



“IMPACT OF POTENTIAL PHENOLIC COMPOUNDS ON QUALITY, CHARACTERISTICS OF MUFFINS FROM PASSIFLORA EDULIS”

¹Gowsika.M, ²Ms.Aarsha geetha

¹PG Student, ²Assistant Professor,

^{1&2}Department of Food Science and Nutrition,

^{1&2}Nehru Arts and Science College, Coimbatore, India

Abstract: Passion fruit is perennial vine plant, belongs to the *Passifloraceae* family. The functional potential phenolic compound found in fruits and its peel powder have a plethora of therapeutic properties such as, antioxidant, microbial, antimicrobial. Passion fruit peel powder (PFPP) was dried using hot air at 60°C. The phenolic compounds present in the passion fruit peel powder were identified by the GC-MS analysis. Further, the passion fruit peel powder was studied for its physicochemical properties, nutritional and antimicrobial properties, and antioxidant. The RTE muffin was formulated by incorporating 5, 10 and 15g of the passion fruit peel powder, where 0% served as the control and sensory evaluation was performed using a five-point hedonic scale. Muffin (s-1) having the highest overall acceptability (3.48±0.509) was selected for further analyses. Antimicrobial activity, (15mm zone of inhibition against *E. coli*) was studied for the developed product. Food product development with passion fruit peel powder is a novel technique. Thus, the formulated product due to its enormous nutrient content and therapeutic properties conserve as a vehicle for future foods

Keywords: PFPP, GC-MS analysis, nutritional properties, muffin & antimicrobial properties of PFPP

I. INTRODUCTION

The term ‘passion fruit’ comprises several species from the genus *Passiflora* L., family *Passifloraceae*; the genus *Passiflora* consists of approximately 400 species, with over 150 being native from Brazil (Bruckner and Picanço, 2001). The most important variety cultivated in Brazil for commercial purposes is the yellow passion fruit, *Passiflora edulis* Sims f. *flavicarpa* Degener (Teixeira et al., 1994), which is used for pulp and juice processing.

Passion fruit is widely grown in South America, Asia, Oceania and Africa and comprises approximately 450-500 species (Dhawan et al., 2004; Ferreres et al., 2007). The flesh of passion fruit can be directly eaten, blended into a drink, or made into salads, jellies, ice cream and fruit-flavored candies (Liew et al., 2014). In the production process of passion fruit juice, a large amount of peel waste is produced, and the quantity of these peels accounts for more than half of the total mass of the fruit (Silva et al., 2014). The main component of the peel is the pith, containing a large amount of fibre and pectin, which can be used in the production of functional foods (Coelho et al., 2017).

The peel of passion fruit is rich in fiber which has properties comparable to food additives. Thus, in this study, the technological properties of flour obtained from yellow passion fruit peel were determined and incorporated on muffin to shelf life study of developed product. The peel of passion fruit can be made into a product called passion fruit peel flour (PFPF) through a drying and milling process. It has been found that PFPF has a certain blood sugar lowering function and is used in Brazil for adjuvant treatment of diabetes (Smith et al., 2012).

Aiming to offer a product with more desirable characteristics, with appropriate texture and reduced synergies, this study evaluated the addition of passion fruit peel flour to yogurt and determined the physicochemical parameters, color and sensory profile. Natural preservatives are **additives that slow the growth of spoilage organisms like mold or bacteria** in baked goods. They also function to limit changes in color, texture and flavor.

Preservatives are used to increase the shelf life of food and to maintain the quality for longer time. It has been reported that chemicals those are used as preservative have side effects. The reaction of preservatives can be very mild to life threatening. Increased awareness about antibiotic resistance and adverse effects of synthetic preservatives has revived the search for a natural source of antimicrobials as a alternative preservatives in bakery products.

The Present study “**Impact of potential phenolic compounds on quality, characteristics of muffins from *Passiflora edulis***” is carried out with following objectives;

- ❖ To examine the total phenol components in passion fruit peel powder.
- ❖ To standard the passion fruit peel powder composition and formulation the muffin.
- ❖ To incorporate the passion fruit peel powder to enhance the nutritional composition of muffin.
- ❖ To study the quality characteristics of muffin formulated from passion fruit peel powder

II. MATERIALS AND METHODS:

2.1. PROCESSING OF PASSION FRUIT PEEL POWDER

The Passion fruit were selected and collected .The fruit was cleaned with running water, cut and the pulp and seeds were removed. The peels were cut with a knife into pieces and then placed in hot air oven. Drying of the samples was performed in hot air oven temperatures for 60°C for 4hr .The samples were dried under ideal conditions. The peel were dried and sieved to obtain powder. Afterward, the powder was packed, closed and stored in the dark at room temperature

2.2. FUNTIONAL ANALYSIS:

2.2.1. Water Absorption Capacity:

This was determined using methods described by (Ocloo et., al, 2010). One gram sample was weighed into 25 ml graduated conical centrifuge tubes and about 10 ml of water added. The suspensions were allowed to stand at room temperature (30 ± 2 °C) for 1 hr. The suspension was centrifuge at 200 x g (2000 rpm) for 30 minute. The volume of water on the sediment was measured and the water absorbed expressed as percent water absorption based on the original sample weight.

2.2.2. Fat/oil Absorption Capacity:

This was determined using methods described by (Ocloo et., al, 2010). One-gram sample was weighed into 25 ml graduated conical centrifuge tubes and about 10 ml of refined vegetable oil added. The suspension was centrifuge at 200 x g (2000 rpm) for 30 minute. The volume of oil on the sediment was measured and the oil absorbed expressed as per cent oil absorption based on the original sample weight.

2.2.3. Pectin Test

Pectin is a natural product of central importance in the emerging bio refinery that uses fruit waste as a raw material. Pectin is mainly used as a thickener and a stabilizer in the food industry. Testing for pectin enables to judge the amount of pectin that has been extracted from the fruit. Pectin is a carbohydrate found mostly in the skin and core of raw fruit. In nature, it functions as the structural "cement" that helps hold cell walls together

2.3. PROXIMATE ANALYSIS:

1 Carbohydrates:

The main function of carbohydrate is supplying energy to the body. This is done in accredited lab by AOAC international 18th Edn Rev II 2007(3.2.05) method.

2 Protein:

The main function of protein is to build and repair tissues. And also use protein to make enzyme, hormones and other body chemicals. Protein is an important building blocks of bones, muscles, cartilage, skin and blood. This is done in accredited lab by AOAC 18th Edn 2006.

3.Total fat:

Dietary fats are essential to give your body energy and to support cell growth. Fats help your body to absorb some nutrients and produce important hormones. This is done in accredited lab by AOAC 18th Edn 2006.

4.Dietary fiber:

Dietary fiber is found in wholegrain cereals and fruit and vegetables. Fiber is made up of the indigestible parts or compounds of plants, which pass relatively unchanged through our stomach and intestines. Fiber is mainly a carbohydrate. The main role of fiber is to keep the digestive system healthy. This is done in accredited by AOAC 926.09, 18th Edn: 2005 IS 7874 Part-1:Reff-2009

5.Moisture:

Moisture content is one of the most important analysis performed on a food. The moisture content of food varies greatly. The propensity of microorganisms to grow in foods depends on their water content and for this reason many foods are dried below the critical moisture content. This is done in accredited lab by AOAC 925.10, 18th Edn 2005 method.

6 Ash:

The ash content in food is simply burning away of organic content, leaving inorganic minerals to determine the amount and type of minerals in food, to estimate the amount of minerals. This is done in accredited lab by AOAC 923.03, 18th Edn 2005

2.4. Microbial analysis

2.4.1 The Total bacteria count

The total bacteria count (TBC) of a substance is a quantitative estimate of the number of microorganisms present in a sample. This is done according to APHA protocol.

Yeast & Mold

Total Yeast and Mold Counts (TYMC) are used to detect and quantify the amount of fungal growth on plant material, and allow for identification of viable yeast and mold species present in sample. This is done according to APHA protocol.

2.4.2. Antioxidant assay

Assays developed to evaluate the antioxidant activity of plants and food constituents vary. Therefore, to investigate the antioxidant activity of chemical(s), choosing an adequate assay based on the chemical(s) of interest is critical.

2.4.3. Polyphenols test

Polyphenols are placed in contact with a colored complex in an alcoholic solution and oxidized, thus discoloring the complex. This is done by GC: method-1.mth MS: method-1.exp.

2.4.4. Antimicrobial analysis

Antimicrobial susceptibility test are used to determine which specific antibiotics a particular bacteria or fungus is sensitive. It defined as a collective term for all active principle that inhibits the growth of bacteria, prevents the formation of microbial colonies and may destroy microorganisms. This test was carried out according to the method of Jahir and Saurabh, 2011.

2.5 SENSORY ANALYSIS

Sensory analysis is a scientific discipline that applies principles of experimental design and statistical analysis to the use of human senses (sight, smell, taste, touch and hearing) for the purposes of evaluating consumer products. Color, texture, Taste, appearance are the main criteria used for sensory evaluation (Amerine, 2014). Sensory evaluation is a critical component to that process. Historically, sensory evaluation has often been associated with product experts, later as a more passive member of the product development team. (Dermott .2013) Sensory analysis was done to find out the acceptability by the same panel members

III RESULTS AND DISCUSSIONS

4.1. Functional Properties of Passion Fruit Peel Powder

4.1.1. Water Absorption Capacity:

Water absorption capacity or water holding capacity (WHC) consists of adding water or an aqueous solution to material, followed by centrifugation and quantification of the water retained by the pelleted material in the centrifuge tube (Damoradan et al., 2010). According to Wang et al. (2006) high values of water absorption capacity are important to help maintain the moisture content of the product. Table-1 represents the water absorption capacity of passion fruit peel powder (PFPP).

Table 1: Water absorption capacity of PFPP(%)

Name of analysis	Product	Value(ml/g)	Result
Water Absorption Capacity	Passion fruit peel Powder	5.2	52%

The water absorption capacity for the Passion fruit peel powder was found to be 52% (5.2ml/g). The value is found to be lower however comparable to 8.10 g reported for passion fruit peel powder (Campinas, 2021). The variance observed could be attributed to the method used as well as the varietal differences. This result shows the passion fruit peel powder could be used in food systems.

4.1.2. Fat/oil absorption capacity:

Fat/Oil Absorption Capacity indicates the ability of flour to retain oil that helps retain the flavor components and provide improved taste to foods. This parameter has a certain relationship with the chemical composition, but the physical structure of the material is more important (Biswas et al., 2011).

Table 2: Fat absorption capacity of PFPP (%).

Name of analysis	Product	Value(ml/g)	Result
Fat/oil Absorption Capacity	Passion fruit peel Powder	1.8	18%

The oil absorption capacity was found to be 18% (1.8ml/g). The value is found to be lower however comparable to 24% (2.4 g) reported for Passion fruit peel powder (Campinas., 2021). This result indicates that the addition of passion fruit peel powder may improve the flavor and taste of product.

4.4. Proximate Analysis

The Proximate composition was used to characterize the powder. All analyses were performed according to AOAC.

Table 3 Represent proximate analysis of PFPP.

S.no	Parameters	Result
1	Carbohydrate	22gm
2	Protein	2.8gm
3	Fat	0.36gm
4	Dietary Fiber	3.41gm
5	Moisture	10.3gm
6	Ash	0.88gm

Carbohydrate of passion fruit peel powder was 22gm/100g. This value is slightly higher than that reported by (Eloi'sa Rovaris Pinheiro.,et al,2007) for passion fruit peel powder 21.28g/100g. Protein content in the powder is found to be 2.8gm/100g. Protein was lower than that reported by (Eloi'sa Rovaris Pinheiro.,et al,2007) of powder 4.05g/100g. Fat content in the powder is found to be 0.36gm/100g. Dietary fiber of passion fruit peel powder is found to be 42.8gm/100gm. Moisture content of passion fruit peel powder is found to be 10.3g/100g. Moisture content was slightly higher than that reported by (Eloi'sa Rovaris Pinheiro.,et al,2007) of powder 9.93g/100g. Ash content in powder was found to be 0.88mg/100g.

4.3. Microbial Analysis

The microbial load in the passion fruit peel powder was tested after the two months' storage period of time.

Table 4: microbial growth of passion fruit peel powder.

S.no	Parameters	Results
1	Total bacterial count	1.97×10^4 cfu/gm
2	Yeast & Mould	Absent

The Total Bacteria Count (TBC) present in the flour was found to be 1.97×10^4 cfu/gm and the maximum requirement as per FSSAI is 50,000 cfu/gm. Also the yeast and mold was found to be absent and the maximum requirement as per FSSAI is 10,000 cfu/gm.

4.3.2 Antioxidants assay

Table 5 antioxidants of passion fruit peel powder

S.no	Parameters	Results	Unit
1	Antioxidants	14.5	μ /mol/g-1

4.3.3. Polyphenols Test

GC-MS analysis:

The Clarus 680 GC was used in the analysis employed a fused silica column, packed with Elite-5MS (5% biphenyl 95% dimethylpolysiloxane, 30 m \times 0.25 mm ID \times 250 μ m df) and the components were separated using Helium as carrier gas at a constant flow of 1 ml/min. The injector temperature was set at 260 $^{\circ}$ C during the chromatographic run. The 1 μ L of extract sample injected into the instrument the oven temperature was as follows: 60 $^{\circ}$ C (2 min); followed by 300 $^{\circ}$ C at the rate of 10 $^{\circ}$ C min $^{-1}$; and 300 $^{\circ}$ C, where it was held for 6 min.

The mass detector conditions were: transfer line temperature 240 $^{\circ}$ C; ion source temperature 240 $^{\circ}$ C; and ionization mode electron impact at 70 eV, a scan time 0.2 sec and scan interval of 0.1 sec. The fragments from 40 to 600 Da. The spectrums of the components were compared with the database of spectrum of known components stored in the GC-MS NIST (2008) library.

4.4 Antimicrobial Analysis

This test was carried out according to the method of Jahir and Saurabh, 2011. The Mueller - Hinton agar plates were inoculated with freshly prepared overnight inoculums which were swabbed over the entire surface of the medium, rotating the plate 60 degrees after each application by using a sterile cotton swab, to ensure the spread of the tested microbes on the surface of the plate completely. Inoculums were 10^8 CFU/ml of bacteria. The 6mm diameter of the well was made with borer on the agar plates. Different concentrations of plant extract were filled in well with the help of micropipette and one well filled with extracts.

The Ciprofloxacin 20 μ g/30 μ L was added in one well as a standard and added 100 μ l of solvent in another well, which was served as a control. Incubate the plate at 37°C for 24hrs, then observed the zone of inhibition.

Table-6 Microbial Load in Flour

S.No	Organism	Zone of inhibition			
		50mg	100mg	150mg	200mg
1	Escherichia coli	8	11	13	15

4.5. Formulation and standardization of product

Various concentration have been undertaken to formulate and standardize the product. Muffin was formulated by incorporating passion fruit peel powder. The concentration (5g,10g and 15g) of passion fruit peel powder on muffin were developed and it was subjected to sensory analysis.

To standardized the product sensory evaluation is collected and the mean and standard deviation for every attribute was calculated. A graph was plotted for each attribute of appearance, color, Aroma, flavor, texture and overall acceptability was between three different concentrations of passion fruit peel powder on muffin

4.6. Sensory analysis

Sensory evaluation is a scientific discipline used to evoke measure, analyses and interpret reactions to those characteristics of food and materials as they are perceived by senses of sight, smell, taste, touch and hearing. Sensory analysis can be utilized during product developed to help determine if they are perceptible difference between formulation differ in specific characteristics (Robert M. Kerr, 2013). The sensory attributes of appearance, color, flavor, texture, aroma and overall acceptability were evaluated by semi-trained panelist consisting of 25 members and the data was evaluated statistically.

Table-7 Mean±SD for Sensory analysis

	APPEAR ANCE	COLOR	FLAVOR	TEXTUR E	AROMA	OVERALL ACCEPTABILITY
CONTR OL	2.36±0.56	2.44±0.58	2.32±0.55	2.4±0.5	2.48±0.50	2.5±0.50
SAMPL E1	3.16±0.62	3.56±0.50	3.56±0.50	3.52±0.50	3.48±0.50	3.48±0.50
SAMPL E 2	2.28±0.45	2.08±0.64	1.64±0.56 8	2.04±0.67	1.56±0.50	1.6±0.5
SAMPL E3	1.48±0.50	1.52±0.5	1.56±0.50 6	1.64±0.48	1.52±0.50	1.52±0.50

IV CONCLUSION:

It was concluded that this study proved that sample (muffins) from *P. edulis* peels contains antioxidant compounds. In details, all identified polyphenols compounds have been recognized by GC-MS analysis. Extract of *P. edulis* peels shows the effectiveness on antimicrobial activity since the formation of inhibition zone on plate that containing foodborne bacterial which is *E. coli*. Therefore, the extract obtained from *Passiflora edulis* may be used, by the food industry in general and bakery products in particular as potential natural additive to replace the synthetic ones since it shows the significant.

V ACKNOWLEDGEMENT:

The authors acknowledge the Nehru Arts and Science College, Autonomous, Coimbatore, Tamilnadu 641105, India for providing financial assistance in the form of the Home research project. This project is financially supported by the Department of Food science and Nutrition and Dietetics, Nehru Arts and Science College, Autonomous, Coimbatore, Tamilnadu 641105, India

VI REFERENCES:

1. Abugoch James L.E.(2009): Quinoa (*Chenopodium quinoa* Willd.): Composition, chemistry, nutritional and functional properties. *Adv Food Nutr. Res.*, 58:1-31.
2. Ajila, C. M., Leelavathi, K., & Prasada Rao, U. J. S. (2008). Improvement of dietary fiber content and antioxidant properties in soft dough biscuits with the incorporation of mango peel powder. *Journal of Cereal Science*, 48(2), 319-326. <http://dx.doi.org/10.1016/j.jcs.2007.10.001.r>
3. Al-Zoreky, N. S. (2009). Antimicrobial activity of pomegranate (*Punica granatum* L.) fruit peels. *International Journal of Food Microbiology*, 134, 244–248. AOAC (1997). *Official methods of analysis of AOAC International* (16th ed.). Washington, DC: Association of Official Analytical Chemists
4. Arnous, A., Makris, D. P. and Kefalas, P. 2001. Effect of principal polyphenolic components in relation to antioxidant characteristics of aged red wines. *Journal of agricultural and food chemistry* 49(12): 5736–5742.

5. Ascheri J.L.R., Spehar C.R., Nascimento R.E. (2002): Comparative chemical characterization of instantaneous flours by extrusion-cooking from quinoa (*Chenopodium quinoa* Willd.), corn and rice. *Alimentaria*, 331: 89-92.
6. Atwell, W., Patrick, B., Johnson, L., and Glass, R. (1983): Characterization of quinoa starch. *Cereal Chem.* 60: 9-11
7. Ayala-Zavala, J. F., Vega-Vega, V., Rosas-Domínguez, C., Palafox-Carlos, H., Villa-Rodriguez, J. A., Siddiqui, W., et al. (2011). Agro-industrial potential of exotic fruit byproducts as a source of food additives. *Food Research International*, 44(7), 1866–1874.
8. Bampidis VA, Robinson PH (2006) Citrus by-products as ruminant feeds: a review. *Anim Feed Sci Technol* 128:175–217. <https://doi.org/10.1016/j.anifeedsci.2005.12.002>
9. Bañón S, Díaz P, Rodríguez M et al (2007) Ascorbate, green tea and grape seed extracts increase the shelf life of low sulphite beef patties. *Meat Sci* 77:626–633. <https://doi.org/10.1016/j.meatsci.2007.05.015>
10. Bhuyar P, Rahim MH, Sundararaju S, Maniam GP, Govindan N (2020) Antioxidant and antibacterial activity of red seaweed; *Kappaphycus alvarezii* against pathogenic bacteria. *Glob J Environ Sci Manag.* <https://doi.org/10.22034/gjesm.2020.01.0>
11. Brand-Williams, W., Cuvelier, M. E., & Berset, C. (1995). Use of a free radical method to evaluate antioxidant activity. *Food Science and Technology*, 28, 25–30.
12. Brittany L. Graf, Patricio Rojas-Silva, Leonel E. Rojo, Jose Delatorre-Herrera, Manuel E. Baldeon and Ilya Raskin.(2015):Innovations in Health Value and Functional Food Development of Quinoa (*Chenopodium quinoa* Willd.).*Comprehensive Reviews in Food Science and Food Safety*, 14,4: 431-445
13. Bruckner, C. H. and Picanço, M. C. 2001. Maracujá: tecnologia de produção, pós-colheita, agroindústria e mercado. (C. Continentes, Ed.). Porto Alegre
14. Cazarin, C. B. B., Silva, J. K., Colomeu, T. C., Zollner, R. L., & Maróstica Junior, M. R. (2014). Capacidade antioxidante e composição química da casca de maracujá (*Passiflora edulis*). *Ciência Rural*, 44(9), 1692- 1698. <http://dx.doi.org/10.1590/0103-8478cr20131437>.
15. CAZARIN, C. B. B.; SILVA, J. K. Antioxidant capacity and chemical composition of passion fruit peel (*Passiflora edulis*). *Ciência Rural*, Santa Maria, v.44, n.9, p.1699-1704, Sept. 2014. Available from: <http://www.redalyc.org/pdf/331/33132415029.pdf>>. Accessed: Jan. 31, 2018. doi: 10.1590/0103-8478cr20131437.