RHEOLOGICAL, NUTRITIONAL AND QUALITY CHARACTERISTICS OF PAN BREAD PRODUCED FROM WHEAT FLOUR AND PAPAYA FRUITS POWDER

Hanaa F. El-Mehiry
Department of Home Economics, Faculty of Specific Education, Mansoura University.

Afaq-Haniem M. Ramadan
Department of Home Economics, Faculty of Specific Education, Mansoura University.

Madiha M. Abd El-Hay
Department of Home Economics, Faculty of Specific Education, Mansoura University
RHEOLOGICAL, NUTRITIONAL AND QUALITY CHARACTERISTICS OF PAN BREAD PRODUCED FROM WHEAT FLOUR AND PAPAYA FRUITS POWDER

Hanaa F. El-Mehiry, Afaf-Haniem M. Ramadan and Madiha M. Abd El-Hay

Department of Home Economics, Faculty of Specific Education, Mansoura University.

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 \(50 \pm 5^\circ C\) 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°C 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°C) 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.**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Pan bread formulae (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
</tr>
</tbody>
</table>

المجلة الثانية- العدد الثاني- مسلسل العدد (4)– يوليو 2016
<table>
<thead>
<tr>
<th></th>
<th>Wheat flour (WF, 100%)</th>
<th>(20%)</th>
<th>(30%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat flour (72% extra.)</td>
<td>93</td>
<td>74.4</td>
<td>65.1</td>
</tr>
<tr>
<td>Sugar (Sucrose)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Shortening</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Yeast</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Salt</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Improver</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Papaya Powder (PP)</td>
<td>-</td>
<td>18.6</td>
<td>27.9</td>
</tr>
</tbody>
</table>

**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).

<table>
<thead>
<tr>
<th>Samples</th>
<th>Water absorption (%)</th>
<th>Arrival time (min)</th>
<th>Dough development (min)</th>
<th>Dough stability (min)</th>
<th>Degree softening (B.U)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control 100% WF</td>
<td>56.0</td>
<td>1.0</td>
<td>1.5</td>
<td>1.0</td>
<td>110</td>
</tr>
<tr>
<td>80% WF + 20% PP</td>
<td>59.2</td>
<td>0.5</td>
<td>1.0</td>
<td>0.5</td>
<td>290</td>
</tr>
<tr>
<td>70% WF + 30% PP</td>
<td>64.3</td>
<td>1.0</td>
<td>1.5</td>
<td>1.5</td>
<td>240</td>
</tr>
</tbody>
</table>

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 cm²) while the formula of 20% and 30% PP recorded 30 cm² and 37 cm².

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 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.

<table>
<thead>
<tr>
<th>Samples</th>
<th>Elasticity (BU)</th>
<th>Extensibility (mm)</th>
<th>Proportional Number (P.N)</th>
<th>Energy (cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control 100% WF</td>
<td>460</td>
<td>195</td>
<td>2.36</td>
<td>128</td>
</tr>
</tbody>
</table>
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).

<table>
<thead>
<tr>
<th>80% WF + 20% PP</th>
<th>350</th>
<th>57</th>
<th>6.14</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>70% WF + 30% PP</td>
<td>430</td>
<td>60</td>
<td>7.17</td>
<td>37</td>
</tr>
</tbody>
</table>

WF: Wheat Flour, PP: Papaya Powder

WF: Wheat Flour, PP: Papaya Powder

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).

<table>
<thead>
<tr>
<th>Composition</th>
<th>CB</th>
<th>B+20%PP</th>
<th>B+30%PP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total sugar (%)</td>
<td>5.81±0.03</td>
<td>6.20±0.03</td>
<td>6.76±0.03</td>
</tr>
<tr>
<td>TA (%)</td>
<td>0.69±0.04</td>
<td>0.82±0.04</td>
<td>0.87±0.01</td>
</tr>
<tr>
<td>TSS (%)</td>
<td>7.90±0.03</td>
<td>8.09±0.02</td>
<td>8.13±0.02</td>
</tr>
<tr>
<td>PH</td>
<td>6.92±0.02</td>
<td>6.53±0.03</td>
<td>6.41±0.00</td>
</tr>
<tr>
<td>Vitamin C (mg/100g)</td>
<td>1.62±0.07</td>
<td>16.73±0.11</td>
<td>21.23±0.06</td>
</tr>
<tr>
<td>Vitamin A (IU/100g)</td>
<td>n.d</td>
<td>333±1.89</td>
<td>467.67±3.79</td>
</tr>
</tbody>
</table>

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.

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

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

<table>
<thead>
<tr>
<th>Samples</th>
<th>Firmness (N)</th>
<th>Cohesiveness</th>
<th>Gumminess (N)</th>
<th>Chewingness (N)</th>
<th>Springiness</th>
<th>Resilience</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC</td>
<td>2.500 c</td>
<td>0.736 a</td>
<td>1.840 c</td>
<td>1.479 a</td>
<td>0.803 a</td>
<td>0.531 a</td>
</tr>
<tr>
<td>B20%PP</td>
<td>3.530 b</td>
<td>0.660 b</td>
<td>2.297 b</td>
<td>0.505 c</td>
<td>0.222 c</td>
<td>0.124 c</td>
</tr>
<tr>
<td>B30%PP</td>
<td>3.730 a</td>
<td>0.611 c</td>
<td>2.322 a</td>
<td>0.669 b</td>
<td>0.284 b</td>
<td>0.215 b</td>
</tr>
</tbody>
</table>

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).

<table>
<thead>
<tr>
<th>Samples</th>
<th>After zero time</th>
<th>After 24 hr</th>
<th>Rate of decrease (%)</th>
<th>After 48 hr</th>
<th>Rate of decrease (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB</td>
<td>320</td>
<td>295</td>
<td>7.81</td>
<td>275</td>
<td>14.06</td>
</tr>
<tr>
<td>B+20%PP</td>
<td>315</td>
<td>285</td>
<td>9.52</td>
<td>270</td>
<td>14.29</td>
</tr>
<tr>
<td>B+30%PP</td>
<td>305</td>
<td>265</td>
<td>14.75</td>
<td>240</td>
<td>21.31</td>
</tr>
</tbody>
</table>

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 $6.533 \times 10^3$ and $6.67 \times 10^3$ followed by B+20%PP recorded $10.33 \times 10^3$ and $0.67 \times 10^3$, while B+30%PP that recorded $2.67 \times 10^3$ and $0.67 \times 10^3$ 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.

<table>
<thead>
<tr>
<th>Bread samples</th>
<th>Parameters</th>
<th>Total bacterial count</th>
<th>Total fungi count</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB</td>
<td>$\times 10^3$/g</td>
<td>65.33</td>
<td>6.67</td>
</tr>
<tr>
<td></td>
<td>Log cfu/g</td>
<td>4.82</td>
<td>3.82</td>
</tr>
<tr>
<td>B+20%PP</td>
<td>$\times 10^3$/g</td>
<td>10.33</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>Log cfu/g</td>
<td>4.01</td>
<td>2.83</td>
</tr>
<tr>
<td>B+30%PP</td>
<td>$\times 10^3$/g</td>
<td>2.67</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>Log cfu/g</td>
<td>3.43</td>
<td>2.83</td>
</tr>
</tbody>
</table>

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:


المجلة الدراسات وبحوث التربية النوعية

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

المعرض:

هنا فاروق المهيري، عفاف هانم محمود رمضان ومديحة محمد إبراهيم

الملخص:

تهدف الدراسة الحالية إلى فحص تأثير الاستبدال الجزئي لدقيق القمح ببعض النسب من مسحوق الباباز (20 و 30%) على الخصائص الريولوجية و الحسية والغذائية والخبز والميكروبيولوجية في خبز القوالب. أظهرت نتائج الفارينوجراف أن إضافة مسحوق الباباز قد سبب زيادة ملحوظة في كل من امتصاص الماء والنبيتات ودرجة المرونة بالمقارنة مع العينة الضابطة (100% دقيق قمح). ولم يلاحظ أي تغيرات في كل من وقت الوصول والوقت اللامن في كل من عجانين المخلوط والكنترول. أظهرت نتائج الاكتستسوجراف أن إضافة مسحوق الباباز للعجينة تسبب في تقليل مرونة العجين، والتمدد، والطاقة بالمقارنة بالعينة الضابطة. أظهرت نتائج التقييم الحسي أن استبدال دقيق القمح بمسحوق الباباز بنسبة 20% كانت مقبولة في الخبز. وأظهرت النتائج أن إضافة مسحوق الباباز إلى دقيق القمح بنسبة 30% أدى إلى زيادة محتوى الألياف الغذائية، الرماد، وفيتامينات أ و ج، كما انخفض المحتوى من الكربوهيدرات. وكان هناك أيضاً انخفاض في حجم الخبز، وزن النظم، وزراعة البكتيريا، وزيادة الوزن مع الزيادة التدريجية من مسحوق الباباز. خصائص اللهب في الخبز لوحظ تأثيراً واضحاً بإضافة مسحوق الباباز في العجين عند نسبة 20 و 30% والتي أكسبت الخبز المزيد من الصلاحية، والزروحة، وأظهرت انخفاضاً في قيم التماسك والصمود. وأظهرت نتائج التحليل الميكروبي أن إضافة مسحوق الباباز إلى الخبز منع وتحكم في نمو البكتيريا والفطريات عند فترة التخزين التي بلغت ثلاثة أيام.

الكلمات الاسترشادية: تقييم الحسي، الفارينوجراف، الاستسوسوجراف، صورة تحليل القوم، الخصائص الطبيعية، الألياف الغذائية