STUDY ON NUTRITIONAL AND QUALITY ATTRIBUTES OF FERMENTED PIGEON PEA INCORPORATED BISCUIT

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ABSTRACT

This study was done on “nutritional quality of biscuit produced from mixture of fermented pigeon pea and wheat flour”. The pigeon pea powder was used for biscuit preparation. It was incorporated into the traditional recipe to replace wheat flour at levels of 10, 20, and 30 in preparation of biscuit. Result of sensory (appearance, colour, flavour, texture, taste and overall acceptability) evaluation revealed that the 80-20% addition of pigeon pea powder has higher overall acceptability, taste, texture and flavour and it was accepted by the panellists. However, a declining trend in acceptability was observed with increasing level of pigeon pea powder for all the sensory characteristics. The nutritional value of the biscuit (as determined through nutrient analysis of moisture, protein, fat, ash and fiber) with 70-30% of pigeon pea powder fortified protein biscuit was higher than other samples.

Key words: biscuit, protein, pigeon pea biscuit, bakery products.

1. INTRODUCTION

Pigeon pea is useful in various ways both as human food and animal feed. As human food pigeon pea is used as ‘dhal’ (split seed without seed coat), whole seed, and green vegetable to supplement cereal-based diets. Pigeon pea green manure provide nitrogen-rich organic material to improve soil structure Whiteman and Norton (1981). Among legumes, Pigeon pea (Cajanus cajan L.) is predominantly grown and consumed in India. It is also known as red gram, arhar, tur dal which belongs to the family of Leguminosae It is observed that pigeon pea is economically and nutritionally an important legume and is a major source of protein for the poor communities of many tropical and subtropical regions of the world Singh (1984). It (Cajanus cajan L.) occupies an important place in rainfed agriculture. Globally, it is cultivated on 4.79 M ha in 22 countries FAO (2008) but with only a few major producers in the world. In Asia, India (3.58 M ha), Myanmar (560,000 ha), and Nepal (20,703 ha) are important pigeon pea producing countries. In the African continent, Kenya (196,261 ha), Malawi (123,000 ha), Uganda (86,000 ha), Mozambique (85,000 ha) and Tanzania (68,000 ha) produce considerable amounts of pigeon pea. The Caribbean islands and some South American countries also have reasonable areas under pigeon pea cultivation. It has the ability to bring minerals from deeper soil horizons to the surface and hence improving soil air circulation Kumar Rao (1983) to the benefit of the accompanying crop. Pigeon pea’s initial slow growth reduces competition for light, water and soil nutrients when intercropped Dalal (1974) thereby minimising any negative impact on the main crop.

2. MATERIALS REQUIRED

Good quality pigeon pea was obtained from local market of Allahabad. Refined wheat flour was obtained from local market of Allahabad. The flour was of creamy white colour and free of bean fragments. Butter was used to replace hydrogenated vegetable oil for biscuit making as a leavening agent, which was purchased in local market of Allahabad. Baking powder was purchased from local market of Allahabad. This was used as a leavening agent. Spray dried milk powder was purchased from local market of Allahabad to provide desired moisture content. Salt and sugar was purchased from local market of Allahabad. Sugar was used as sweetener which also plays an important role in caramalization.

3. METHODS

Table 1 Ingredients for pigeon pea powder biscuit

<table>
<thead>
<tr>
<th>Sample</th>
<th>Pigeon pea powder (g)</th>
<th>Refined flour (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlled</td>
<td>........</td>
<td>100</td>
</tr>
<tr>
<td>Sample A</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>Sample B</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>Sample C</td>
<td>30</td>
<td>70</td>
</tr>
</tbody>
</table>
Selection of raw material
- Milling
- Fermentation of pigeon pea
- Drying
- Sifting
- Creaming (mixing sugar and shortener)
- Addition of refined flour and pigeon pea flour
- Addition of skimmed milk and leavening agent
- Final mixing of added ingredients for dough making
- Spreading
- Shaping
- Loading in trays
- Baking (160°C/25 minute)
- Cooling
- Packing
- Storage

Fig 1 Flow chart for pigeon pea powder biscuit preparation

3.1 PHYSICO-CHEMICAL ANALYSIS OF PIGEON PEA BISCUIT

There are different physical characteristics of biscuit such as spread ratio, volume and density. In the case of pigeon pea biscuit, spread ratio, volume and density was calculated including sample T0, T1, T2 and T3 and control sample (T0) (AACC, 2000). The physical characteristics of biscuit prepared replacing wheat flour with 0 to 30% pigeon pea powder. The present data in Table 2 indicate reduction of spread ratio of biscuit was attributed to better binding strength of pigeon pea powder protein, also resulting in increase of thickness. The average spread ratio of different samples, T1, T2 and T3 of pigeon pea powder biscuit was found to be 5.01, 4.95, 4.95 and 4.85 respectively. It shows that the spread ratio of the biscuit was decreased significantly with increasing level of pigeon pea powder flour. The results showed that increase in level of pigeon pea powder flour resulted in linear decrease of spread ratio other research workers also reported reduction in spread ratio when soy flour and fenugreek flours were substituted for wheat flour (Singh et al. 1996; Hooda and Jood, 2005).

Reduced spread ratios of pigeon pea powder biscuit were attributed to the composite flours form aggregates with increased number of hydrophilic sites available competing for limited free water in biscuit dough (McWatters, 1978). The average volume of different samples T0, T1, T2 and T3 of pigeon pea biscuit was found to be 24.13, 23.94 and 23.78 cm³ respectively. The decrease in the volume of the pigeon pea powder is due to decrease in the mass of the biscuit prepared, the mass decreases due to the loss of protein, fat and other nutrient content of the sample. There was also a decrease in the volume during incorporation of pigeon pea is due to decrease in the spread ratio because they are interrelated to each other as spread ratio is decreasing the volume which is also decreasing. Likewise, the same result was obtained by Rufeng et al. (1995) in defatted soy flour. The average density of different samples T0, T1, T2 and T3 of pigeon pea powder biscuit was found to be 0.40, 0.45 and 0.46 g/cm³ respectively. The increase in the density is due to the increase in the pigeon pea powder in the biscuit because pigeon pea powder has the fat retaining capacity during baking and it decrease during the storage because fat, protein and vitamins present in the biscuit are loss during the storage. Likewise the same result was obtained by Rufeng et al. (1995) in defatted soy flour.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Spread ratio</th>
<th>Volume (cm³)</th>
<th>Density (g/cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>5.01</td>
<td>24.13</td>
<td>0.40</td>
</tr>
<tr>
<td>T1</td>
<td>4.95</td>
<td>23.94</td>
<td>0.45</td>
</tr>
<tr>
<td>T2</td>
<td>4.95</td>
<td>23.78</td>
<td>0.46</td>
</tr>
<tr>
<td>T3</td>
<td>4.94</td>
<td>23.42</td>
<td>0.51</td>
</tr>
</tbody>
</table>

Table 2. Effect of different treatments on physical analysis of pigeon pea biscuit

Chemical analysis of pigeon pea biscuit was calculated on the basis of moisture, ash, fat, protein and fibre content. The data presented in Table 3 indicate that the average ash content of different samples, T0, T1, T2 and T3 of pigeon pea powder biscuit was found to be 2.56, 3.09, 3.19 and 3.36%, respectively. The ash content in food stuff not necessarily accounts for exactly the same composition as the mineral matter present in the original food, there may be some losses due to volatilization or some interaction between the constituents. Anjum et al. (2003) reported non-significant effect of storage on ash content of wheat flour samples. Therefore, it can be concluded that significant effect of ash content of sample T0, T1, T2 and T3 were observed. The data presented in Table 3 indicate that the average moisture content of different samples T0, T1, T2 and T3 of pigeon pea powder biscuit was found to be 1.46, 6.09, 6.30 and 6.43% respectively. The moisture content of biscuit...
The results in the present study showed that there was a 5.64, 4.96, 5.29 and 5.65%, respectively. Protein content justifies the suitability of incorporating pigeon pea powder in making nutritionally enhanced biscuit. The protein content of the biscuit was found to increase linearly with increase in the pigeon pea powder because the pigeon pea powder contains good amount of protein content (16.13%). Therefore, it can be concluded that significant effect of protein content of sample T0, T1, T2 and T3 were observed.

Table 3 indicate that the average protein content of different samples T0, T1, T2 and T3 of pigeon pea powder biscuit was found to be 9.65, 10.13, 10.89 and 11.07%, respectively. Protein content contains good amount of protein content (16.13%). The protein content is similar; other researchers incorporate legumes in the cassava based composite flour (Padmaja and Jisha, 2005). The data presented in Table 3 indicate that the average fat content of different samples T0, T1, T2 and T3 of pigeon pea powder biscuit was found to be 5.64, 4.96, 5.29 and 5.65%, respectively. The results in the present study showed that there was a significant decrease in the fat content of pigeon pea powder biscuit during storage. Table 3 indicates the increase in fat content on incorporation of pigeon pea powder because pigeon pea powder contains 6.32% fat, but there is decrease in fat content in biscuit which may be attributed to the development of rancidity. The fat deterioration during storage may be due to activity of lipase enzyme which split off the fat into free fatty acids and glycerol in the presence of catalyst like moisture, light and heat and there is an increase in the fat content during the storage which is due to fat retaining capacity of pigeon pea powder during baking. Therefore, it can be concluded that significant effect of fat content of sample T0, T1, T2 and T3 were observed with an increase in the fat content of biscuit by Tyagi et al. (2006) was reported and explained to be largely due to the incorporation of defatted mustard flour. The data presented in Table 3 indicate that the average fibre content of different samples T0, T1, T2 and T3 of pigeon pea powder biscuit was found to be 2.41, 1.93, 2.20 and 2.48%, respectively. The mean fibre content of the biscuit increased with the increase in amount of the pigeon pea powder. Therefore, it can be concluded that significant effect of fiber content of sample T0, T1, T2 and T3 were observed. This result is in the agreement with the reported by Arvind and Lorentz (1999), where the pigeon pea powder has high amount of fibre. As compared to the research which incorporates pineapple pomace powder in the biscuit by Inyang and Wayo (2005b, mean fibre content of control biscuit was 0.846%. A slight decrease or variation in the fibre content of the biscuit was because of pectin, starch, cellulose and other carbohydrates denature after a long storage, decrease in the fibre content was also reported by Nassar et al. (2008).

4. CONCLUSION

The present investigation was carried with the development of pigeon pea powder in the preparation of pigeon pea biscuit. This is a good source of protein and, four treatments were used (controlled sample, 10, 20 & 30) of pigeon pea powder. The biscuit containing 20% pigeon pea powder were found to be satisfactory after testing physio-chemical analysis like ash, moisture, fat, protein, fibre, vitamin C and depending on different sensory attributes like colour, texture, taste, flavour and overall acceptability during shelf life study in comparison with 10, 20 and 30% pigeon pea powder biscuit which was found significantly different in their physicochemical and organoleptic characteristics change for a storage period of 60 days self-life study. There was significant variation in these 10, 20, and 30% treatment but 30% sample was found to be more satisfactory as compared to sample control sample,10 and 20% in the case of protein content.

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