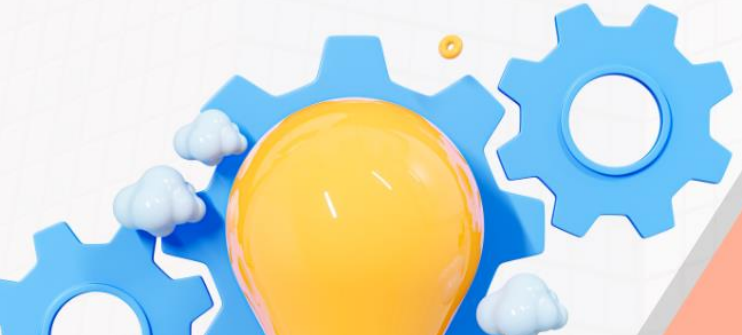
4TH EDITION

E-EXTENDED

ABSTRACT

INTERNATIONAL AGROTECHNOLOGY INNOVATION SYMPOSIUM (i-AIS)



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ABOUT FACULTY OF PLANTATION AND AGROTECHNOLOGY

The Faculty of Plantation and Agrotechnology was established in 2010 at Universiti Teknologi MARA (UiTM). The mission of the faculty is to play the vital role of producing well-trained professionals in all areas of plantation and agriculture-related industries at national and international levels.

Bachelor of Science (Hons) Plantation Technology and Management is a three-year program that strongly emphasizes the various aspects of Production Technology, Management, and Information Technology highly sought after by the agricultural and plantation sectors. Students in this program will be fully trained to serve as professionals in the plantation sector and related industries. They will have ample opportunities to fulfill important positions in the plantation industry such as plantation executives. This program provides a strong balance of technology and management courses essential for the plantation industry such as management of plantation crops, soil fertility, plantation management operation, plantation crop mechanization, and agricultural precision. As an integral part of the program, students will be required to undergo industrial attachment to gain managerial skills in the plantation industry.

The faculty is highly committed to disseminating, imparting, and fostering intellectual development and research to meet the changing needs of the plantation and agriculture sectors. With this regard, numerous undergraduate and postgraduate programs have been offered by the government's intention to produce professionals and entrepreneurs who are knowledgeable and highly skilled in the plantation, agriculture, and agrotechnology sectors.

PREFACE

International Agrotechnology Innovation Symposium (i-AIS) is a platform to be formed for students/lecturers/ staff to share creativity in applying the knowledge that is related to the world of Agrotechnology in the form of posters. This virtual poster competition takes place on the 1st of December 2022 and ends on the 8th of January 2023. This competition is an assessment of students in determining the level of understanding, creativity, and group work for the subject related to agrotechnology and being able to apply it to the field of Agrotechnology. The i-AIS 2022 program takes place from December 1, 2022, to January 8, 2023. The program was officiated by the Dean of the Faculty of Plantation and Agrotechnology, namely Prof. Madya Ts. Dr. Azma Yusuf. The program involves students from faculties of the Faculty of Plantation and Agrotechnology (FPA)and HEP participating in i-AIS 2022, namely, the Faculty of Education and Pre-Higher Education. This program involves the UiTM student and some of the non-UiTM students which come from the international university and the local university. Two categories are contested, namely UiTM and non-UiTM. To date, students from these programs have shown remarkable achievements in academic performance and participation in national as well as international competitions.

This competition is an open door for the students and lecturers to exhibit creative minds stemming from curiosity. Several e-content projects have been evaluated by esteemed judges and that has led to the birth of this E-Poster Book. Ideas and novelties are celebrated, and participants are applauded for displaying ingenious minds in their ideas.

It is hoped that such an effort continues to breed so that there is always an outlet for these creative minds to grow.

Thank you.

Dean
On behalf of the Organizing Committee
Conference Chair
Universiti Teknologi MARA
Faculty of Plantation and Agrotechnology
http://fpa.uitm.edu.my

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THE UTILIZATION OF DATE PALM FRUITS POWDER IN THE DEVELOPMENT OF PASTA

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ABSTRACT - Date palm fruits have proven rich in nutrients that are needed by the human body including carbohydrates, vitamins, and minerals. The present work focused on increasing the nutritional quality of pasta via date palm fruits powder to monitor the influences of physicochemical, texture, and colour attributes of functional pasta. Three pasta products were prepared with 22.86 %, 15.24 %, and 7.62 % of date palm fruits powder (DPFP) for Formulations 1, 2, and 3, respectively. The nutritional content, colour, and texture of the date palm fruits pasts were evaluated. Ash (0.96 % - 1.45 %), fat (6.41 % - 8.45 %), and carbohydrate content (72.75 % - 80.64 %) show an increasing ($p<0.05$) trend along with decreasing percentage of date palm fruits powder in each formulation. However, moisture content (8.81 % - 10.51 %) and protein content (4.3887% - 9.36 %) show a decrease ($p<0.05$) in trend along with an increasing percentage of date palm fruits powder. This research shows that date palm fruits pasta had a good lightness L* (64.0767 - 69.5733), redness a* (5.8900 - 4.8233), and yellowness b* (68.1867 – 73.1633). Hardness, cohesiveness, springiness, chewiness, and gumminess show an increasing trend ($p<0.05$) for each formulation as decreasing date palm fruits powder in each formulation. In conclusion, date palm fruits pasta can be recommended for application in pasta production to produce high nutritional value pasta products with enhanced physicochemical, texture, and colour attributes which at the same time can contribute to achieving better policies of sustainable food systems in the country to ensure food security in future.

Keywords: Date palm fruits pasta, nutritional, physicochemical properties, texture, colour.

INTRODUCTION

The date palm tree has been widely known as *Phoenix Dactylifera L.* by societies in the Middle Eastand Saudi Arabia [1]. Date palms grow in hot, dry climates with long summers, little rain, and low humidity. According to the statistic's date production, the volume of date imports to Malaysia amounted to approximately 45 thousand metric tons in 2019 [2]. This resulted in date import volume rise compared to the previous year which was 19.38 thousand metric tons.

Date palm fruits have a high potential to be used as food products because of their highest nutritional and economical value. Date palm fruits made up of pulp (mesocarp) and seed (kernel) are a low-cost source of nutrients and one of the world's most nutritious fruits [3]. Moreover, the importance of human nutrition comes from date palm fruits as it is rich in bioactive compounds with antioxidant and antimicrobial activities [4]. The pulp of date palm fruits is rich in nutrients that are needed by the human body including carbohydrates, vitamins, minerals, and fats [5]. Date palm fruits are also rich in polyphenols, anthocyanins, carotenoids, and tannins. Moreover, the variation in the chemical composition of date palm fruits will help these date palm fruits to influence their nutritional value and sensory quality [5].

There are various types of date palm fruits found worldwide. In Malaysia, the most popular date palm fruits are Mazafati (Kurma madu), Maryami, Medjool, Ajwa, and Sayer. Each of these date palm fruits has been found to have medicinal significance in the prevention of certain diseases [6]. Several studies have confirmed the therapeutic effects of date palm fruits and their efficacy in the treatment of many disease conditions. Date palm fruits are useful to reduce the risk of diabetes, Alzheimer's disease, and certain types of cancer [6].
Pasta is considered a healthy food product with high in carbohydrates and has good protein content [7]. The aim of this study is to determine the physicochemical analysis of pasta from date palm fruits powder. The development of date palm fruits pasta will help to produce nutritious pasta in the food industry. High-quality date palm fruits powder will help to transform the date palm fruits into a valuable product as well as will offer society, especially the food industries new knowledge and opportunity to improve the overall economic food which contributes to the improvement of the community and achieving better policies of sustainable food systems in the country to ensure food security in future.

MATERIAL AND METHOD

Materials

The main raw materials that have been used in the development of pasta are Medjool's date palm fruits powder which is bought from Lazada's online shopping platform. The ingredients that have been used to prepare pasta from date palm fruits powder contain wheat flour (Cap Ros), salt (Double Swallow), egg, and cooking oil (Buruh). All the raw materials for the development of pasta have been purchased from local markets in Selangor. The amount of raw materials used in the development of pasta will be referred to base on the formulation described in Table 2.1.

Preparation of Pasta

In the production of date palm fruits powder, the wheat flour has been sifted in the basin to remove impurities and lumps. To make pasta dough, flour was mixed with adequate amounts of salt. Cooking oil and an egg was slowly added during mixing using a stand mixer (Giselle, KEA0315, Malaysia) with a speed of 2 for a duration of seven (7) minutes. Then, the dough has been sliced using a knife into three (3) cm thick slices and kneaded by hand a few times until the pieces of dough no longer crumble. After that, the dough has been rolled into a pasta-forming section using the pasta-making machine (Shule QZ-180, China). The extruded fettuccine pasta was immediately separated and dried in a cabinet dryer (Vision Scientific, VS-4150ND, Korea) for 16 hours at 60°C. Then, the dried pasta was stored and packed into plastic packaging. Three replications of each formulation were prepared.

Colour analysis

The colour of uncooked pasta was analyzed using Calorimetry (Chroma Metre CR-400, Konica Minolta, Europe). Before each measurement, the apparatus was calibrated against a white tile. The pasta samples have been put in a petri dish and measured with direct contact between the sensing head of the colourimeter and the samples. Colour (lightness = L*, redness = a*, and yellowness = b*) was measured at a random position of the pasta samples. The colourimetric difference ΔE between three (3) samples was estimated with the following formula:

$$\Delta E = \sqrt{((\Delta L^*)^2 + [(\Delta a^*)]^2 + [(\Delta b^*)^2)}$$

Texture profile analysis (TPA)

Dried pasta was boiled at 100°C for 12 min. The textural properties for each formulation were measured using a cylinder probe that set attached to a Texture Analyzer (TA-XT2i, USA). Each formulation has been measured by using three replicate pastas. The sample of pasta has been tested for hardness, adhesiveness, cohesiveness, springiness, chewiness, and gumminess parameters. The texture profile analysis attribute namely hardness, springiness, cohesiveness, gumminess, and chewiness were automatically measured by machine and were recorded.

Moisture analysis by using drying method using a drying oven

The moisture content of date palm fruits pasta has been determined in triplicate. An aluminium dish was dried with a cover for 3 hours in an oven at 105°C. After 3 hours, the dish was transferred into the desiccator to let it cool and weighed after it has attained room temperature. The dried aluminium dish with covers was labelled and weighed accurately. 5g of homogenized pasta sample was weighed into the aluminium dish. Next, the aluminium dish with the sample uncovered was placed in a 60°C oven overnight. Before removing it from the oven, replaced the cover of aluminium dish. The aluminium dish with cover was cooled in a desiccator and

weighed soon after it is attaining room temperature. The weight obtained was recorded. The percentage of moisture was calculated by using the formula described below:

% Moisture (wt/wt) = $(wt\ of\ wet\ sample{+}pan) - (wt\ of\ dried\ sample{+}pan)$ $(wt\ of\ wet\ sample{+}pan) - (wt\ of\ pan)\ x\ 100$

Protein determination by using the Kjeldahl Method

The protein content of date palm fruits pasta has been determined in triplicate by using Kjeldahl Method. The Kjeldahl method is based on three steps which are digestion, distillation, and titration. Firstly, the sample will undergo a digestion process using a digestion system (TURBOSOG, Gerhardt, Malaysia). Approximately 0.8 g of the sample was weighed into a digestion tube and 2 pills of catalyst mixture (5g of potassium sulphate and 5 g of selenium) were added followed by the addition of 20 ml of concentrated sulfuric acid. After the digestion is complete, the liquid will be distilled using a distillation apparatus (Vapodest 45 S, Gerhardt, Malaysia) and 70 ml of 2% boric acid will be added with screened methyl red as an indicator. Then, 50 ml of distilled water and 80 ml of 32% NaOH will be used to start the distillation. After completion, the sample will be titrated with 0.1M HCl. The volume of titrant will be recorded, and the percentage of protein will be calculated using the formula described below:

Total nitrogen (g) per 100g food sample = (titre – blank) x 1.4 x 100 /1000 x sample weigh (g) Crude protein (g) per 100g food sample = total nitrogen x conversion factor for foodstuff analyzed.

Ash determination by using dry-ashing method

The ash content in the pasta has been determined in triplicate by using the dry-ashing method, which is using a muffle furnace (Cober, Daihan Scientatic, South Korea). The bottom of each porcelain dish was labelled clearly using a carbon pencil. A shallow porcelain dish was dried in an oven at 105ºC for 3 hours and cooled in a desiccator and weighed soon after it has attained room temperature. 5g of the homogenized sample was weighed into the porcelain dish. If the samples contain high moisture, the sample needs to be dried in an oven at 105°C for one day. Then, the dried sample was burned gently over a Bunsen burner until the smoke no longer evolved when heated strongly. Then, the dish in the muffle furnace was placed and heated at 550°C for 3 hours until a whitish or greyish ash is obtained. After attained at room temperature, the dish was removed, cooled in a desiccator, and weighed (assume this to be the constant weight).

g ash per 100g total sample = $weight\ of\ ash\ (g)\ weight\ of\ sample\ (g)\ x\ 100$

Fat determination by using Soxhlet Extraction

Fat concentrations have been determined in triplicate by the Soxhlet Extraction method using the solvent extraction system (M Tops, FAM 9209-06, UK). The cleaned and dried round bottom flask was obtained and labelled clearly. 2g of dried pasta was weighed into an extraction thimble or a piece of filter paper. The opening of the thimble was plugged loosely with cotton or folded the filter paper. Then, the thimble or paper was placed into a Soxhlet extractor. The content was weighed accurately, the round bottom flask was labelled, and 180mL petroleum ether was added by using a measuring cylinder. The apparatus was connected to the condenser, the water was turned on and extracted for a minimum of 8 hours on an electrothermal extraction unit. The flask containing the petroleum ether extract was removed after the extraction was complete. After that, the round bottom flask was placed in a steam bath to remove the residual petroleum ether. When all the solvent has been removed, dried the outside of the flask with tissue paper before placing it in an oven set at 105°C for one hour of drying. Then, the flask was transferred immediately into a desiccator to cool and weighed (assume this to be constant weight).

Carbohydrate determination using by difference

The total of carbohydrates has been determined by using the formula of by difference below:

% Total carbohydrate = 100% - % (moisture + protein + fat + ash)

Statistical analysis

The data has been analysed for statistical analysis using statistical software, which is Microsoft Excel (Version 2205). The mean and standard deviation for three replicates samples has been calculated. The data has been statistically evaluated with a one-way analysis of variance (ANOVA). The significance level is set at $p \leq 0.05$, differences were considered significant.

RESULTS AND DISCUSSION

Nutritional composition

The moisture content of pasta is the percentage of water contained in dried pasta. The results of this measurement are tabulated in Table 3.1. The utilization of date palm fruits powder in the development of pasta showed significant increase ($p<0.05$) in moisture content when date palm fruits powder was added and showed a directly proportional relation with increased concentration. The previous study of date palm fruit powder [8], shows date palm fruits powder had low moisture content (6.9 %). These characteristics are important since they allow their protection against all bacterial spoilage and therefore increase their shelf life. Obtained results could be interpreted as referring to the water absorption behaviour of date palm fruits, where date palm fruits were reported to have high water absorption capacities [9]. Moreover, that fine particle size subsequently increases the water uptake and volume expansion of pasta, which leads to greater hydration capacity [10].

Protein is one of three macronutrients, which are nutrients the body needs in larger amounts. Protein is present in every body cell, and an adequate protein intake is important for keeping the muscles, bones, and tissues healthy. Table 3.1 clearly shows that the protein content of date palm fruit pasta decreased when the amount of date palm fruits powder in the pasta increased. This happened due to protein content of date palm fruits powder was lower (6.78-9.97 %) than the protein content in wheat flour (8-20 %) [11] [12]. There is a significant different ($p<0.05$) in protein content in date palm fruits pasta in formulation 1 (4.3887 %) compared to formulation 2 (8.5710 %) and 3 (9.3590 %). The higher protein concentrations in pasta could result in a higher covalently linked protein network that subsequently reduced the degree of protein hydrolysis [13].

The ash content of pasta is depended on the quality of the flour and thus corresponds to the higher mineral content [14]. Based on table 3.1, the ash content increased when the date palm fruits powder in the pasta increased. There is a significant different ($p<0.05$) in ash content in date palm fruits pasta in formulation 3 (0.9633 %) compared to formulation 1 (1.4533 %) and formulation 2 (1.4567 %). The ash content of these date palm fruits pasta ranged between 1.45 % (Formulation 1) to 0.9633 % (Formulation 3). This showed that Formulation 1 had a higher mineral content as the ash content of a food sample gives an insight into the inorganic (mineral) content of the sample.

The fat content of these date palm fruits pasta ranged between 6.41 % (Formulation 3) to 8.45 % (Formulation 1). Based on table 3.1, the fat content is decreased along with the decrease of date palm fruits powder in the pasta. All samples of date palm fruits pasta have a significant different ($p<0.05$) of fat content value. Formulation 1 has higher fat content (8.4533 %), followed by Formulation 2 (7.4800 %), and Formulation 3 (6.4100 %).

According to table 3.1, date palm fruits powder contains high carbohydrate content with the range of between 72.7577 % to 80.6411 % in consonance with expected results as these kinds of pasta are usually sources of energy since the pasta is produced with the utilization of date palm fruits powder. Normal pasta that is produced by using semolina flour contains 66.64 % of carbohydrate [15], which make date palm fruits pasta contain a higher amount of carbohydrates compared to conventional semolina pasta in the market. All samples of date

palm fruits pasta have a significant different ($p<0.05$) in carbohydrate content value. Formulation 1 has higher fat content (80.6411%), followed by Formulation 2 (72.8921 %), and Formulation 3 (72.7577 %). The carbohydrate content decreased when the date palm fruits powder in the pasta decreased.

Colour analysis

Colour is an important factor for assessing the visual quality and market value of food products. Protein quality parameters also exhibit a significant relationship with b* of pasta [16]. Processing factors like drying and oil absorption also will affect the colour of pasta [17] [18]. Furthermore, alkaline reagents such as egg white also will influence a yellowish tinge to the pasta colour [19].

According to Figure 3.1 and Table 3.2, it could be said that all formulations of date palm fruits pasta had a good lightness. Based on the result, it clearly showed that an increase in lightness values (L*) can be observed in samples containing less date palm fruits powder. Formulation 1 pasta showed the lowest lightness L*value (64.0767) followed by formulation 2 (69.9167), and formulation 3 (69.5733). An increase in L*value may be due to a decreased percentage of date palm fruits power in each formulation. However, date palm fruits pasta showed a decrease in redness a* value from 5.8900 (Formulation 1) to 4.8233 for both formulation 2 and 3. This decrease in redness a* value may be due to the golden brown colour of the date palm fruits powder. In addition, date palm fruits pasta shows a decrease in yellowness b*value (68.1867–73.1633). Such colour changes in pasta samples could be due to swelling and conversion of pigments during the drying process [20].

Texture profile analysis (TPA)

Tabl4 3.3 shows the Texture Profile Analysis (TPA) of cooked pasta represented in hardness, adhesiveness, cohesiveness, springiness, chewiness, and gumminess parameters. A significant difference ($p<0.05$) was recorded for hardness, springiness, chewiness, and gumminess by comparing for each formulation from formulation 1 to formulation 3. Additionally, similar patterns were exhibited in all formulations of pasta, where each attribute of texture's parameters continued to decrease in elevation in accordance with decreased the percentage of date palm fruits powder.

Springiness, chewiness, and gumminess subsequently followed the hardness pattern to show increasing values along with decreased concentrations of date palm fruits powder. This pattern may be related to the higher cooking loss values (Table 3.3). Cohesiveness values did not record any significant differences between all pasta formulations. However, cohesiveness parameters indicated how the sample holds together upon cooking, which interpreted the higher values recorded for the Formulation 1 (22.86 % DPFP) pasta than the Formulation 2 (15.24 % DPFP) and Formulation 3 (7.62 % DPFP).

TABLE, IMAGE, AND FIGURE

Table 2.1 Production of Pasta by Using Date Palm Fruits Powder.

Ingredient	Percentage (%)		
	Formulation 1	**Formulation 2**	**Formulation 3**
Wheat flour	72.38	80	87.62
Date palm fruits powder	22.86	15.24	7.62
Cooking oil	1.90	1.90	1.90
Salt	2.86	2.86	2.86
Egg	1	1	1
Total	**100**	**100**	**100**

Table 3.1 Nutritional Composition of Date Palm Fruits Pasta.

Pasta	Moisture (%)	Protein (%)	Ash (%)	Fat (%)	Carbohydrate (%)
F1	8.1800±0.1127^{c}	4.3887±0.3523^{b}	1.4533±0.0153^{a}	8.4533±0.5065^{c}	80.6411±0.7965^{a}
F2	9.6000±0.5384^{b}	8.5710±0.5334^{a}	1.4567±0.0208^{a}	7.4800±0.3064^{b}	72.8921±1.1802^{b}
F3	10.510±0.3387^{a}	9.3590±0.4012^{a}	0.9633±0.0153^{b}	6.4100±0.5092^{a}	72.7577±0.6478^{c}

Values are the means of triplicates±SD.

^{a,b,c}Mean in the same column followed by different superscript letters differ significantly ($p<0.05$) assessed to Duncan.

Table 3.2 Colour Analysis of Cooked Date Palm Fruits Pasta.

Pasta	L*	a*	b*	ΔE
F1	64.0767±1.1320^{b}	5.8900±0.1670^{b}	22.5567±0.3988^{b}	68.1867±1.1015^{b}
F2	69.9167±0.4579^{b}	4.8233±0.2802^{b}	21.97±0.2066^{a}	73.4433±0.4879^{a}
F3	69.5733±0.2601^{a}	4.8233±0.0702^{a}	22.1200±0.1587^{b}	73.1633±0.2139^{a}

Values are the means of triplicates ± SD

^{a,b}Mean in the same column followed by different superscript letters differ significantly ($p<0.05$). L*, Lightness; a*, Redness; b*, Yellowness.

Table 3.3 Texture Analysis of Date Palm Fruits Pasta.

Pasta	Hardness (g)	Cohesiveness (%)	Springiness (cm)	Chewiness (g cm)	Gumminess (N)
F1	438.4570±32.4371^{b}	0.4513±0.6558^{a}	0.5577±0.3412^{b}	109.7147±11.8043^{b}	198.0917±33.7090^{b}
F2	470.2260±119.4815^{b}	0.4567±0.7736^{a}	0.5807±0.6004^{b}	142.2727±70.7619^{b}	225.0373±101.7994^{b}
F3	680.9413±76.6083^{a}	0.6733±0.2054^{a}	0.7520±0.0336^{a}	338.8230±83.7241^{a}	447.8737±94.9023^{a}

Values are the means of triplicates ± SD

^{a,b}Mean in the same column followed by different superscript letters differ significantly ($p<0.05$) assessed to Duncan.

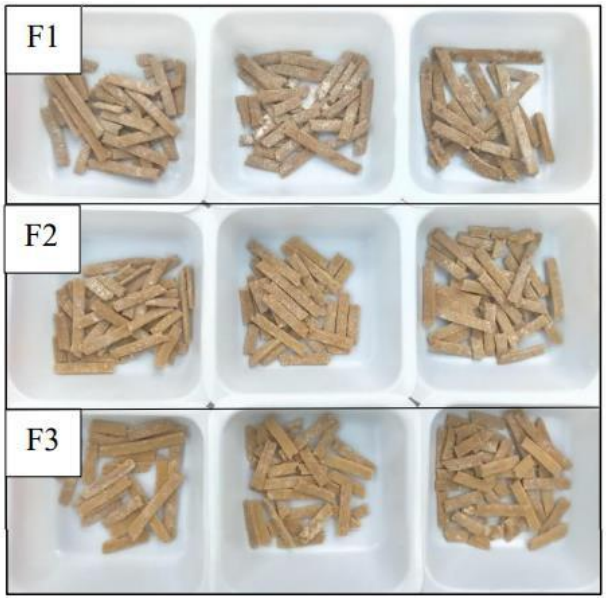

Figure 3.1 Colour of Date Palm Fruits Pasta.

CONCLUSION

In this study, the structure and properties of date palm fruits pasta made using different concentrations of date palm fruits pasta were investigated. The physicochemical properties of date palm fruits pasta have clearly differed in every formulation. The utilization of date palm fruits powder in the development of pasta increased the nutritional quality of pasta including greater protein, carbohydrate, mineral, and lipid contents. The utilization of date palm fruits powders up to 22.86% can be considered a suitable strategy to improve the nutritional aspects of pasta which at the same time provides an insight into the full utilization of date palm fruits in the production of pasta by reducing wastage of overripe date palm fruits during the season by converting them into a more stable form.

Date palm fruits pasta can be recommended for application in pasta production to target high nutritional value and high-quality functional pasta products with enhanced physicochemical, texture, and colour attributes. This might encourage the adaption of large-scale production for manufacturing the high nutritional value of pasta on an industrial scale to be available in the market for consumers where at the same time can give an opportunity to the food industry sector to improve the overall economic food which contributes to the improvement of the community and achieving better policies of sustainable food systems in the country to ensure food security in future.

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