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Abstract:

The present study aims to investigate the effect of partial replacement of wheat flour by different levels of papaya *(carica papaya* L.) powder (20 and 30%) on rheological, nutritional, microbiological and baking characteristics of pan bread. The farinograph data showed increased water absorption, dough stability and softening degree as compared with control sample. While, there were no changes in the arrival time and development time between the dough with or without PP blends. Extensograph results showed a decrease in the dough elasticity, extensibility, and dough energy for the formulae compared to control sample. The sensory analysis results showed that replacement of wheat flour with PP up to 30% of substitution level produced acceptable pan bread. The chemical analysis showed that addition of PP to wheat flour by 30% increased dietary fiber, ash, vitamin A and C while, the content of carbohydrates was decreased. Physical characteristics data recorded a decrease in bread volume, specific volume and an increase in weight with progressive inclusion of the papaya powder. Texture properties of prepared bread affected by the addition of PP level in dough as 20 and 30% addition of PP gave bread more firmness, gumminess and showed a decrease in cohesiveness and resilience values. Microbiological examination showed that addition of PP to pan bread inhibit and controlled the microbial and fungi growth at three days storage period.

Key words: *Carica papaya*; sensory evaluation; farinograph; extensograph; texture profile analysis; physical properties; dietary fiber

Introduction:

Bread is an important staple food and the most consumed bakery products all over of the world in both rural and urban populations. A variety of bread of different shape, sizes, flavors and textures that contain different ingredients and are baked under different conditions exists across many continents. The bakery products can be used as a vehicle for incorporation of different nutritionally rich ingredients. Composite flour is a combination of wheat flour and powder from different source of crops (Shittu *et al.*, 2007). Composite flour has an advantage where importation of wheat flour is concerned because it promotes the use of local crops, decrease wheat flour procurement and increases utilization of indigenous resources. So, using composite flour in commercial baked production will help to decrease and reduce wheat importation which represents (Hugo *et al.*, 2000). Several developing countries have encouraged the initiation of programs to evaluate the feasibility of alternative locally available flours as a substitute for wheat flour. Many efforts have been carried out to promote the use of composite flours, in which a portion of wheat flour is replaced by locally grown crops, to be used in bread, thereby and decreasing the cost associated with import wheat (Abdelghafor *et al.*, 2011).

Using composite flour is growing rapidly and has an advantage in making high quality bread with functional properties (Ndife *et al.*, 2011; Oluwalana *et al.*, 2012 and Dooshima *et al.*, 2014). Now most of bakery products are used as a source for substitution of different rich ingredients that nutritionally for their diversification (Hooda and Jood 2005 and Sudha *et al.*, 2007). This approach not only promotes development of diversified and high value bakery products, but also decreases over exploitation and excessive use of wheat for making bakery products.

Papaya (*Carica papaya* L.) is one of the most major fruits cultivated around the tropical and subtropical regions of the world and the most economically important fruit plant in the *Caricaceae* family (Amri and Mamboya, 2012). Papaya fruit is 15–50 cm long, 10–20 cm in diameter, and weighted up to 9 kg (Medina *et al.*, 2010). It is native to the tropics of the Americans but now popularly grown in all regions (Ashaye *et al.*, 2005). Papaya is being highly appreciated worldwide for its nutritional value, flavor and the digestive properties (Galindo *et al.*, 2009). It is rich of many major nutrients and on hand throughout year. Also, it is the richest source of some potent antioxidant such as vitamins A, B, C, E and beta-carotene and some minerals such as K and Mg. It contains other nutrients substances such as fiber, folate and pantothenic acid (Aravind *et al.*, 2013).

Recently papaya is used in different industries application especially baked products which used for the weight conscious persons that seek about healthy nutrition. The use of composite flours has been advantageous in supplying carbohydrate for human nutrition as well as encouraging better use of local or domestic agricultural products as flour. Papaya based products can also be used as carbohydrate-based and fat-reducing agents in baked food recipes. When the pulp of papaya fruit is used in the preparation of baked foods, it causes reduction in trans-fatty acid, total fatty acid caloric content and increasing nutritional value. It was confirmed from literature that the baked products having 25% papaya were also liked by the consumer (Ansari *et al.*, 2014). In addition Varastegani *et al.* (2015) indicated that dried papaya contained bioactive components that are powerful to human health, thus recommended to be added to wheat flour as composite flour, which can be used in bakery products in terms of flavoring, dietary fiber, resistant starch, water holding capacity, oil binding capacity and antioxidant properties that can be used in the Industrial approaches.

Therefore, the present study was carried out to evaluate the rheological and nutritional characteristics of pan bread produced from wheat flour and PP. Also, sensory and quality evaluation and microbiological examination of the resulted breads.

Materials and Methods:

Materials:

Papaya fruits (*Carica papaya* L.) (Solo. variety), wheat flour (72% extraction), sugar, salt and vegetable shortening were purchased from local market of different areas in Mansoura City, Egypt.

Growth media including nutrient Agar, peptone, beef extract, dextrose, potassium dihyrogen, magnesium sulfate, rose bengal and streptomycin solution were purchased from El-Gomhoria Company for chemical and drugs, Cairo, Egypt.

Preparation of papaya powder (PP):

Ripe papaya fruits were rinsed thoroughly in water and peeled, the seeds were removed and fruit pulp sliced manually. Papaya pulp was oven dried at 50 ± 5° C for approximately 6 – 7 hours. Dried samples of papaya were obtained as flakes and powdered and sieved using 20mm mesh sieve.

Preparation of PP blends:

Wheat flour (72% extraction) was well blended and replaced with specified amounts of papaya pulp powder to produce mixtures containing 20 and 30%. All samples were stored in airtight containers and kept at -4°C until required.

Rheological properties:

The effect of different PP levels addition on dough characteristics was determined by Farinograph (model No: 81010, Duisburg, Germany) according to the standard methods **AACC (2005)**. Elastic properties of dough were measured using Extensograph according to the **AACC (2005)**.

Preparation of pan bread:

Bread was prepared according to Lazaridou *et al.*, (2007) as shown in Table (1). The weighted dry ingredients were placed in a mixer for 5 sec, and then suspension of the yeast in water was added to the dry ingredient. All the ingredients were mixed for 4 minutes at slow speed and for additional 6 minutes at fast speed .Water was added to the mixture as indicated by the farinograph results. The dough temperature was 28.9 - 32.2℃ following mixing. Dough was left to rest for 20 min at 28-30˚C (as first proofing) then transferred and scaled into 150g pieces, rounded into balls by hand then placed in metal pans and let to ferment at the same temperature for a final proof for 50 min. Bread dough loaves were baked at 240°C for 20–25 min in electric oven. The loaves of pan bread was allowed to cool at the room temperature (25 ℃) for 2 h before being packed in bags of polyethylene and then stored at room temperature for the further analysis**.**

Table (1): Formulae used for pan bread preparation.

Ingredients	Pan bread formulae (%)		
	Control	WF + PP	WF + PP

	Wheat flour (WF, 100%)	(20%)	(30%)
Wheat flour (72% extra.)	93	74.4	65.1
Sugar (Sucrose)	1	1	1
Shortening	2	2	2
yeast	1	1	1
Salt	2	2	2
Improver	1	1	1
Papaya Powder (PP)	-	18.6	27.9

Sensory Evaluation:

Fifteen-member panel of students and staff of Faculty of Specific Education from the Mansoura University, they were asked to express their opinion of prepared pan bread. Loaves were organoleptically evaluated for general appearance, crust color, taste, odor, crumb color and texture according to **Gujral *et al*., (2004)** on a 9-point hedonic scale (1 = dislike extremely, 5 = neither like nor dislike, 9 = like extremely).

Nutritional Analysis:

Moisture, protein, fate, ash and dietary fiber contents were determined according to the standard methods of **AOAC (2000).** Vitamin C, titratable acidity, pH value, total sugars and total soluble solids were determined according to the method of **AACC (2000).** Vitamin A was determined according to the method of **Neeld and Pearson (1963)**, minerals were determined by using Atomic Absorption Spectrometry (pyeunicm Model 3300) at 422nm according to the procedure of **AOAC (2005).**

Baking quality of prepared papaya pan bread:

Weight, volume and specific volume of pan bread loaves were determined as described by the method of **AACC (2000).**

Texture profile analysis:

Texture measurements of bread samples were investigated with universal testing machine (Cometech, B type, Taiwan) provided with software.

Back extrusion cell with 35 mm diameter compression disc was used. Two cycles were applied, at a constant crosshead velocity of 1 mm/s, to 30% of sample depth, and then returned. From the resulting force–time curve, the values for texture attributes, i.e. firmness (N), gumminess (N), chewiness (N), adhesiveness (N.s), cohesiveness, springiness and resilience were calculated from the TPA graphic according to Bourne (2003).

Freshness of baked papaya pan bread:

Freshness of baked papaya pan bread samples was tested at the zero time and after 24 and 48 hrs of baking at the room temperature by alkaline water retention capacity (AWRC) according to method of Yamazaki (1953), as modified by Kitterman and Rubenthaler (1971).

Microbiological examination:

The total bacteria count was recorded as colony numbers per 1.00 g of sample according to the method of **Difico- Manual (1985).** Fungal count determined according to Martins (1950).

Statistical analysis:

The obtained data were statistically analyzed using computerized SPSS (Statistical Soft-Ware, SAS Institute, Cary, NC). Data were analyzed by one way ANOVA (Analysis of variance) test using Duncan's multiple range test and $p<0.05$ was used to indicate significance between different samples (Snedecor and Cochran 1967).

Results and Discussion:

Effect of blending PP to wheat flour on rheological Characteristics of dough:

Farinograph parameters:

The data pertaining to the effect of different levels of PP blending to wheat flour on farinograph characteristics of dough were showed in Table (2). From such data it could be noticed that water absorption, dough stability and degree softening increased for the PP formulae compared with the control sample. Wheat-PP blends had the highest water absorption which recorded 64.3% in 70% WF + 30% PP while the control sample (100% WF) was 56%. Water absorption related to the capacity of flour to absorb water. Similar effects on water absorption were observed by Yusufu and Akhigbe (2014) the reported that the water absorption capacity increases as the percentage PP incorporation increases. PP may have contained more hydrophilic constituents than wheat flour, which gave rise to higher water absorption capacity. Moreover Abou-Zaid *et al.* (2011) reported that the differences in water absorption are mainly caused by the greater number of the hydroxyl groups which exist in the fiber, sugars, higher protein content and structure which retained more water and allow more water interactions through hydrogen bonding

The arrival time of dough made from the substituted flours (30% PP) was the same with control sample (1 min) which shortened for the dough of 20% PP (0.5 min). The stability time of 30% PP dough was longer (1.5) than that of the control except for the dough of 20% PP which is shortened than control (0.5 min). Development time is the time from the first addition of water to the time the dough reaches the point of greatest torque. During this phase of mixing, the water hydrates the flour components and the dough is developed. There was no significant difference in the development time between the dough with or without substitution (1 to 1.5 min). The level of substitution therefore does not appear to affect the arrival and development time of the composite flours. These results are similar to Malomo *et al.* (2011). The dough softening degree of the control sample was 110 BU, while the addition of 20 and 30% PP increased the dough softening degree as compared to the control. Weakening of the dough may be due to the dilution of gluten of wheat flour by addition of PP. Similar finding was observed by Mohsen *et al.* (2010).

Samples	**Water absorption (%)**	**Arrival time (min)**	**Dough development (min)**	**Dough stability (min)**	**Degree softening (B.U)**
Control 100% WF	56.0	1.0	1.5	1.0	110
80% WF + 20% PP	59.2	0.5	1.0	0.5	290
70% WF + 30% PP	64.3	1.0	1.5	1.5	240

WF: Wheat Flour, PP: Papaya Powder

Extensograph parameters:

Extensograph data of all dough samples are represented in Table (3). From such data, it could be noticed that the addition of PP to wheat flour decreased elasticity (resistance to extension) to 350 BU for substituted wheat flour at level 20% PP ,while 30% had a slight decrease 430 BU in compared with control dough (100% wheat flour) 460 BU. Results in the same table revealed that the values of extensibility of wheat flour dough were decreased as a result to addition of PP to wheat flour recorded 57 and 60 mm for 20 and 30% PP at comparison to with wheat flour dough which recorded 195 mm. On the other hand data showed that the addition of PP to wheat flour at the level of 20% and 30% increased proportional number to reach 6.14 and 7.17, respectively meanwhile, the wheat flour dough recorded 2.36. Concerning the energy value, the results demonstrated that the control sample recorded the highest value of energy (128 cm^2) while the formula of 20% and 30% PP recorded 30 cm^2 and 37 cm^2.

Finally the results indicated a decrease in dough elasticity, extensibility and dough energy for the formulae compared to control sample. These changes were attributed mainly to the dilution of gluten of wheat flour by addition of PP (Yaseen *et al.*, 2012). Moreover Adubofuor *et al.* (2012) indicated that the increase level of substitution of dried papaya in wheat flour caused a decrease in wheat protein (gluten) content. Also gas retention is a property of protein in flour which must be sufficiently extensible and strong enough to allow the dough to be rise and prevent the gas from escaping. Protein content of wheat flour accounts for the elasticity of the dough by causing it to extend and trap the carbon dioxide generated during the heating process and thereby preventing it from collapsing (Hui *et al.*, 2006).

Table (3): Effect of wheat flour substituted with papaya powder on extensograph parameters.

Samples	Elasticity (BU)	Extensibility (mm)	Proportional Number (P.N)	Energy (cm^2)
Control 100% WF	460	195	2.36	128

80% WF + 20% PP	350	57	6.14	30
70% WF + 30% PP	430	60	7.17	37

WF: Wheat Flour, PP: Papaya Powder

Sensory quality of breads:

As seen in Figure (1) all formulae were rated lower than the control sample. Significant differences (P<0.05) were observed within all formulae and between the control sample for all sensory characteristics. Taste and general acceptability of produced bread were acceptable. The crumb color of bread was changed and became darker by increasing levels of PP in the formulae. Taste scores decreased significantly as the level of PP increased in formulae. A slight bitter taste at a 20 and 30% added level of papaya to flour may be due to the phenolic compounds and tannins found in the fruits. When the proportion of PP increased in breads, the softness and mouth feel of bread scores decreased significantly. However, there was a variation in general acceptability among PP substitution levels in this study. Bread made with 100% wheat flour had a higher acceptability score compared to all PP substitutions. However acceptability increased as the level of PP decreased.

Generally overall pan bread quality at the different levels of PP substitution was found to be acceptable. These results are in agreement with the studies of **Taha (2000)**; **Kyomugisha, (2002) and Abdelghafor *et al.*, (2011).**

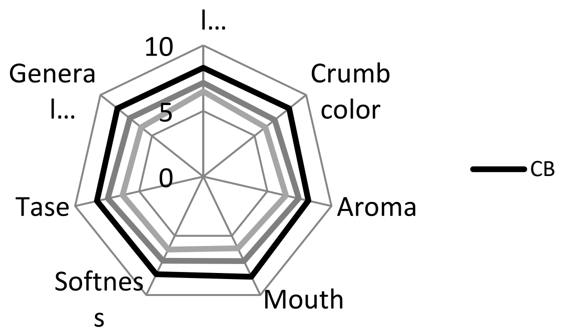

Fig. (1): Radar plots of sensory evaluation of blended pan bread with different levels of papaya powder and the comparison to the control bread, CB: Control Bread, PP: Papaya Powder.

Proximate chemical composition of control and blended PP pan breads:

The results of the proximate chemical composition of control and papaya breads are presented in Figure (2). The moisture content was 35.70±0.04, 36.16 ±0.03 and 36.9±0.05 % for control bread (CB), B+20% PP and B+30% PP respectively. Also, the moisture content increased gradually by increasing level of PP in bread due to the increase of dietary fiber content as PP level increased in the bread formulae (Carroll, 1990). Protein content was 10.95±0.04, 10.20±0.02 and 10.97±0.06 % for bread samples of CB, B+20%PP and B+30%PP, respectively. There was no significant difference in protein content between control bread samples and blended PP. Both ash and dietary fiber tendency to increase according to the increments of PP in pan bread samples due to the higher content of PP in ash and dietary fiber compared to wheat flour. On the other hand, fat content decreased in pan bread samples by increasing level of PP in bread due to the lower content of PP fat. Data revealed that the carbohydrate content of pan bread samples recorded 45.80±0.20, 42.26 ±0.27 and 39.74 ±0.02 % for CB, B+20%PP and B+30%PP, respectively. It could be observed from previous results that blending with PP improved the nutritional attributes for blended papaya pan bread samples. These results are in agreement with those obtained by (Puwastien *et al.*, 2000; Saxholt *et al.*, 2008; Roberts *et al.*, 2008 and Aravind *et al.*, 2013) who reported that papaya is nutritional fruit that rich in many nutrients such as dietary fiber, minerals and vitamins A and C.

Mineral content of control and blended PP pan breads:

Data of mineral content of control and blended PP were tabulated in Figure (3). From such data, it could be noticed that the minerals content were gradually increased in blended papaya bread samples by the increase of the level of PP in bread formulae compared to control sample. Potassium (K) was the predominant element among minerals analyzed. The bread sample of 30% PP had significantly higher potassium concentrations (549.80 mg/100g) followed by 20% PP sample that recorded 460.30 mg/100g. Meanwhile, the control sample (CB) recorded the lowest level of potassium (186.53 mg/100g) ($p<0.05$). These results are similar to that obtained by Vinci *et al.* (1995); Gebhardt and Thomas (2002); Aravind *et al.*, (2013) and Maisarah *et al.* (2014) they reported that rip papaya fruit often ranks high in nutritional charts as a strong source of Ca, Mg and K.

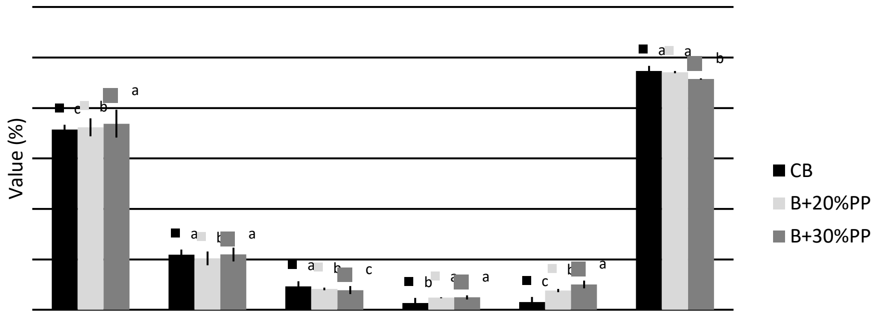

Fig. (2): Proximate chemical composition of control and blended papaya powder pan breads. Values are expressed as mean ± SD, Mean values in each bar with different superscript are significantly different at p<0.05, CB: Control Bread, PP: Papaya Powder

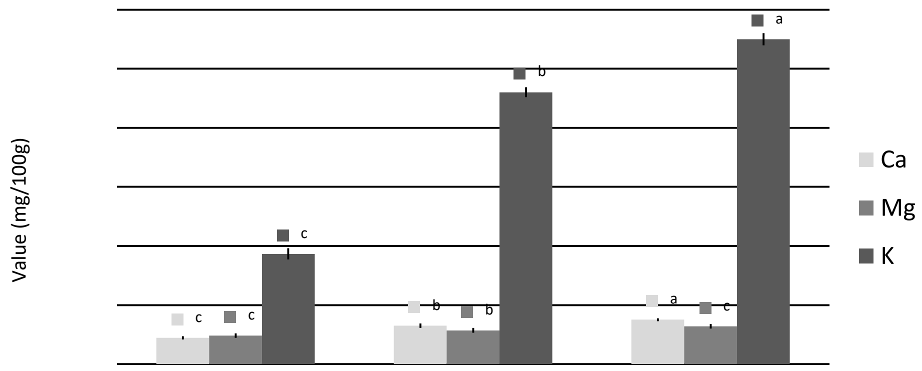

Fig. (3): Mineral content of control and blended papaya powder pan breads (on dry weight basis). Values are expressed as mean ± SD, Mean values in each bar with different superscript are significantly different at p<0.05, CB: Control Bread, PP: Papaya Powder

Physiochemical characteristics of control and blended PP pan breads:

Data in Table (4) showed the physiochemical characteristics of control and blended PP pan breads. From such data, it could be noticed that B+30% PP sample had the highest amount of total sugars of 6.67 %, and lowest amount of total sugars was in control bread (CB) that recorded 5.81%, as it seen total sugars content slightly increased by the addition level of PP in bread samples. Titratable acidity content was 0.69, 0.82

and 0.87% for samples of CB, B+20% PP and B+30% PP, respectively. The results demonstrated that the percentage of total soluble solids (TSS) increased as increased level of incorporation in bread formulae, TSS varied from 7.90 to 8.13%. While the PH value was decreased in bread samples as PP increased in bread formula. PH values recorded 6.92, 6.53 and 6.41 for the bread samples of CB, B+20% PP and B+30% PP respectively. Also, a noticeable increase in vitamin C and A content observed as PP level increased in the formula. These results agree with Yusufu and Akhigbe (2014) they reported that Ascorbic acid content increases as the percentage of papaya inclusion increases in formula and stated that composite flour of *carica* papaya fruit enhanced vitamin C content and functional characterizes in baked food products. Incorporation of PP to wheat flour improved and enhanced the nutritional quality of pan bread. These results are in the same trend with Varastegani *et al.* (2015) who reported that papaya pulp powder can use as an additive to wheat flour as composite flour that can be used in bakery food products as a term of flavoring, antioxidant activities and soluble dietary fiber content.

Table (4): Physiochemical characteristics of control and blended PP pan breads (w/w).

Composition	CB	B+20%PP	B+30%PP
Total sugar (%)	5.81± 0.03 ^{c}	6.20±0.03 ^{b}	6.76±0.03 ^{a}
TA (%)	0.69±0.04 ^{c}	0.82±0.04 ^{b}	0. 87±0.01 ^{a}
TSS (%)	7.90±0.03 ^{c}	8.09±0.02 ^{b}	8.13±0.02 ^{a}
PH	6.92±0.02 ^{a}	6.53±0.03 ^{b}	6.41±0.00 ^{bc}
Vitamin C (mg/100g)	1.62±0.07 ^{c}	16.73±0.11^{b}	21.23±0.06 ^{a}
Vitamin A (IU/100g)	n.d	333±1.89 ^{b}	467.67±3.79 ^{a}

Values are expressed as mean ± SD, Mean values in the same raw having different superscript are significantly different at $p<0.05$, where CB: Control Bread, PP: Papaya Powder, TA: Titratable acidity, TSS: Total Soluble Solids

Physical characteristics of control and blended PP pan breads:

Loaf weight, volume and specific volume of prepared loaves of bread samples are given in Table (5). The results indicated that all formula loaves were lower in loaf volume and higher in loaf weight than control sample. For instance, while the loaf volume of bread samples with 30%PP was 330 $cm^3$and control bread (CB) was 430 cm^3 with about 33% reduction. The loaf weight of the same bread sample was 140 g .These results are at the same trend with Abdel-Aal *et al.* (1993) who reported that loaf and specific volumes of pan breads prepared from composite flours were 25-60% lower than those obtained from wheat flour. While, Dhingra and Jood (2001) indicated that the decrease in loaf volume may be due to dilution effect on gluten content with incorporation of non-wheat flour to wheat flour (composite flour) that has been reported to be associated with the decrease of loaf volume. While the control sample was 134 g with about 4.3% increase. The increase in loaf weight was caused by the presence of hydrocolloids in the formulae. Meanwhile the reduction of loaf volume could be due to the reduction of dough gas retention power. The results were in agreement with the farinograph and extensograph results that indicated weaker properties for prepared dough than the control bread samples. Similar findings were obtained by **Ribotta *et al.* (2005).**

Table (5): Physical characteristics of control and blended PP pan breads.

Samples	Weight (g)	Increase %	Volume (cm^3)	Reduction %	Specific volume Cm^3/g	Reduction %
CB	134	-	430	-	3.2^a	-
B+20%PP	137	2.2	340	26.47	2.5^b	28
B+30%PP	140	4.3	330	30.30	2.4^c	33

Mean values in the same column having different superscript are significantly different at p<0.05, CB: Control Bread, PP: Papaya Powder

Texture characteristics of control and blended PP pan breads:

As shown in Table (6), the addition of PP in formulation of pan bread samples significantly affected the textural properties of the bread Firmness of blended bread samples were significantly (p <0.05) increased by increasing the level of PP in bread formulae from 2.50 in control bread (CB) to 3.73 in B+30%PP. Pan bread sample substituted with 30% PP were significantly (p<0.05) harder than that with 20% PP. These results agree with Gomez *et al.* (2013) who reported that the hardness of bread may due to the interaction between various materials used in product and gluten. Cohesiveness was significantly (p<0.05) affected by substitution of PP in pan bread formulae. It reduced from 0.736 in control bread (CB) to 0.611 in bread of 30%PP. This reduction indicated that the bread blended with PP has slightly decreased in the ability to resist before the bread structure deformed under the teeth. Pan bread samples substituted with PP showed significantly (p<0.05) higher value of gumminess. It affected by the addition of PP to formulae, it ranged from 1.840 in CB to 2.322 in B+30%PP. These results are in the same trend with **Feili *et al.* (2013)** who reported that the addition of fiber to bread formula caused an increase in gumminess of tested breads. The increase in springiness of control bread sample (CB) may be due to dilution of gluten structure in blended papaya bread (composite flour) these results are similar to obtained by **Dhingra and Jood (2001).**

Table (6): Texture characteristics of control and blended PP pan breads

Samples	Firmness (N)	Cohesiveness	Gumminess (N)	Chewiness (N)	Springiness	Resilience
BC	2.500 [c]	0.736 [a]	1.840 [c]	1.479 [a]	0.803 [a]	0.531 [a]
B20%PP	3.530 [b]	0.660 [b]	2.297 [b]	0.505 [c]	0.222 [c]	0.124 [c]
B30%PP	3.730 [a]	0.611 [c]	2.322 [a]	0.669 [b]	0.284 [b]	0.215 [b]

Mean values in the same column having different superscript are significantly different at p<0.05, CB: Control Bread, PP: Papaya Powder

Freshness of control and blended PP pan breads :

The change in alkaline water retention capacity (AWRC) for different prepared bread samples stored at room temperature for 0, 24 and 48 hrs are shown in Table (7). It could be observed that the control sample had the highest value of AWRC, being 320, 295 and 275% at 0, 24 and 48 hrs of storage, respectively. However all bread formulae caused a noticeable decrease in the AWRC values at 0, 24 and 48 hrs of storage compared with control. From the results, it could be noticed that AWRC of bread substituted of wheat flour with PP at levels 20% and 30% at zero time were 315 and 305% respectively, while after 24 hr were 285 and 265%, respectively.

The maximum decrease in AWRC values after 48 hrs of storage was observed in formula B+30%PP. This may be due to the increase of water absorption of the dough. Similar finding was observed by Yaseen *et al.* (2012) who reported that the increase of water absorption may cause slower bread staling rate. However Yaseen and Shouk (2011) and Erazo-Castrejon *et al.* (2001) they found that bread hardness increased during the staling experiment for 5 days.

Table (7):

Effect of adding different levels of PP to wheat flour (72% extraction) on alkaline water retention capacity (AWRC).

Samples	After zero time	After 24 hr	Rate of decrease (%)	After 48 hr	Rate of decrease (%)
CB	320	295	7.81	275	14.06
B+20%PP	315	285	9.52	270	14.29
B+30%PP	305	265	14.75	240	21.31

Data are average of triplicate analysis, CB: Control Bread, PP: Papaya Powder

Total bacteria and fungi count of control and blended PP pan breads at room temperature:

As shown in Table (8), after three days at room temperature, a low bacterial counts were detected in prepared pan bread samples, the highest total bacterial and fungi count were observed in control pan bread (CB) that recorded 65.33× 10^3 and 6.67× 10^3 followed by B+20%PP recorded 10.33× 10^3 and 0.67× 10^3, while B+30%PP that recorded 2.67× 10^3 and 0.67× 10^3 respectively. The total viable bacterial count is widely used as an indicator to microbiological quality of food. Nearly the two levels used in preparing pan bread were effective against bacterial pathogens however pan bread of 30 % PP showed best results against bacterial pathogens. It could be noticed that adding PP to pan bread inhibit and controlled the bacterial and fungi growth in prepared bread. This effect was obtained with the two levels of PP in storage period at three days at room temperature. These results are in parallel with the finding of Aravind *et al.* (2013); Arumugam *et al.* (2014) and Marshall *et al.* (2015) who identified that *carica papaya* as potential source of useful phytochemicals and bioactive substances nutrients that showed positive inhibitory effects and antimicrobial activity against the pathogenic bacteria. Furthermore Lopez-Malo *et al.* (2002) reported that fungi are more resistant to these natural antimicrobials when incorporated in food products.

Bread samples	Parameters	Total bacterial count	Total fungi count
CB	**× 10^3 /g**	65.33	6.67
	Log cfu/g	4.82	3.82
B+20%PP	**× 10^3 /g**	10.33	0.67
	Log cfu/g	4.01	2.83
B+30%PP	**× 10^3 /g**	2.67	0.67
	Log cfu/g	3.43	2.83

Data are average of three triplicate analysis CB: Control Bread, PP: Papaya Powder

Conclusion:

Papaya powder may be blended with wheat flour at levels as high as 30% without adversely affecting baking performance of pan bread. However, the addition of PP as a source of dietary fibers, minerals, vitamins A and

C to wheat flour affected the rheological and sensory characteristics of pan bread in various ways. Substitution of wheat flour with PP greatly enhanced and improved the nutritional quality of bread. The bread samples would serve as functional bread because of their high fiber, minerals and vitamins A and C contents. However, further research work should be focused on how to improve the organoleptic qualities and hence acceptability of PP blended breads.

References:

1. **A.O.A.C. (2000)**. Official Methods of Analysis of AOAC International, 17th ed. by Horwitz, W. Suite 500, 481 North Fredric avenue Gaithersburg, Maryland, MD.
2. **A.O.A.C., (2005)**. The Official Methods of Analysis of AOAC International, 18 ed. The Assoc. Official Ana. th Chem. Arlington.
3. **AACC, (2000).** Approved Method of the AACC, 10th ed., American Association of Cereal Chemists, St., Paul, Minnesota.
4. **AACC, (2005).** Approved Method of the American Association of Cereal Chemists, 11th ed. INC. St. Paul, Minnesota.
5. **Abdel-Aal, E.S., F.W. Sosulski, M.M. Yousef and A.A. Shehata, (1993)**. Selected nutritional, physical and sensory characteristics of pan and flat breads prepared from composite flours containing Faba bean. Plant Food. Hum. Nutr., 44: 227-239.
6. **Abdelghafor, R. F., A. I . Mustafa, A. M. H. Ibrahim, and P. G. Krishnan, (20110.** Quality of bread from composite flour of sorghum and hard white winter wheat. Advance Journal of Food Science and Technology 3: 9-15.
7. **Abou-Zaid, A.A.M., T.R. Mostafa, and S.A. AL-Asklany, (2011).** Utilization of faba bean and cowpea flours in gluten free cake production. Australian Journal of Basic and Applied Sciences, 5(12): 2665-2672.
8. **Adubofuor, J., A.M. Michael, and D. Sylvia, (2012)**. Nutritional and physicochemical properties of partially dried ripe pawpaw pulp and assessing the physical properties of rock buns and cakes prepared from the pawpaw pulp incorporated into wheat flour. African Journal of Food Science and Technology, 3(10): 244-251.
9. **Amri, E., and F. Mamboya, (2012)**. Papain, a plant enzyme of biological importance: a review, American Journal of Biochemistry and Biotechnology 8(2), 99-104.
10. **Ansari, A., A. Asghar, A. Shehzad, and S. Tanweer, (2014).** Rheological properties of papaya enriched wheat flour for baked products. Pakistan Journal of Food Sciences, 24(3): 126-131.

11. **Aravind. G., B. Debjit, S. Duraivel and G. Harish (2013)**. Traditional and Medicinal Uses of Carica papaya. Journal of Medicinal Plants Studies; 1(1): 7-15

12. **Arumugam, N., T. Boobalan, P. Raja Rajeswari and M.D. Duraimurugan (2014).** Antimicrobial activity and phytochemical screening of Cynodon dactylon and Carica papaya. Research in Biotechnology, 5(5): 21-31.

13. **Ashaye, O.A., S.O. Babalola, A.O. Babalola, J.O. Aina, and S.B. Fasoyiro, (2005).** Chemical and Organoleptic Characterization of Pawpaw and Guava Leathers. World Journal of Agricultural Sciences 1(1): 50-51.

14. **Bourne, M. C., (2003).** Food texture and viscosity: Concept and measurement. Elsevier Press, New York/London.

15. **Carroll, L.E., (1990)**. Functional properties and applications of stabilized rice bran in bakery products. Food Technol., 44: 74-76.

16. **Dhingra, S. and S. Jood, (2001).** Organoleptic and nutritional evaluation of wheat breads supplemented with soybean and flour. Food Chem., 77:479-488.

17. **Difico-Manual, (1985).** Dehydrated culture media and reagents for Microbiology .tenth Edition, Detroit, Michigan.

18. **Dooshima, I. B., J. Amove, and A. Okoh. (2014)**. Quality evaluation of composite bread produced from wheat, defatted soy and banana flours. Int. J. Nutr. Food Sci. 3:471–476.

19. **Erazo-Castrejon, S.V., D.C. Doehlert, and B.L D'Appolonia, (2001).** Application of oat oil in bread making. Cereal Chemistry, 78: 243-248.

20. **Feili, R., Z. Wahidu, W. A. Wan Nadiah, and A.Y. Tajul, (2013).** Physical and Sensory Analysis of High Fiber Bread Incorporated with Jackfruit Rind Flour, Food Science and Technology 1(2): 30-36.

21. **Galindo E. T., G.R. Hernandez, J.D. Mateos, G.F. Sandoval, L. Chel-Guerrero, I.B. Rodriguez, and S.T. Gallegos, (2009).** Proteolytic activity in enzymatic extracts from Carica papaya L. cv. Maradol harvest by-products, Process Biochemistry 44: 77-82.

22. **Gebhardt, S.E. and R.G. Thomas, (2002).** Nutritive value of foods. US Department of Agriculture, Agricultural Research Service, Home and Garden Bulletin. , 72.

23. **Gomez, M., M. Talegon, and DL.E. Hera**, (**2013)**.Influence of mixing on quality of gluten-free 590 bread. J Food Quality 36: 139–145.

24. **Gujral, H.S., I. Guardiola, J.V. Carbonell, and C. Rosell, (2004).** Improvement of the bread making quality of rice flour by glucose oxidase. Food research international, 37: 75-81.

25. **Hooda, S. and S. Jood, (2005)**. Organoleptic and nutritional evaluation of wheat biscuits supplemented with untreated and treated fenugreek flour. Food Chemistry 90:427–435.

26. **Hugo, L.F., L.W. Rooney, and J.R.N. Taylor, (2000)**. Malted sorghum as a functional ingredient in composite bread. Cereal Science 79(4): 428-432.

27. **Hui, Y.H., H. Corke, N. Cross, I. De Leyn, and Wai-Ku-Nip, (2006).** Baking Products: Science and Technology, 1st edition. Blackwell Publishing Ltd, 2121 State Avenue, Ames, Iowa, Humphrey.

28. **Kitterman, J.S. and G.L. Rubenthaler, (1971).** Assessing the quality of early generation wheat selection with the micro AWRC test. Cereal Science Today, 16: 313-316, 328.

29. **Kyomugisha, F., (2002).** Production and Characterization of Bread Made from Epuripur Sorghum. Uganda.

30. Lazaridou, A., D. Duta, M. Papageorgiou, N. Belc, and C.G. Biliaderis, (2007). Effects of hydrocolloids on dough rheology and bread quality parameters in gluten-free formulations. Journal of Food Engineering, 79(3): 1033–1047.

31. **Lee, M.R., B.G. Swanson, and B.K. Baik, (2001).** Influence of amylase content on properties of wheat starch and bread making qualities of starch and gluten blends. Cereal Chem., 78: 701-706.

32. **López-Malo, A., S.M. Alzamora, and E. Palou E, (2002).** Aspergillus flavus dose-response curves to selected natural and synthetic antimicrobials, Int J Food Microbiol, 73(2-3): 213-218.

33. **Maisarah, A.M., R. Asmah, and O. Fauziah, (2014).** Proximate Analysis, Antioxidant and Antiproliferative Activities of Different Parts of Carica Papaya. J Nutr Food Sci 4(2): 1-7.

34. **Malomo, S. A., A.F. Eleyinmi, and J.B. Fashakin, (2011).** Chemical composition, rheological properties and bread making potentials of composite flours from breadfruit, breadnut and wheat. African Journal of Food Science 5(7): 400-410.

35. **Marshall, E.U., C. Stephen, U. O. Emmanuel and E.A. Chizaram, (2015).** Antimicrobial screening and phytochemical analysis of Carica papaya Leaf extracts. Standard Research Journal of Microbiological Sciences, 2(1):1-4.

36. **Martin, J.P., (1950).** Use of acid, rose Bengal and streptomycin in the plate method for estimating soil fungi. Soil Sci.69(3):215-232.

37. **Medina, J.D., G.V. Gutiérrez, and H.S. García, (2010**).PAWPAW: Post-harvest Operation. In: Mejía D (ed) Compendium on Post-harvest Operations. Accessed online on 15th September, 2010 from <http://www.fao.org/inpho/ content/ compend/ text/ CH22_01.htm.

38. **Mohsen, S.M., A.A. Yaseen, A.M. Ammar, and A.A. Mohammad, (2010)**. Quality characteristics improvement of low-phenylalanine toast1 bread. Intrnational Journal of Food Science and Technology, 45: 2042-2051.

39. **Morita, N., T. Maeda, M. Miyazaki, M. Yamamori, H. Miura, and I. Ohtsuka, (2002).** Dough and baking properties of high amylase and waxy wheat flours. Cereal Chem., 79: 491-495.

40. **Ndife, J., L. O. Abdulraheem, and U. M. Zakari. (2011).** Evaluation of the nutritional and sensory quality of functional breads produced from whole wheat and soya bean flour blends. Afr. J. Food Sci. 5:466–472.

41. **Neeld, J.B., and W.N. Pearson, (1963).** Macro and micromethods for the determination of serum vitamin A using trifluroacetic acid. J. Nutr., 79:454–462.

42. **Oluwalana, B., S. A. Malomo, and E. O. Ogbodogbo. (2012).** Quality assessment of flour and bread from sweet potato wheat composite flour blends. Int. J. Biol. Chem. Sci. 6:65–76.

43. **Puwastien, P., B. Burlingame, M. Raroengwichit, and P. Sungpuag, (2000)**. ASEAN Food Composition Tables of Nutrition. Mahidol University, Thailand.

44. **Ribotta, P.D., S.F. Ausar, D.M. Beltramo and A.E. Leo, 2005.** Interactions of hydrocolloids and sonicatedgluten proteins. Food Hydrocolloids, 19: 93-9.

45. **Roberts, M., D.A. Minott, P.E. Tennant, and J.C. Jackson, (2008).** Assessment of compositional changes during ripening of transgenic papaya modified for protection against papaya ringspot virus. J. Sci. Food Agric. 88: 1911-1920.

46. **Saxholt, E., A.T. Christensen, A. Moller, H.B. Hartkopp, K. Hess Ygil, and O.H. Hels, (2008).** Danish Food Composition Databank, revision 7, Department of Nutrition, National Food Institute, Technical University of Denmark, website: http://www.foodcomp.dk/.

47. **Shittu, T.A., A.O. Raji, and A.O. Sanni, (2007).** Effect of baking time and temperature on some physicalo properties of bread loaf. Food Research International 40(2): 280-290.

48. **Snedecor, G.W., and W.G. Cochran, (1967).** Statistical Methods; 7th Ed., The Lowa State University Press., Ames, Lowa.

49. **Sudha, M., R. Vetrimani, and K. Leelavathi, (2007)**. Influence of fibre from different cereals on the rheological characteristics of wheat flour dough and on biscuit quality. Food Chemistry 100: 1365-1370.

50. **Taha, A.O.M., 2000.** The Role of Sorghum Flour Starches (Amylose/amylopectin) in Composite Bread Quality. M.Sc. Thesis, University of Khartoum, Sudan.

51. **Varastegani, B., Z. Wahidu, and A.Y. Tajul, (2015).** Investigation on physiochemical and sensory evaluation of cookies substituted with papaya pulp flour. Journal of Food Quality, 38:175-183.

52. **Vinci, G., F. Botre, G. Mele, and G. Ruggieri, (1995).** Ascorbic acid in exotic fruits: a liquid chromatographic investigation. Food Chem, 53: 211-214.

53. **World Health Organization; Food and Agriculture Organization of the United Nations, (2015):** Guidelines on Food Fortification with

Micronutrients. Available online:http://www.who.int/ nutrition/ publications/ guide_food_fortification_micronutrients.

54. **Yamazaki, W.T., (1953)**. An alkaline water retention capacity test for the evaluation of cookie baking potentialities of soft winter wheat fl ours. Cereal Chem., 30, 242–246.

55. **Yaseen, A.A., A.A. Shouk, Enssaf , M.A. El-Hamzy, and M.M.S. Ashour . (2012).** Production and Evaluation of Low Phenylalanine Pan Bread. Journal of Applied Sciences Research, 8(12): 5799-5805.

56. **Yaseen, A.A., and A.A. Shouk, (2011).** Low phenylalanine Egyptian shamy bread. Pol. J. Food Nutr. Sci., 61: 257-262.

57. **Yusufu, M. I., and A. O. Akhigbe, (2014).** The Production of Pawpaw Enriched Cookies: Functional, Physico-Chemical and Sensory characteristics. Asian Journal of Agriculture and Food Science, 2(2): 100-106.

الخواص الريولوجية والغذائية وجودة خبز القوالب المنتج من دقيق القمح ومسحوق ثمار الباباز

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الملخص:

تهدف الدراسة الحالية إلى فحص تأثير الاستبدال الجزئي لدقيق القمح ببعض النسب من مسحوق الباباز (٢٠ و ٣٠%) على الخصائص الريولوجية و الحسية والغذائية والخبيز والميكروبيولوجية فى خبز القوالب. أظهرت نتائج الفارينوجراف أن إضافة مسحوق الباباز قد سبب زيادة ملحوظة فى كل من امتصاص الماء والثبات ودرجة المرونة بالمقارنة مع العينة الضابطة (١٠٠% دقيق قمح).ولم يلاحظ اى تغيرات فى كل من وقت الوصول والوقت اللازم فى كل من عجائن المخلوط والكنترول. أظهرت نتائج الاكستنسوجراف أن إضافة مسحوق الباباز للعجينة تسبب فى تقليل مرونة العجين، والتمدد، والطاقة بالمقارنة بالعينة الضابطة. أظهرت نتائج التقييم الحسي ان استبدال دقيق القمح بمسحوق الباباز بنسبة ٣٠٪ كانت مقبولة فى الخبز. وأظهرت النتائج أن إضافة مسحوق الباباز إلى دقيق القمح بنسبة ٣٠٪ ادى الى زيادة محتوى الألياف الغذائية، الرماد، وفيتامينات أ و جـ ، كما انخفض المحتوى من الكربوهيدرات. وكان هناك أيضا انخفاض في حجم الخبز، والوزن النوعى، وزيادة الوزن مع الزيادة التدريجية من مسحوق الباباز. خصائص اللبابة فى الخبز لوحظ تأثرا واضحا باضافة مسحوق الباباز في العجين عند نسبة ٢٠ و ٣٠٪ والتى أكسبت الخبز المزيد من الصلابة، اللزوجة، وأظهرت انخفاضا في قيم التماسك والصمود. وأظهرت نتائج التحليل الميكروبي أن إضافة مسحوق الباباز الى الخبز منع وتحكم فى نمو البكتريا والفطريات عند فترة التخزين التى بلغت ثلاثة أيام.

الكلمات الاسترشادية: لتقييم الحسي، الفارينوجراف، الاكستنسوجراف، صورة تحليل القوام، الخواص الطبيعية، الألياف الغذائية