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Functional Properties of Pineapple Pomace Powder and Semolina blend flour used for making pasta

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Abstract

The food industry may profit from investigating the use of composite flour made from semolina and pineapple Pomace since it has more advantages. Due to their great nutritional value and favourable effects on human health, these flours can be utilized to make pasta and other similar items. Tray dryer and hot air oven used for the purpose drying effect of pineapple pomace and its quality. The current study's goal is to examine the functional characteristics of these composite flours at various ratios processed under various circumstances utilizing a hot air oven and tray drier. Composite flours were mixed in six treatments at the following ratios: (T_0) 100:00, (T_1) 95:5, (T_2) 90:10, (T_3) 85:15, (T_4) 80:20 and (T_5) 75:25. The blend's many functional characteristics, including its capacity for absorbing water, oil swelling, and foaming, were identified. It was found that the capacity for absorbing water, oil, and swelling was lower for T_0 and rose as the percentage of pineapple Pomace powder in the flour mix increased from T1 to T_5. Additionally, the blend's foaming capacity varied from 33.03 to 22.26 %. T_1 to T_5 Additionally, the blend's water absorption ranged from 163.3% to 212.8 % T_1 to T_5. Additionally, the blend's ability to absorb oil varied from 223.6 % to 246.6 %.

Keywords: Functional Properties, Composite Flour, Semolina and Pineapple Pomace powder

1. Introduction:

Before peeling and processing, the pineapple's centre is removed together with the crown and stem. Processing leftovers range from 45 to 65 percent as 60 percent of pineapple fruits are edible. Researchers found that 9.12 percent of the centre, 13.48 percent of the peels, 14.4 percent of the pulp, 14.87 percent of the top, and 48.04 percent of the final goods were produced from pineapple. Utilizing industrial leftovers is essential for improving the process economics and sustainability **(Pranayjeet and Surekha, 2018).**

The states that product cannot make the claims a "excellent source of fibre" and a "high source of fibre" unless it contains, in a serving size, 20 percent or more fibre and 10 to 19 percent of the dietary fibre intake that is advised per day. The peel and centre of pineapples contain around 76 percent of their weight in fibre, 99.2 percent of which is insoluble and 0.8 percent soluble (**Martnez *et al*., 2012).** Because (PP) has significant amounts it can be used as a food supplement to increase the nutritional value of foods by providing dietary fibre.

By increasing the overall amount of dietary fibre in bread, pineapple by-products can be employed in food fortification as a promising source of dietary fibre, lowering the risk of communicable diseases. **(Nasri *et al.*, 2014)**

Semolina, granular endosperm, pasta, warm breakfast cereal, couscous, and baby food are all made from durum wheat. Some of the characteristics that can help identify whether semolina is acceptable for making pasta are granulation, moisture, sand, colour, gluten quality, ash level, cooking test, falling number, and speck count. Unwanted particles of dark and black semolina might be seen in finished pasta. Infectious wheat seeds, foreign objects, and stones that evaded washing or purification are a few of the pollutants that can be detected in completed pasta. Other contaminants include specks created by germ, bran, and discolored wheat kernels **(Awoyale *et al.*, 2021).**

Food makers can add nutrients that were lost during the processing of durum wheat grain by raising the semolina flour content. Compared to unenriched semolina, enriched semolina has more vitamins and minerals **(Rosenberg *et al.*, 2004).**

Upadhyay *et al.*, (2008) reported that hot air oven drying of carrot Pomace in a tray drier without considering air velocity. On the other hand, no accurate information on the There has been offered hot air oven force convection drying for thin layer carrot pomace.

Drying materials with high moisture content is a challenging operation that requires simultaneous mass and heat transport **(Yilbas *et al.*, 2003).** The materials are dried in thin layers as a result of the quick drying and minimal nutrient loss. Samples are dried using the thin-layer technique in a single layer. **(Kumar *et al.*, 2012)**

The other option, drying, which extends storage time, lowers storage space requirements, and lowers transportation costs by bringing moisture contents down to 10%, is not without drawbacks. The bioactive components in apple Pomace are vulnerable to heat and oxygen, which is the main worry while drying apple Pomace. Various drying methods there have examined in various fruit Pomace and vegetables because this phenomenon is not specific to apple Pomace **(Bai *et al.*, 2013; Choicharoen *et al.*, 2009). (Jung *et al.*, 2015)**

2. Methods and Materials

2.1 Material:

From Prayagraj, fresh pineapple was purchased (Uttar, Pradesh). The current study was conducted in the processing and food engineering department's research lab at Sam Higginbottom University of Agriculture, Technology, and Sciences in Prayagraj. The Pomace was dried in a hot air oven at 70, 80, & 90 ^{o}C and a tray dryer at 80, 100, and 120 ^{o}C. After being sieved, dried Pomace was pulverized in a grinder. For additional examination, pineapple Pomace powder that was produced after grinding was employed. For the composite flour mix, the percentages used in the treatments below are T_0 = 100 %, Semolina T_1 = 95 %, Semolina & 5 % Pineapple Pomace Powder, and T_2 = Semolina 90%. & Pineapple Pomace Powder 10%, T_3 = 85 % Semolina & 15 %

Pineapple Pomace Powder, T_4 80 %, Semolina & 20 % Pineapple Pomace Powder, T_5 = 75 % in semolina & 25 % pineapple Pomace powder lists the various functional qualities of many composite flours.

2.2 Methods:

2.3 Functional properties

2.3.1 Determination Swelling Capacity (SC)

Chandra *et al.*, (2015) approach for calculating (sc) was used. A 10 ml graduated cylinder was filled with one gramme of the flour sample weights. After carefully adding 5 ml of pure water, the sample's volume was measured. The sample was left in water for 1 hour without being touched, and the volume it occupied after swelling was noted and computed using equation 1.

$$\text{Swelling Capacity} = \frac{\text{Volume occupied by sample before swelling}}{\text{Volume occupied by sample after swelling}} \quad \text{......... (1)}$$

2.3.2 Determination of Water Absorption Capacity

By using a modified version of ***Chandra et al*., (2015)** outlined method the flours ability to absorb water was assessed. One gramme of sample was combined with 10 ml of distilled water and let to stand for 30 min at room temperature (30 ± 2 °C). After that, the sample was centrifuged at 3,000 rpm or 2000 g for the remaining 30 min. Equation 2 was used to compute water absorption as a percentage of water bound per gramme of flour.

$$\text{WAC} = \frac{weight\ of\ sediment\ with\ centrifuge\ tube - wt.of\ centri.tube}{weight\ of\ original\ sample} \times 100 \quad \text{........ (2)}$$

2.3.3 Determination of Oil Absorption Capacity

The modified method outlined by **Chandra *et al*., (2015)** was also used to determine the oil absorption capacity. One gramme of the material was combined with 10 ml of soybean oil (Sp. Gravity: 0.9092) and left to stand for 30 minutes at room temperature (30 ± 2 °C) before being centrifuged for the same amount of time at 300 rpm or 2000 g. Equation 3 was used to determine oil absorption Capacity in terms of the percentage of flour that was water-bound.

$$\text{Oil Absorption Capacity} = \frac{weight\ of\ sediment\ with\ centrifuge\ tube - wt.of\ centri.tube}{weight\ of\ original\ sample} \times 100 \quad \text{.... (3)}$$

2.3.4 Determination of foaming capacity

According to **Narayana and Rao (1982)** descriptions, foaming capacity was calculated In a graduated cylinder, sample (1.0 g) was added to 50 ml of distilled water at a temperature of 30 20 oC. The suspension was blended and shaken to foam for five minutes. As a measure of foaming capability, the volume of the foam after 30 seconds of whipping was calculated.

$$\text{Foaming capacity} = \frac{vol.of\ foam\ AW - vol.of\ foam\ BW}{vol.of\ foam\ BW} \times 100 \quad \text{.... (4)}$$

2.4 Statistical Analysis

Every analysis had been performed in triplicate, unless otherwise specified. Variance analysis with a single wave the statistical significance was assessed using (ANOVA), and the findings were presented as the mean standard deviation.

3. Results and Discussion

Composite flours' functional characteristics are important when developing novel food products. The capacity for swelling, foaming, absorbing water and oil, as well as other functional features of several flours, were examined.

Table1. Functional Properties of Composite flour Comprising Pineapple Powder (Tray Dryer) and Semolina

Sample	SC (ml)	FC (%)	WAC (%)	OAC (%)
T_1	7.02±0.2	33.23±0.2	163.3±0.2	223.6±0.2
T_2	9.03±0.3	31.3±0.3	195.6±0.4	228.5±0.1
T_3	10.03±0.2	29.23±0.2	197.6±0.1	229.4±0.1
T_4	11.02±0.2	25.33±0.3	205.7±0.5	231.8±0.5
T_5	12.02±0.2	22.26±0.2	212.8±0.1	246.5±0.1

SC=Swelling Capacity, FC= Foaming Capacity, WAC=Water Absorption Capacity, OAC=Oil Absorption Capacity

Table2. Functional Properties of Composite flour Comprising Pineapple Powder (Hot air oven) and Semolina

Sample	SC (ml)	FC (%)	WAC (%)	OAC (%)
T_0	6.02±0.2	33.03±0.2	153.6±0.4	219.7±0.1
T_1	8.02±0.2	31.01±0.1	174.3±0.1	220.8±0.1
T_2	9.03±.03	29.04±0.3	196.6±0.1	221.8±0.1
T_3	10.02±0.1	27.04±0.3	209.2±0.2	227.7±0.2
T_4	11.03±0.2	25.02±0.2	218.3±0.1	234.4±0.3
T_5	13.02±0.3	23.02±0.3	221.9±0.1	243.7±0.2

SC=Swelling Capacity, FC= Foaming Capacity, WAC=Water Absorption Capacity, OAC=Oil Absorption Capacity.

3.1 Swelling Capacity

The degree to which the starch in the flour's internal composition has been exposed to the action of water is represented by variations in swelling capacity (SC). When starch's capacity to swell and absorb water molecules is put to the test, the intensity of the associative forces within the starch granules is revealed. The composite semolina and treated pineapple Pomace flour had swelling capacities ranging from 7.02 ml to 12.02 ml. hot air oven, and 8.02 to 13.02 ml for tray drying. Tables 1 and 2 showed that for both treatments, T_5 had the highest values while T_1 and T_0 had the lowest swelling capacities. When a product comes into contact with water, its volume expands, affecting its ability to swell **(Obiegbuna *et al.*, 2019).** The blend with 20% carrot Pomace powder of 120 mesh displayed the maximum swelling power, which may be related to CPP becoming larger and more fibrous particle sizes **(Ahmad *et al.*, 2016).** Increased edoema has also been documented for wheat flour mixed with sesame peel flour **(Zouari *et al.*, 2016).** As shown in tables 1 and 2, the swelling capacity of composite flour is greater in a hot air oven than in a tray drier.

3.2 Foaming Capacity (FC)

The highest area of amount interfacial that a protein can produce is known as its foam capacity **(Fennama, 1996).** Foaming ability is produced because the proteins in the dispersion lower the surface tension at the air-water interface. **(Ahmad *et al.*, 2016)** Tables 1 and 2 displays the foam capacities for tray dryers, which range from 22.26 to 33.23 percent, and hot air ovens, which range from 23.02 to 31.03 percent T_0 had the highest recorded foam capacity (33.03%), whereas T_5 had the lowest capacities and T_1 had the highest. It was said by **Kaushal *et al.*, (2012),** FC of flour blends decreased significantly upon increasing the level of blending. The depletion of semolina's protein content by the rising concentration of pineapple Pomace powder may be the cause of the decrease in foaming power. **(Ahmad *et al.*, 2016)** reported a decrease in (FC) their investigation on the addition of carrot Pomace powder to wheat flour for the production of cookies. According to the data, the blend's potential to produce foam does not significantly alter depending on the drying method

3.3 Water Absorption Capacity

Table 1 contains details on the capacity of composite flours to absorb water. For all flours, the WAC ranged from 163.3 to 221.9 percent. The WAC for treatment T_0 was the lowest (153.6%), and the highest (212.8 % & 221.9) for treatment T_5. This was probably caused by the high insoluble fibre content, as T_1 had the second-lowest WAC **(Martinez *et al.*, 2012).** (163. 3 & 174.3 percent) the outcomes show that the flour's fibre addition affected how much water was absorbed. The WAC might have increased as a result of the blend's higher fibre content. The addition of various fibres increased the WHC of mixed flours, which in turn affected the characteristics of dough's water absorption, according to numerous researches **(Wang *et al.*, 2002; Anil, 2007; Sudha *et al.*, 2007; Ajila *et al.*, 2008**). Given the abundance of hydroxyl groups, more water can hydrogen bind with them and a greater amount of water can be absorbed, depending on the fibre structure **(Wang *et al.*, 2002; Sabanis *et al.*, 2009).** There was no discernible difference in the WAC and OHC of the composite flour produced under different drying conditions.

3.4 Oil Absorption Capacity

All of the flours had OACs that ranged from 223.6 to 246.3 percent, with T_5 having the highest OAC (253.4 percent) and T_0 having the lowest (219.7 percent). In dietary systems where effective oil absorption is essential, wheat proteins' capacity to bind with oil is helpful. The ability of dietary fibre to absorb oil depends on a number of factors, including surface characteristics, overall charge density, thickness, and hydrophobicity of the fibre particle **(Figuerola *et al.*, 2005).** Because there is more dietary fibre that can absorb both oil and water, adding additional pineapple powder causes the OHC of the composite flour to increase. According to **(Ahmad *et al.*, 2016)** the rise in WAC and OAC could be related to the increase in fibre content after increasing the level of carrot powder, which increased competition between carrot powder and flour for the absorption of water and oil water.

Conclusion

In the current study, it was discovered that when pineapple mace powder concentration climbed and semolina concentration declined from treatment T_1 to T_5, functional attributes like the capacity to absorb water and oil improved. Due to the substitution of pineapple Pomace powder for some of the semolina, the composite flour's ability to froth decreased from T_1 to T_5. With the addition of pineapple powder to the treatment of pasta flour, the amount of insoluble fibre in the powder rose.

References

Ahmad, M., Wani, T. A., Wani, S. M., Masoodi, F. A., & Gani, A. (2016) Incorporation of carrot pomace powder in wheat flour: effect on flour, dough and cookie characteristics. *Journal of food science and technology*, 53 (10), 3715-3724.

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, 319–326.

Anil, M. (2007) Using of hazelnut testa as a source of dietary fiber in bread making, *Journal of Food Engineering* 80, 61–67

Arêas, J. A. G., Rocha-Olivieri, C. M., & Marques, M. R. (2016) Extrusion cooking: Chemical and nutritional changes In B. Caballero, P. M. Finglas, & F. Toldrá (eds.), Encyclopedia of food and health (pp. 569–575). Cambridge, MA: Academic Press. Retrieved from https://doi.org/10.1016/B978-0-12-384947-2.00266-X

Awoyale, W., Alamu, E. O., Chijioke, U., Tran, T., Takam Tchuente, H. N., Ndjouenkeu, R., & Maziya-Dixon, B. (2021) A review of cassava semolina (gari and eba) end-user preferences and implications for varietal trait evaluation. *International Journal of Food Science & Technology*, 56 (3), 1206-1222.

Bai J-W, Sun D-W, Xiao H-W, Mujumdar AS, Gao Z-J (2013) Novel high-humidity hot air impingement blanching (HHAIB) pretreatment enhances drying kinetics and color attributes of seedless grapes. *Journal of Innov Food Science Emerge Technology* 20:230–237

Chandra, S., Singh, S., & Kumari, D. (2015). Evaluation of functional properties of composite flours and sensorial attributes of composite flour biscuits. *Journal of Food Science and Technology*, 52, 3681-3688.

Choicharoen K, Devahastin S, Soponronnarit S (2009) Performance and energy consumption of an impinging stream dryer for high-moisture particulate materials. *Journal of Drying Technology* 28:20–29

Fennama RO (1996). Marcel Dekker Inc. New York, Basel, Hong Kong, *Journal of Food Chemistry*. pp 36–39.

Figuerola, F., Hurtado, M. L., Estévez, A. M., Chiffelle, I., & Asenjo, F. (2005) Fibre concentrates from apple pomace and citrus peel as potential fibre sources for food enrichment. *Journal of Food chemistry*, 91 (3), 395-401

Hikal, W. M., Mahmoud, A. A., Said-Al Ahl, H. A., Bratovcic, A., Tkachenko, K. G., Kačániová, M., & Rodriguez, R. M. (2021). Pineapple (Ananas comosus L. Merr.), waste streams, characterisation and valorisation: An Overview. *Open Journal of Ecology*, 11(9), 610-634.

Jung, J., Cavender, G., & Zhao, Y. (2014) Impingement drying for preparing dried apple pomace flour and its fortification in bakery and meat products *Journal of Food Science and Technology*, 52 (9), 5568-5578.

Kaushal P, Kumar V, and Sharma HK (2012) Comparative study of physico-chemical, functional, anti-nutritional & pasting properties of taro (Colocasia esculenta), rice (Oryza sativa), pegion pea (Cajanus Cajan) flour and their blends. LWT- *Journal of Food Science Technology* 48:59-68.

Kumar, N., Sarkar, B. C., & Sharma, H. K. (2012) Mathematical modeling of thin layer hot air drying of carrot pomace *Journal of food science and technology*,49 (1), 33-41.

Kummu, M., de Moel, H., Porkka, M., Siebert, S., Varis, O., & Ward, P. J. (2012) Lost food, wasted resources: Global food supply chain losses and their impacts on freshwater, cropland, and fertiliser use. *Journal of Science of the Total Environment*, 438, 477–489. https://doi. org/10.1016/j.scitotenv.2012.08.092.

Leonard, W., Zhang, P., Ying, D., & Fang, Z. (2019) Application of extrusion technology in plant food processing byproducts: An overview. *Comprehensive Reviews in Food Science and Food Safety*, 19 (1), 218-246.

Martinez, R., Torres, P., Meneses, M.A., Figueroa, J.G. & PerezAlvarez, J.A. (2012) Chemical, technological and in vitro antioxidant properties of mango, guava, pineapple and passion fruit dietary fibre concentrate. *Journal of Food Food Chemistry*, 135, 1520–1526.

Molla, M. M., Sabuz, A. A., Khan, M. H. H., Chowdhury, M. G. F., Alam, M., Akhter, S., & Ali, M. S. (2021) Effect of Pineapple Pomace on the Development of Peanut Bar and their Physicochemical and Nutritional Properties with Consumer Acceptance *Journal of the Science of Food and Agriculture* Vol. 7 (3), pp. 46-56.

Narayana, K., & Narasinga Rao, M. S. (1982). Functional properties of raw and heat processed winged bean (*Psophocarpus tetragonolobus*) flour. *Journal of food science*, 47(5), 1534-1538.

Nasri, H., Baradaran, A., Shirzad, H., &Rafieian-Kopaei, M. (2014) New concepts in nutraceuticals as alternative for pharmaceuticals. International journal of preventive medicine, 5 (12), 1487.

Obiegbuna, J. E., Nwankwo, J. A., Ozue, J. O., & Okolo, A. C. (2019) Evaluation of Yield and Physicochemical Properties of Single Cereal Grain Akamu and Pre-and Post-Processed Multigrain Cereal Akamu Powders *International Journal of Food and Nutrition Research*, *3*, 29.

Pranayjeet, S., & Surekha, D. (2018) Development of extruded snack by using multigrain with pineapple pomace powder *International Journal of Agricultural Engineering*, 11(2), 328-334

Rosenberg, I. H., Abrams, S. A., Beecher, G. R., Champagne, C., Clydesdale, F., Goldberg, J., & Seligson, F. (2004) Dietary reference intakes: guiding principles for nutrition labeling and fortification. *Nutrition Rev*, *62*, 73-79.

Sabanis, D., Lebesi, D. & Tzia, C. (2009) Effect of dietary fiber enrichment on selected properties of gluten-free bread, LWT- *Journal of Food Science and Technology*, 42, 1380–1389.

Selani, M. M., Brazaca, S. G. C., dos Santos Dias, C. T., Ratnayake, W. S., Flores, R. A., & Bianchini, A. (2014) Characterisation and potential application of pineapple pomace in an extruded product for fibre enhancement. *Journal of Food chemistry*, 163, 23-30.

Sudha, M.L., Vetrimani, R. & Leelavathi, K. (2007a) Influence of fiber from different cereals on the rheological characteristics of wheat flour dough and on biscuit quality. *Journal of Food Chemistry*, 100, 1365–1370

Upadhyay A, Sharma HK, Sarkar BC (2008) Characterization of dehydration kinetics of carrot pomace, *International Journal of Agricultural Engineering* The CIGR Ejournal FP 07 35. Vol. X

Wang, J., Rosell, C.M. & Benedito de Barber, C. (2002) Effect of the addition of different fibres on wheat dough performance and bread quality *Journal of Food Chemistry*, 79, 221–226

Yilbas BS, Hussain MM, Dincer I (2003) Heat and moisture diffusion in slab products to convective boundary condition *Journal of Heat Mass Transfer* 39:471–476

Younis, K., & Ahmad, S. (2015) Investigating the Functional Properties of Pineapple Pomace Powder and Its Incorporation in Buffalo Meat Products *Journal of Cogent Food & Agriculture*, 1 (1), 1119397.

Zouari R, Besbes S, Ellouze-Chaabouni S, Ghribi-Aydi D (2016) Cookies from composite wheat–sesame peels flours: dough quality and effect of Bacillus subtilis SPB1 biosurfactant addition. *Journal of Food Chemistry* 194:758–769.