Formulation and quality assessment of instant *dhokla* mix with incorporation of pumpkin flour

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This study presents an instant *dhokla* mix with incorporation of pumpkin (*Cucurbita moschata*) flour at 10, 20 and 30% levels in instant mix. Incorporation of pumpkin powder in instant *dhokla* mix resulted in a significant increase in nutrients (threefold increase in protein and twofold increase in fiber). Beta-carotene levels of *dhokla* mix increased by 8.4% in 20% pumpkin flour incorporated *dhokla* mix when compared to standard.

Keywords: Bengal gram flour, *Dhokla*, Pumpkin flour, Ready to eat food

Introduction

Legume based fermented foods constitute an important part of human diet in developing countries, including India. *Dhokla*, a lactic acid fermented cake, is one such food having its origin in Gujarat, India. *Dhokla* is prepared from a batter of coarsely ground rice (*Oryza sativa* Linn.) and bengal gram dhal (*Cicer arietinum* Linn.), fermented at low temperature, steamed in a pie dish, cut and seasoned. Bengal gram significantly lowers serum lipids in man. During recent years, importance of B complex vitamins, ß-carotene and vitamin C, has been realized in terms of their antioxidative properties. Foods containing carotene are reported to prevent skin diseases, eye disorders and cancer. Incorporation of ß-carotene rich foods in human diet is therefore considered a cost-effective approach to vitamin-A related health problems. Pumpkins (*Cucurbita moschata* Duchesne ex Poir.) that are high in ß-carotene, carbohydrates and minerals are used in Traditional system of medicine for several ailments. Germination and fermentation could reduce antinutritional materials and affect pharmacological activities of pumpkin.

This study presents formulation of an instant *dhokla* mix with pumpkin flour (PF), and evaluation of its physico-chemical properties, sensory properties and acceptance.

Experimental Section

Mature pumpkins and ingredients for standard and variations of instant *dhokla* mix were purchased from a local supermarket.

Preparation of Pumpkin Flour (PF)

Rind, fibrous matter and seeds of pumpkin were removed and flesh was cut into small pieces followed by soaking for 45 min in 0.2% (w/v) solution of sodium metabisulphite and rinsed under running tap water. Pumpkin pieces were cut into slices (1 mm thickness) and dried in a tray drier (Mechanical Dehydrator, Hitech Equipments, India) to a moisture content of 10-14% at 60°C for 24 h. Dried slices were pulverized (Lincoln Pulverizer, LP - 20) and then sieved through a standard 85 BSS mesh. PF was kept in an air tight container until time of use.

Preparation of Instant *Dhokla* Mix and *Dhokla*

Formulation for standard and PF incorporated *dhokla* batters was prepared with ingredients (Table 1) mixed together with water until it reached a thick batter consistency and allowed to rest for 30 min. This batter was spread on aluminum trays lined with polythene sheets and placed in a tray drier at 60°C for 17 h. This was ground coarsely in a domestic mixer, dried for 3 h at 60°C, and then ground to a fine powder in a domestic mixer. Powder was sieved through a standard 85 BSS mesh.

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mesh to obtain *dhokla* mix and stored in air tight containers. *Dhokla* mix was rehydrated (Table 1) with water and leavening agent (ENO-fruit salt regular) and poured into a greased flat tray for steaming in a domestic pressure cooker to obtain *Dhokla*.

### Physical Analysis

#### Time Required for Cooking

Difference between time at which cooker was set on burner for steaming, and time at which cooker was switched off, was taken as time required for cooking.

#### Height

A clean transparent ruler (15 cm) was used to measure height. Batter was prepared in a flat bottomed vessel. Ruler was placed vertically into centre and four corners of batter until it touched bottom of vessel and then removed. This was done before addition of leavening agent. This value was recorded as height before cooking. Similarly, after cooking, ruler was inserted vertically into centre of product and recorded as height after cooking.

#### Weight

Vessel, in which batter was to be prepared, was weighed using a digital pan balance. Then, vessel was weighed with batter before addition of leavening agent and recorded as weight before cooking. After steaming, vessel with product was placed directly on weighing balance and value was recorded as weight of product after cooking.

#### Porosity

*Dhokla* was cut into four equal parts and length and breadth of each part was noted. Then number of pores on both sides of four parts were recorded and added. Average number of pores per cm² was calculated by dividing total number of pores by number of sides. This value was then divided by length × breadth to obtain final porosity/ cm² value of *dhokla*.

### Chemical Analysis

Chemical analysis was carried out for pumpkin (fresh, flour and flour incorporated *dhokla* mixes) for fat, protein, ash, ß-carotene, fiber, iron, moisture and carbohydrate content.

### Sensory Evaluation

Standard and PF incorporated *dhoklas* were evaluated by 25 semi-trained panelists. All participants tasted standard and three variations of instant pumpkin *dhokla*. For each sample, participants were asked to score odor, texture, taste, color, and appearance on a 9 point hedonic scale (1 = dislike extremely, 5= neither like nor dislike, 9 = like extremely). Standard and PF incorporated *dhoklas*, labeled with a 3 - digit code, were served at room temperature on paper plates and presented simultaneously to participants. Between tasting different samples, participants rinsed their mouth with water. Participants did not receive any information about nature, contents, nutritive value or potential health benefits of *dhokla*.

### Statistical Analysis

A one way analysis of variance (ANOVA) was used to evaluate impact of PF incorporation on sensory parameters of *dhokla*. Significant differences between treatments were compared by Duncan’s Multiple Range Test. Relationship between physical and sensory parameters was evaluated using correlation method of analysis.

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>IPD S</th>
<th>IPD 10</th>
<th>IPD 20</th>
<th>IPD 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pumpkin powder, g</td>
<td>-</td>
<td>20</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Bengal gram flour, g</td>
<td>200</td>
<td>180</td>
<td>160 g</td>
<td>140</td>
</tr>
<tr>
<td>Curd, g</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Semolina, g</td>
<td>17.5</td>
<td>17.5</td>
<td>17.5</td>
<td>17.5</td>
</tr>
<tr>
<td>Sugar, g</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Chilly ginger paste, g</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Salt, g</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Citric acid crystals, g</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
</tbody>
</table>

| Water, ml  | 150 | 200 | 250 | 275 |
| Leavening agent, g | 7.5 | 7.5 | 7.5 | 7.5 |

Table 1—Recipe formulation for 300g of instant dhokla mix
Results and Discussion

Time Required for Cooking

A consistent increase in time required for cooking was observed in all samples (Table 2). Standard took minimal time (10 min) and 30% PF incorporated dhokla took maximum time (17 min). Difference in time required for cooking increased by 2 min with every 10% increase in PF incorporation, indicating that PF(%) incorporation and time required for cooking are directly proportional. PF incorporation has been reported to result in a compact product, which indicates a delay in steaming process, due to increase in time required for cooking as concentration in PF increased and another contributing factor can be gelatinization temperature (90°C) of PF\textsuperscript{15,16}.

Correlation between Concentrations of Pumpkin Flour and Time Required for Cooking

Correlation between time required for cooking and concentration of PF incorporation was found to be strong (0.994), indicating that with an increase in PF concentration, the time required to cook the product also increased.

Weight

For all samples, weight of batter upon rehydration was same but increased (25 g) when it was steamed (Table 2), indicating that PF (%) incorporation did not influence weight of final product at any given point of formulation or preparation process.

Height

For all samples, height of batter was same and a gradual decrease in height was observed after it was steamed (Table 2). Height of standard (2.5 cm) was highest and that of 30% PF incorporated dhokla was lowest (2 cm). Difference in height when compared between variations (0.1 cm) was not as drastic as when compared with standard (0.5 cm), indicating that amount of PF present influences raising capacity of dhokla adversely. This could be because PF incorporation results in a compact product causing a decrease in height of final product\textsuperscript{15}.

Porosity

Porosity of dhokla decreased with increase in PF incorporation (Table 2). Dhokla with 30% PF incorporation was more compact than standard. Difference in porosity was minimal between 20% (0.895) and 30% (0.893) PF incorporation. A more pronounced difference was seen between standard and variations, indicating that with increase in PF, porosity of product decreased because PF incorporation results in a compact product causing a decrease in porosity. Emulsifier blend additions, which increase specific volume and porosity of rice cakes and result in softer products\textsuperscript{17}, may help increase porosity of PF incorporated dhokla.

Chemical Composition

Chemical composition of fresh pumpkin and PF (Table 3) revealed that there was a threefold increase in ß-carotene (3778 mcg). Other carotenoids present in PF include a-carotene and cis-ß-carotene\textsuperscript{18}. Processing of vegetables has been found to increase bio-availability of carotenoids, since it breaks down cellulose structure of the plant\textsuperscript{19}. Strong correlations have been found between carotenoids and antioxidative activity of PF flesh of some cultivars\textsuperscript{20}. A minimum increase (1.05%) was noted in iron. A significant increase was noted in protein (14.34%),

<table>
<thead>
<tr>
<th>Products</th>
<th>Cooking time</th>
<th>Weight before cooking</th>
<th>Weight after cooking</th>
<th>Height before cooking, cm</th>
<th>Height after cooking, cm</th>
<th>Porosity/cm$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD S</td>
<td>10</td>
<td>125</td>
<td>150</td>
<td>1.4±0.01</td>
<td>2.5±0.20</td>
<td>2.765</td>
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<td>IPD 10</td>
<td>13</td>
<td>125</td>
<td>150</td>
<td>1.4±0.03</td>
<td>2.3±0.40</td>
<td>1.329</td>
</tr>
<tr>
<td>IPD 20</td>
<td>15</td>
<td>125</td>
<td>150</td>
<td>1.4±0.02</td>
<td>2.2±0.02</td>
<td>0.895</td>
</tr>
<tr>
<td>IPD 30</td>
<td>17</td>
<td>125</td>
<td>150</td>
<td>1.4±0.03</td>
<td>2±0.19</td>
<td>0.838</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pumpkin (Fresh)/100g</th>
<th>Pumpkin flour/100g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture, g</td>
<td>87.3</td>
<td>14.956</td>
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<tr>
<td>Fat, g</td>
<td>0.089</td>
<td>1.621</td>
</tr>
<tr>
<td>Protein, g</td>
<td>1.345</td>
<td>15.69</td>
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<tr>
<td>Carbohydrates, g</td>
<td>4.38</td>
<td>4.218</td>
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<tr>
<td>Ash, g</td>
<td>2.48</td>
<td>5.788</td>
</tr>
<tr>
<td>ß-carotene, mcg</td>
<td>1079.6</td>
<td>4857.6</td>
</tr>
<tr>
<td>Fibre, g</td>
<td>0.668</td>
<td>3.078</td>
</tr>
<tr>
<td>Iron, mg</td>
<td>0.418</td>
<td>1.47</td>
</tr>
</tbody>
</table>

Table 2—Physical parameters

Table 3—Chemical composition of fresh pumpkin and pumpkin flour


ash (3.30%) and fat (1.53%). A drastic decrease was observed in moisture content (72.34%), may be due to dehydration of fresh pumpkin. A 0.16% decrease was observed in carbohydrate content when fresh pumpkin and PF were compared. Comparison of chemical composition between standard and 20% PF incorporated mix (Table 4) revealed that highest increase was in energy (9.6%) and lowest increase in fibre (0.311%). A significant increase was noted in β-carotene (8.4%), protein (2%) and carbohydrates (1.16%). An increase to a lesser extent was observed in moisture (0.65%) and fat (0.52%). Increase in chemical composition values indicated that incorporation of PF to standard instant dhokla mix had a positive impact on variations.

Sensory Evaluation
Sensory evaluation brings very valuable information on quality characteristics\(^1\). Mean and standard deviation scores for different sensory parameters of standard instant dhokla and PF (10%, 20%, 30%) incorporated dhokla (Table 5) revealed that mean scores for odour, color, taste, texture and appearance decreased consistently with increase in PF incorporation. Difference in all mean sensory values between standard and 10% PF incorporated dhokla were minimal. Whereas difference between standard and 30% PF incorporation was more profound, indicating that PF incorporation does have an impact on sensory attributes of dhokla (Fig. 1). This was reaffirmed by results of correlation analysis (-0.977), which indicated that overall acceptance decreased with increase in PF (% incorporation).

One way statistical ANOVA (P>0.05) indicated a significant impact in terms of odor, texture, taste, color, and appearance in PF incorporated dhokla. Duncan’s multiple range test revealed that odor and taste of standard and 10% PF incorporated dhokla were liked equally by participants. Odor and taste of 20% and 30% PF was preferred to a lesser degree when compared to standard and 10% PF incorporation. Color (Fig. 1) and texture of standard was favored over that of variants, wherein 10% and 20% PF incorporated dhokla were liked equally by participants.
participants. Appearance of standard and three variants ranked equally. Thus, 20% PF incorporated dhokla was found acceptable. Similar results have been reported for 20% substitution of PF in butter cake and chiffon cakes.

Correlations between Overall Acceptance and Porosity
Decrease in acceptance can be attributed to decrease in porosity. As correlation analysis revealed a strong link (0.961).

Conclusions
Incorporations of PF in varying percentages had a significant impact on chemical, physical and sensory properties of dhokla prepared from instant mix. In terms of chemical composition (fat, protein, ash, β-carotene, fiber, iron, moisture, carbohydrate content), 20% PF incorporated dhokla showed significant increase in all parameters as compared to standard. Incorporation of PF had an impact on all physical parameters excluding weight of the product. Cooking time increased, whereas porosity and height decreased with increase in PF (%). Sensory evaluation revealed that amount of PF present in product was inversely proportional to overall acceptability of product. However, 20% PF incorporated dhokla was found to be ideal in terms of physical, nutritive and sensory parameters.

References