6 months	After 2 month	After 4 months	After 6 months
Jam	68.80Ba ±0.20	68.81BA ±0.19	68.82Ba ±0.44	68.84Bb ±0.32	68.80Ba ±0.22	68.81Ba ±0.30	68.82Ba ±0.53
Nectar	21.50Aa ±0.20	21.51Aa ±0.39	21.53Ab ±0.23	21.54Ab ±0.42	21.51Aa ±0.29	21.51Aa ±0.18	21.53Aa ±0.39

Different letters denote statistical significance (P≤0.05)

6-d. Effect of storage period on total phenolics of Burdekin Plum jam and nectar samples.

Table (9) illustrated the effect of storage on the phenols of jam and nectar samples . The content of phenol compounds was in Burdekin Plum jam (12.45 mg/100g) and (13.45 mg/100g) in nectar sample . During storage, a reduction occurred in all samples noting that this decrease was higher in room temperature than in the refrigerator. At the end of storage, the phenolics of Burdekin Plum jam and nectar gave values of 7.62 and 9.08 mg/100g (room temperature) while gave values of 8.75 and 10.63 mg/100g (refrigeration).

Those results indicate the benefits of adding Burdekin Plum to food products and prove their role in maintaining the quality. **(Rozefelds *et al*, 2016).**

Table (9): Effect of storage period on Total phenolics of Burdekin Plum jam and nectar samples

Total phenolics of Burdekin Plum jam and nectar samples							
Storage period Samples	Zero time	Room temp.			Refrigerator		
		After 2 month	After 4 months	After 6 months	After 2 month	After 4 months	After 6 months
Jam	12.43Aa ±0.18	12.45Ac ±0.34	10.62Ba ±0.19	7.62Bc ±0.33	11.76Cb ±0.52	10.65Ab ±0.17	8.75Ac ±0.29
Nectar	14.53Aa ±0.22	13.45Ac ±0.17	11.78Bb ±0.33	9.08Ca ±0.29	13.15Cc ±0.54	11.95Ab ±0.19	10.63Ba ±0.30

Different letters denote statistical significance (P≤0.05)

6-e.Effect of storage period on total flavonoids of Burdekin Plum jam and nectar samples.

The effect of storage period on total flavonoids of Burdekin Plum jam and nectar samples was tabulated in table (10).

The study confirmed that the flavonoids decreased throughout the entire period of storage in all tested samples and in both storage conditions.

The total flavonoids in jam recorded a value of 13.52 in ambient room temperature and 16.12 in the refrigeration noting that the initial value was 19.23 mg/100g.

As for nectar, the decrease was 16.76% and 19.87% for the samples stored at room temperature and in the refrigeration, respectively.

It is worthy to mention that Burdekin Plum protected the content of flavonoids in the blends although its value was low. This might be due, as previously stated, to the presence of greater variety; quantity and abundance of phytochemical compounds in Burdekin Plum which cause a synergistic effect that retain the quality of the products. **(Bhagyalakshmi *et al*, 2002)** confirmed the decrement of total flavonoids during the storage period.

Table (10): Effect of storage period on Total flavonoid of Burdekin Plum jam and nectar samples

Total flavonoids of Burdekin Plum jam and nectar samples							
Storage period Samples	Zero time	Room temp.			Refrigeration		
		After 2 month	After 4 months	After 6 months	After 2 month	After 4 months	After 6 months
Jam	19.23Aa ±0.21	17.87Ac ±0.29	15.81Bb ±0.33	13.52Ca ±0.45	11.65Cc ±0.42	18.07Ab ±0.19	16.12Ba ±0.19
Nectar	22.64Aa ±0.17	20.86Ac ±0.26	18.28Bb ±0.47	16.76Ca ±0.51	14.59Cc ±0.32	21.43Ab ±0.18	19.87Ba ±0.41

Different letters denote statistical significance (P≤0.05)

6-f.Effect of storage period on total antioxidant of Burdekin Plum jam and nectar samples.

The Results given in table (11) presented the effect of storage on antioxidant activity of Burdekin Plum jam and nectar samples.

The obtained results revealed a decrease in antioxidant activity especially at ambient temperature during storage in all tested samples.

The antioxidant activity of Burdekin Plum jam gave values of 12.24% after 6 months of storage at room temperature and 20.05% in the refrigeration, while it reached 19.15 and 26.96% at the end of storage at room temperature and in the refrigerator, respectively.

Table (11): Effect of storage period on Total antioxidant of Burdekin Plum jam and nectar samples.

Total antioxidant of Burdekin Plum jam and nectar samples							
Storage period Samples	Zero time	Room temp.			Refrigeration		
		After 2 month	After 4 months	After 6 months	After 2 month	After 4 months	After 6 months
Jam	30.32Aa ±0.21	26.67Ac ±0.23	19.35Bb ±0.41	12.24Ca ±0.38	7.85Da ±0.17	27.31Ab ±0.62	20.05Ba ±0.17
Nectar	45.22Aa ±0.17	33.78Ba ±0.27	25.99Cb ±0.37	19.15Da ±0.22	13.78Ea ±0.42	34.92Ba ±0.22	26.96Ca ±0.32

Different letters denote statistical significance (P≤0.05)

6-g.Effect of storage period on reducing sugars, non-reducing sugars and total sugars of Burdekin Plum jam and nectar samples.

Table (12) showed the effect of storage period on reducing , non-reducing and total sugars in jam and nectar samples. Results showed a decrease in non-reducing and total sugars with a simultaneous increase in reducing ones in all tested samples either stored at room temperature or refrigeration. This phenomenon could be explained by the known reaction which usually occurs under acitic condition within storage period especially at ambient temperature,where non-reducing sugars are inverted to reducing ones **(Sommano *et al*, 2013)**.

From the aforementioned tables, it could be indicated that the initial reducing, non-reducing and total sugars in Burdekin Plum jam were 35.60 , 19.82 and 55.42 mg/100g , respectively after one 2 month at room temperature, while at the end of storage it reached 40.63 , 13.91 and 54.54 mg/100g , respectively . On the other hand, Burdekin Plum jam stored in the refrigerator recorded for reducing , non-reducing and total sugars values of 35.75 , 19.70 and 55.45 mg/100g, respectively, while they became 40.82,13.47and 54.29 mg/100g , respectively after 6 months at the same storage conditions. From the same tables, it could be noticed that slightly increased reducing sugars in nectar samples where it increased to 40.36 mg/100g after the storage period in the refrigeration and 40.27mg/100g at room temperature. Those results are in agreement with those reported by (**Courtney *et al*, 2015 and Rozefelds *et al*, 2016).** It could be noted that when browning take place during storage period, it might mainly be due to the non-enzymatic reaction of sugars and amino acids leading to the formation of brown pigment (Maillard reaction).

Table (12): Effect of storage period on Reducing sugars , Non reducing sugars and Total sugars of Burdekin Plum jam and nectar samples.

Room temperature									
Storage period Samples	2 month			4 months			6 months		
	Reducing sugars %	Non reducing sugars %	Total sugars %	Reducing sugars %	Non reducing sugars %	Total sugars %	Reducing sugars %	Non reducing sugars %	Total sugars %
Jam	35.60Cb ±0.81	19.82Cb ±0.51	55.42Cc ±0.73	38.43Cc ±0.17	16.40Ac ±0.73	54.83Ac ±0.24	40.63Bb ±0.17	13.91Ca ±0.73	54.54Bb ±0.73
Nectar	35.76Ac ±0.53	19.89Cb ±0.23	55.65Ca ±0.34	38. 55Cb ±0.19	16.18Ba ±0.33	54.73Bb ±0.75	40.27Ca ±0.43	14.07Ba ±0.23	54.34Cc ±0.17
Refrigeration									
Storage period Samples	2 month			4 months			6 months		
	Reducing sugars %	Non reducing sugars %	Total sugars %	Reducing sugars %	Non reducing sugars %	Total sugars %	Reducing sugars %	Non reducing sugars %	Total sugars %
Jam	35.75Ac ±0.33	19.70Cc ±0.72	55.45Cc ±0.63	38.77 Bc ±0.23	15.97Ca ±0.19	54.74Ca ±0.24	40.82Ab ±0.54	13.47Cc ±0.32	54.29Cc ±0.54
Nectar	35.78Ab ±0.22	19.81Cc ±0.31	55.59Cb ±0.43	38. 51Cb ±0.67	16.61Aa ±0.27	54.76Ca ±0.08	40.36Bc ±0.13	14.11Ba ±0.26	54.47Cb ±0.15

Different letters denote statistical significance (P≤0.05)

6-h. Effect of storage period on microbial count of Burdekin Plum jam and nectar samples.

Table (13) The total bacterial count mold and yeast in jam and nectar samples were investigated during storage at room temperature or in the refrigerator. For jam products , results indicated that no microbial growth occurred in all samples either at room temperature or on the refrigerator until the end of storage for (6 months), except slight growth appeared after 6 months of storage at room temperature.

Concerning nectars, it could be observed that yeast and mold were absent in all samples during storage for 6 months under both storge conditions. Bacterial growth was detected after 4 months in nectars then increased gradually during storage. It increased from 1.5 to 3.2 cfu/ml at room temperature and 0.7 to 5.4 cfu/ml on the refrigerator .This activity might be attributed to anumber of pharmacologically active compound including tannins , saponins , alkaloids , Anthraquinone, polysaccharide, flavonoids and phenols…etc working in synergism and having a direct microbial activity, **(Raoof *et al*, 2021).** According to the presented results , Burdekin Plum Fruit could represent a new

source of potent antimicrobial , nontoxic and less expensive remedy and it could also be used as a natural preservative in food processing.

Table (13): Effect of storage period on microbial count of Burdekin Plum jam and nectar samples.

Room temp								
Time	0 month		2 months		4 months		6 months	
Samples	Total count	Mold &Yeast	Total count	Mold &Yeast	Total count	Mold &Yeast	Total count	Mold &Yeast
Jam	Nd	Nd	Nd	Nd	Nd	Nd	1.8	Nd
Nectar	Nd	Nd	Nd	Nd	1.5	Nd	3.2	Nd
Refrigeration								
Jam	Nd	Nd	Nd	Nd	Nd	Nd	Nd	Nd
Nectar	Nd	Nd	Nd	Nd	0.7	Nd	5.4	Nd

6-i. Sensory evaluation of Burdekin Plum jam and nectar samples.

The data of Burdekin Plum jam and nectar sensory evaluation were illustrated in table (14), the data of Burdekin Plum jam and nectar sensory evaluation were illustrated in table (14). It could be noticed, that the highest score of colour was given to Burdekin Plum jam and nectar with a score of (10) followed by control 1 (Plum jam) with a score of (8) , the lowest preference was for control 2(Plum nectar) with a score of (7).

The best flavour was scored for Burdekin Plum jam with a score of (9.5) followed by Burdekin Plum nectar (9) then came control 1 (Plum jam)and control 2(Plum nectar) having a similar value of (8.5). Colour as well as odour is important factors in the determination of consumer preference. Burdekin Plum nectar recorded the best score for odour (9.5) .All the remaining samples gave a value of (9). Concerning the overall acceptability Burdekin Plum jam and nectar were superior then other samples, they had a score of (10) followed by control (Plum jam) and control 2(Plum nectar) having a similar value of (9). It could be concluded that Burdekin Plum jam and nectar improved all characteristics of sensory evaluation. Generally, Burdekin Plum jam and nectar were highly accepted by panelists.

Table (14): Sensory evaluation of Burdekin Plum jam and nectar

Samples	Characteristics				
	Colour	Flavour	Odour	Taste	Overall acceptability
control	8c± 1.19	8.5aB± 1.27	9c± 1.77	8bA± 1.24	9c± 1.49
Control 2	7bA± 1.37	8.5aB± 1.47	9aB± 1.26	9aB± 1.70	9aA ± 1.51
Jam	10 aB± 1.70	9.5aB± 1.33	9aB± 1.09	9aB± 1.02	10aB± 1.73
Nectar	10aB± 1.02	9aB± 1.27	9.5c± 1.77	8bA± 1.24	10c± 1.49

Values are means ± S.D for 10 determinations Means ± S.D with same alphabetical superscript along the same column are not significantly different

Control 1: plum jam Control 2: plum nectar

5-Conclusion

In conclusion, Burdkin Plum products were the most successful products, because they contain a high percentage of proteins, sugars, minerals, vitamin C antioxidants, phenols, flavonoids and dietary fibers with high acceptance in general of the products, and therefore represent a functional food rich in many benefits.

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