Influence of orange bagasse addition on chemical composition of biscuits

Bhavna Tripathi, Dr. Rajlakshmi Tripathi and Dr. Meera Vaidya

Abstract

Biscuits containing four different levels of orange bagasse powder (0%, 4%, 6% and 8%) were studied regarding proximate composition, total dietary fiber content, physical characteristics, and acceptability in a sensory test. Data revealed that incorporation of orange bagasse in biscuits formula increased dietary fiber from 0.25 to 5.99% and ash have the same trend, while protein content was decreased from 14.13 to 13.39% respectively. The thickness and diameter of sample decreased significantly with increasing levels of orange bagasse. Sensory evaluation of biscuits has showed that biscuits with 6% of orange bagasse powder had highest scores for all organoleptic characteristic.

Keywords: Orange bagasse, biscuits, dietary fiber, proximate composition

1. Introduction

Bakery industry is one of the largest food industry in India with an estimated production of 70,000 tones and cost of Rs.3000 billion US Dollar. The industry has been growing at an average rate of 15% during the past three year and this is expected to be maintaining in coming year (IBMA, 2010) \([6]\). The major products within this industry include bread, biscuits, cakes and pastry (Chough et al. 2013) \([6]\). The demand of bakery products is increasing at rate of 10.07% per annum (Kamaljit et.al, 2010) \([13]\). In India biscuits consumption per capita is 2.1 kg., compared to more than 10 kg in the USA, UK and west European countries and above 4.25 kg in south-east Asian countries, e.g. Singapore, Hong Kong, Thailand, Indonesia, etc. China has per capita consumption of 1.90 kg, while in the case of japan it is estimated at 7.5 kg (Srivastava, 2009) \([18]\). Bread and biscuits form the major baked products accounting for over 80% of total bakery foods produced in the country. Bakery products are gaining extreme popularity as processed foods which offer ready to eat convenience as well as have comparatively long shelf life.

Dietary fiber (DF) is such a non-nutritional component. It is edible part of plant or analogous carbohydrate that are resistant to digestion and absorption in the human small intestine with complete and partial fermentation in the large intestine. Dietary fiber includes polysaccharides, oligosaccharides, lignin and associated plant substances. It promotes beneficial physiological effects including laxation, and/or blood cholesterol attenuation, and/or blood glucose attenuation (AACC, 2001) \([11]\). Citrus is the most abundant crop in the world, orange lemon grapefruits and mandarins represent the total produced citrus fruits. The amount of waste of orange bagasse.

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The present investigation was performed to assess chemical profile of orange bagasse fortified biscuits. Study included estimation of dietary fiber and organoleptic properties of control and fortified biscuits.

2. Materials and method

2.1. Preparation of raw materials: Control biscuits were prepared by using rubbing method as given by Kamaliya (2002). The following ingredients wheat flour, baking soda, milk powder, sugar and shortening were purchase from Priyederashani market Jabalpur. Commercial variety of sweet orange (citrus sinensis) were procured from local market. Commercial variety of sweet orange (citrus sinensis) were procured from local market. The peel of the orange was removed with plain stainless steel knife and juice extracted manually. The bagasse left was dried at 60 c 8 hour in air oven dryer. The dry bagasse was ground with grinder and sieved through a mesh number 40(425) as described by Romero-Lopez (2011)\(^\text{[16]}\).

2.1.1. Steps in the preparation of orange bagasse powder sample

\[
\text{Orange} \quad \downarrow \quad \text{Hand peeling} \\
\text{Extraction of juice (by juicer)} \\
\text{Orange juice} \quad \text{Orange bagasse} \\
\text{Orange bagasse} \quad \downarrow \quad \text{Separation of seeds from pulp} \\
\text{Spreading over the trays} \\
\text{Dehydration (60° C for 16 hours)} \quad \downarrow \quad \text{Grinding} \\
\text{Sieving} \\
\text{Storage in air tight container} \quad \text{Fig 1}
\]

Table 1: Biscuits formulation with various percentage of Orange Bagasse Powder

<table>
<thead>
<tr>
<th>Ingredients (g)</th>
<th>OBB1</th>
<th>OBB2</th>
<th>OBB3</th>
<th>OBB4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refined wheat flour</td>
<td>100</td>
<td>96</td>
<td>94</td>
<td>92</td>
</tr>
<tr>
<td>Orange bagasse powder (OB)</td>
<td>0</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Powdered sugar</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Shortening</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Skimmed milk powder</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Baking powder</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Ammonium bicarbonate</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Common salt</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Ajwain</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
</tbody>
</table>

OBB1= biscuits with 100% refined wheat flour  
OBB2= biscuits with 4% Orange Bagasse Powder  
OBB3= biscuits with 6% Orange Bagasse Powder  
OBB4= biscuits with 8% Orange Bagasse Powder

2.1.2. Flow diagram for preparation of biscuits

\[
\text{Weighing of ingredients} \quad \downarrow \\
\text{Sieve flour} \quad \downarrow \\
\text{Add shortening and rubbing} \quad \downarrow \\
\text{Add sugar and mix lightly} \quad \downarrow \\
\text{Mix water and make smooth dough} \quad \downarrow \\
\text{Rolling / sheeting (4 mm)} \quad \downarrow \\
\text{Cutting} \quad \downarrow \\
\text{Tray greasing} \quad \downarrow \\
\text{Baking (150 °C for 15 min.)} \quad \downarrow \\
\text{Cooling} \quad \downarrow \\
\text{Packaging} \quad \text{Fig 2}
\]

2.2 Sensory evaluation

Twenty four hour after preparation of biscuits organoleptic evaluation was performed. A total 20 semi-trained panelist were recruited from staff and students of the Govt. M.H College of home Sci. & Sci. for Women, Jabalpur. Each panelist evaluated all the samples prepared for each treatment in one session. Criteria for selection of panelist were that panelist were regular consumer of biscuits and were not allergic to any food. Panelist requested to evaluate colour, taste, texture, flavor and overall acceptability on 9 point Hedonic scale using numerical values ranging from 1 to 9, where 1 entitiled disliked extremely and 9 represented liked extremely. Samples were identified with a code and presented in a random sequence to panelist. The panelists were instructed to rinse their mouth with water after every product and not make comments during evaluation to prevent influencing other panelist. They were also asked to comment freely on samples on the score card provided to them.

2.3 Physical properties

2.3.1. Height / thickness

Thickness of biscuit was assessed by vernier calipers (AACC, 1967). Six biscuits were stacked one above the other and the average value was reported in millimeter.

2.3.2. Weight

Weight of biscuits was measured as average value of six individual biscuits with the help of electrical weighing balance Bala et al. (2015)\(^\text{[4]}\). Average value for weight was recorded in grams.

2.3.3. Diameter

The diameter was measured by laying six biscuits edge to edge and measuring nearest mm. The biscuits were rotated 90° and their diameter re measure as check determination. The average value of diameter was expressed in millimeter (AACC, 1967).

2.3.4. Spread ratio: According to AACC, (1967) the spread factor calculated by dividing the average value of diameter
2.3. Nutritional quality

Protein, fat, ash, moisture content of the biscuit were determined as per IS 7219: 1973 (R 2010) [9], IS 12711:1989 (R 2010) [11], IS 12711:1989 (R 2010) [11], IS 1011:2002 (R 2009) [10], IS 9497:1989 (R 1998), respectively.

2.4 Statistical analysis

The data were subjected to ANOVA and mean scores were separated using Duncan’s multiple range test by SPSS version 16.0.

3. Results and discussion

3.1. Effect on chemical composition: The mean scores of chemical composition of experimental biscuits are shown in table no. 2. The Data revealed that moisture and protein contents decreased (3.17 to 5.36 and 14.12 to 13.28 respectively) with increasing the level of orange bagasse whereas, ash and total dietary fiber content increased significantly with increasing orange bagasse powder. These results confirmed those obtained by (Nassar et al. 2008) [15]. Proximate composition of substituted biscuits showed decrease in protein content, this might be due to the result of the lower protein content of orange bagasse as reported by Bilgici et al. (2007) [5].

Table 2: Chemical composition of fortified biscuits

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Moisture</th>
<th>Ash</th>
<th>Protein</th>
<th>Fat</th>
<th>Dietary Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>3.17±0.03a</td>
<td>2.85±0.15a</td>
<td>14.12±10a</td>
<td>26.95±0.069</td>
<td>0.283±0.05a</td>
</tr>
<tr>
<td>OBB4%</td>
<td>4.10±0.043a</td>
<td>3.08±0.066ab</td>
<td>13.87±10a</td>
<td>26.31±0.299a</td>
<td>3.13±0.013b</td>
</tr>
<tr>
<td>OBB6%</td>
<td>4.98±0.005b</td>
<td>3.41±0.50b</td>
<td>13.65±0.065b</td>
<td>26.31±0.121b</td>
<td>4.58±0.055b</td>
</tr>
<tr>
<td>OBB8%</td>
<td>5.36±0.066a</td>
<td>3.62±0.070a</td>
<td>13.28±0.041a</td>
<td>26.17±0.124a</td>
<td>5.95±0.057a</td>
</tr>
</tbody>
</table>

a mean value ± standard deviation

b mean value marked with different superscript in the same column are significantly different at Duccan - \( p \leq 0.05 \)

Table 3: Organoleptic characteristics of biscuits

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Color</th>
<th>Taste</th>
<th>Flavor</th>
<th>Texture</th>
<th>Overall acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>OBB1</td>
<td>7.2±0.20a</td>
<td>7.33±0.09ab</td>
<td>7.02±115a</td>
<td>7.36±0.005a</td>
<td>7.23±105a</td>
</tr>
<tr>
<td>OBB2</td>
<td>7.2±0.10a</td>
<td>7.20±0.20a</td>
<td>7.03±0.057a</td>
<td>7.60±100b</td>
<td>7.41±0.415a</td>
</tr>
<tr>
<td>OBB3</td>
<td>7.36±0.08a</td>
<td>7.26±0.01a</td>
<td>7.40±0.20a</td>
<td>7.26±0.049a</td>
<td>7.50±0.40a</td>
</tr>
<tr>
<td>OBB4</td>
<td>7.20±0.10a</td>
<td>7.43±0.01a</td>
<td>7.13±12a</td>
<td>7.05±0.043a</td>
<td>7.19±0.127a</td>
</tr>
<tr>
<td>Total</td>
<td>7.24±1.32</td>
<td>7.30±1.29</td>
<td>7.145±195</td>
<td>7.31±212</td>
<td>7.361±290</td>
</tr>
</tbody>
</table>

a mean value ± standard deviation

b mean value marked with different superscript in the same column are significantly different at Duccan - \( p \leq 0.05 \)

3.2. Sensory evaluation: The results of the organoleptic evaluation of biscuits sample are presented in table 3 and figure 4 - 7. Statistical analysis revealed that there were no significance difference \( (p>0.05) \) among all treatments for overall acceptability. While, the biscuits with 8% and 6% orange bagasse powder had highest score for taste and flavor respectively. Thus, sensory scores of biscuits has revealed that, biscuits with 8% and 6% orange bagasse had highest levels of acceptance for all sensory characteristics.
3.3. Effect on physical properties: the mean values of physical attributes of control biscuit and fortified biscuits with orange bagasse powder are outlined in figure (3). The mean value of diameter for control biscuits was 48.5mm while that of developed biscuits ranged from 46 to 44.4 for orange bagasse powder at 4-8% levels. On the side, the average thickness of control biscuits were 7.27mm and for incorporated levels, it varied from 6.81 to 6.09. The data recorded a gradual increment of spread ratio of all substituted biscuits ranging from 6.67 to 7.53. Results indicated that the incorporation of orange bagasse significantly affected the diameter, thickness and spread ratio of the fortified biscuits. The same trend was reported by (Nassar et al. 2008 and Youssuf and Mousa, 2012)\[135, 19].

4. Conclusion
It could be concluded that dehydrated orange bagasse the remaining after juice extraction could be utilized as a suitable source of dietary fiber and could be incorporated as ingredients in large variety of food products such as biscuits.

5. References
8. IBMA. Biscuits industry in India. 2010. www.ibmabiscuit.in/industry-statistics.htm
9. Indian standard methods for determination of protein in foods and feeds IS 7219-1973