Incorporation of Processed Jackfruit Seed Flour in Noodles and its Quality Evaluation

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ABSTRACT: The study was conducted to evaluate the quality of noodles made from jackfruit seed flour and refined wheat flour with higher percentage of refined wheat flour. Formulation was done by using autoclave method jackfruit seed flour (JSF) were prepared and examined for physiochemical properties. Noodles were prepared using JSF and refined wheat flour in different ratio and evaluated for proximate, functional, pasting properties, colour and sensory analysis. To prepare noodles refined wheat flour replace by JSF in the ratio of in 100: 0% (T1); 90:10% (T2); 80:20 (T3) and 70:30 (T4). The moisture content 7.5%, total ash 0.05%, crude protein 13.25%, crude fat 1.16% were in JSF. The pasting properties for JSF were evaluated using RVA and the value of peak viscosity (1571.66), trough viscosity (1187), peak time (5.42), break down viscosity (384.33), final viscosity (1484.66), set back (296.66), pasting properties (87.83). Average value for proximate composition for noodles prepared incorporating the different ratio of JSF with refined wheat flour were significantly different (p≤0.05). Sample T4 had highest water absorption capacity and swelling index. While T2 had least water absorption capacity and swelling index, control sample (T1) had lowest water absorption capacity and swelling index in the comparison of other sample were significantly different (p≤0.05). Color analysis showed T4 as dark in color as compared to other samples. In terms of sensory properties, with the lower proportion of JSF noodles scored low. Mean score for color, taste, texture, aroma, and overall acceptability. T4 (30:70) were “liked very much” as compared to T1, T2 and T3. Incorporating of JSF up to 30% in the formulation were improved or did not change the sensory characteristics of noodles and liked very much it reduces dependency on refined wheat flour importation. Future aspect of this study to enhances the nutritional profile of noodles.

Keywords: Jackfruit seed flour (JSF), Autoclave, Noodles, Proximate composition, Pasting properties, Functional properties, color analysis, Sensory analysis.

Introduction

The physiological necessity and a source of enjoyment, food is eating for quantity, quality, and variety (Ali et al.,2006). The majority of food is obtained through agriculture, which is a difficult, time-consuming, delicate, and capital-intensive endeavour. India produces over 770 million tonnes of raw food products of both plant and animal origin, which are to make them appealing, nourishing, and storable, they must be treated and turned into edible forms. Noodles are becoming more and more popular, particularly in Asian nations, due of its easy preparation, appealing sensory qualities, long shelf life, diversity of product, and nutritional content. Studies on the creation and upgrading of high-quality noodles that satisfy consumers are required due to the growing global market. Jackfruit (Artocarpus heterophyllus) have the different name as referred to jaca and jacque in Spanish and known by many names, including "Kathal," "Panasa," "Jaca," "Nangka," "Kanoon," "Mit," "Pilapalam," "Halasu" ( Popenee,1974). The crop was high yield produced fruit all year round with the June and December when output reaches its peak (Goswami et al., 2010; Ong et al., 2014). A single fruit contained 100–150 seeds. Within 6 to 8 months of the blossoming, the fruit was ready. Jackfruit trees can produce 20 to 250 fruits each year, and occasionally even up to 500 fruits, depending on rainfall, irrigation, and tree age. A hollow sound is one of the harvest signs when tapped, a change in skin tone, an odour improvement, and a flattening of spines. They also reported that the fruit weight was 4.5–50 kg and turns green to yellow. They said that fruit's inside was made up of sizable golden bulbs each bulb contains a smooth, oval, light-brown seed with a taste of bananas (Mamtha and Mahesh, 2014).

Although jackfruit was popular due to its mouth-watering flavour, many people were not aware of its numerous health advantages. It's renowned for having great nutritional and therapeutic properties. Jackfruit had a lot of fibre, calcium, phosphorus, potassium, and glucose, magnesium, and vitamin C. The seeds have a very low fat content, making them an excellent part of a diet free of fat (Deepika et al., 2011). It contains a high sugar content, antioxidant activity, and fewer calories, all of which are advantageous to health (Amit and Ambarish, 2010). With maturity, the seed's starch content rises. Huge amounts of nitrogen are present in jackfruit seeds (Theivasanthi and Alagar, 2011). Jackfruit seeds can be utilised. Seed as a substitute component, namely in bakery and bread preparations (Hasidah and Aziah, 2003). The seeds of the jackfruit include lignans, isoferolavones, saponins, and numerous other phytonutrients with a variety of health advantages, including anti-cancer, anti-hypertensive, anti-aging, qualities as anti-inflammatory, antiulcer, and many more (Omale and Friday, 2010). Processed jackfruit seed and they found a product diversification which was used to change the flavour and make it more appealing to consumer (Jagadeesh et al., 2006). In addition to reducing the over-reliance on jackfruit seed, using jackfruit seed flour in items like noodles will also help to correct the nutrient imbalance brought on by consuming refined goods and evaluating their functional qualities and qualitative attributes. It also took into account the market in order to create noodles made of JSF (jackfruit seed flour), this study was created prospects for composite flour noodles.
Material and Methods

The study was carried out, “Incorporation of Processed Jackfruit Seed Flour in Noodles and its Quality Evaluation” to create a value-added extruded product from the JSF. The created product, noodles, was carefully examined for its physico-chemical, cooking, nutritional, organoleptic, and shelf life features. The following headings present the methodology of the current study:

1.1 Procurement of materials; Jackfruit seed were procured from local market of Hisar
1.2 Processing and preparation of flour
1.3 Proximate composition of flour
1.4 Functional properties of flour
1.5 Preparation of noodles using processed JSF (Autoclave)
1.6 Functional properties of noodles
1.7 Sensory evaluation
1.8 Statistical analysis

Procurement of materials;
Jackfruit seed were procured from local market of Hisar. When selecting jackfruit seeds for collection, it is essential to choose ripe and mature seeds. Look for the following characteristics:

a. Appearance: The seeds should be brownish and have a smooth surface. Avoid seeds that are discoloured, moldy, or damaged.
b. Size: Opt. for larger seeds as they tend to be more developed and have a higher yield.
c. Firmness: Gently press the seed between your fingers. Ripe seeds will have a firm texture. Avoid seeds that are mushy or too soft.

Processing and preparation of flour
The autoclave seeds were further processed to dry at 121°C and milling of processed dry seeds done to prepare flour according to the flow chart given below.

Proximate composition of flour
Protein content:
JSF flour total nitrogen were determined by the Kjeldahl method (AOAC, 2006) with slight modification using Kjeldhal & the distillation system. In the long neck round bottom flask, 0.5 g of the samples were accurately weighed & added to 1:4 (coppersulphate: potassium sulphate) & 10 ml of conc. H2SO4 acid was added. The flasks were placed in a fume hood & the contents were digested at 90°C temperature up to the solution became a transparent bluish-green colour, cooled to room temperature loaded in the distillation unit & 45 ml of 40% NaOH was added for neutralization. The released ammonia was cooled or condensed in the saturated boric acid solution contained (50 ml) with a mixed indicator (0.1% methylene blue solution in ethanol & saturated solution of methyl red), & 0.02 N sulphuric acid was used for distillation. A blank reagent was instantaneously run.

Total Nitrogen (%) = \[ \frac{1.4 \times (Sample \ reading - blank \ reading) \times N \times 100}{W} \]

Where,

\( W = \) Sample weight (g)
N= Normality of H2SO4
The sum of protein % was calculated by multiplying the result of the factor of 6.25.

Moisture content:
Determine the moisture content of the flour using methods like oven drying or Karl Fischer titration. Moisture affects the shelf life and stability of the flour. In order to prevent microbes from growing and spoiling the product, the moisture must be controlled to a certain level. According to Ocloo et al. (2010), the drying time has a significant impact on the moisture content of flours. A flour's shelf life and quality are both improved by a lower moisture content. Five grammes of the sample were weighed into moisture cups that had already been weighed, then evaporated at 100°C in an oven until a constant weight was reached.

Fat content
The fat per cent of JSF was determined by the technique mentioned in AOAC (2006). 3 g of sample was wrapped in Whatman Number 1 filter paper & taken in a thimble, transferred into Soxhlet apparatus. About 250ml of petroleum ether was taken in a beaker& placed on a heating mantle. Extraction was done at 85°C for 3 hours followed by evaporation of solvent at 140°C for 20 minutes. The round bottom flask was transferred to a hot air oven maintained for 1 hour at 105±5°C to remove any residual solvent. After drying the contents were placed in a desiccator & the fat percentage was calculated as follows.

\[
\text{Fat} \, (\%) = \frac{\text{weight of fat} \times 100}{\text{weight of sample}}
\]

Ash content
The method described in AOAC (2006) was used to estimate the ash content of JSF flour. A flame in the crucible was used to directly burn 2g of JSF flour sample until no fumes were coming out. After that, the sample was maintained at 550°C in a muffle furnace for a further 1-2 hours, or until residues were recovered that were greyish-white.

\[
\text{Ash} \, (\%) = \frac{\text{Weight of ash} \times 100}{\text{Initial weight}}
\]

Functional properties of flour
Pasting properties
Samples of JSF were assessed for various pasting characteristics viz. Peak viscosity, Peak time, Break down, Final viscosity, Set back and Pasting temperature using Rapid-Visco Analyzer, Perten Instrument Australia in the Dept. of Food Technology, GJUS&T, Hisar.

Procedure
Twenty five ml of distilled water was weighed into a canister. 3.5 g sample was weighed and transferred in canister. Paddle was placed into the canister and jogged to disperse the sample. Paddle and canister was inserted into Rapid Visco Analyzer and wait for the command for pressing down the tower from the thermonic line windows till the temperature of RVA reached 50 °C. Pressed down the tower and wait till the test was run for 13 min. Canister was removed on completion of test. From Thermocline windows following observations were recorded.

Peak Viscosity; Maximum viscosity after the peak, normally occurring around the commencement of sample cooling.
Trough viscosity; Maximum viscosity after the peak, normally occurring around the commencement of sample cooling.
Peak time ; Time taken at which peak viscosity occurred
Pasting temperature ; Temperature where viscosity first increase by at least 25 cP over a 20 sec. period using the standard -1 profile.
Break down viscosity ; Peak viscosity minus trough viscosity.
Final viscosity ; Viscosity at the end of the test.
Set back ; Final viscosity minus trough viscosity

Preparation of noodles using processed JSF (Autoclave)
The noodles were prepared using JSF (Jackfruit seed flour) and refined wheat flour mixed in different combinations to obtain a good quality of noodles. Following proportions of refined wheat flour: jackfruit seed flour was prepared as shown in Table 1.

Table 1. Ingredients used in preparation of noodles

<table>
<thead>
<tr>
<th>Ingredients (%)</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refined wheat</td>
<td>100</td>
<td>90</td>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>flour (g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jackfruit seed</td>
<td>0</td>
<td>10</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>flour (g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Functional properties of noodles
Cooking time
On unripe banana noodles, the Ojure and Quadri technique (2012) was used to examine the cooking quality of the noodles. 300 ml of boiling deionized water was used to cook 10 grammes of noodles in a covered beaker. The amount of time that it took to cook the noodles was calculated by removing a piece every two minutes and sandwiching it between two pieces of glass. The noodles
were thoroughly cooked when the middle of the noodles turned transparent or when they were totally hydrated. By briefly rinsing in cold, deionized water, cooking was put to an end.

**Cooked weight**

On cassava noodles, the cooked weight of each noodle was examined using the Omeire et al. (2015) method. They defined cooking weight as the increase in weight of the noodles while cooking, which represented the amount of water absorbed and served as a gauge for the noodles' capacity to expand. Each treatment was prepared using the specified cooking time, after which the cooking weight was computed and expressed as a percentage.

**Cooking loss**

According to Yadav and Gupta (2015), a dried substance's cooking loss is the amount of that substance that was leached out into the water used to boil the noodles. On unripe banana noodles, Ojure and Quadri's (2012) methodology for analysing cooking loss was applied. The central opaque core in each strand of noodles was boiled off by cooking 10 grammes of noodles in 300 ml of distilled water in a 500 ml beaker. By transferring the cooked water to a beaker that had already been weighed and allowing it to evaporate for an entire night at 100°C, the cooking loss (%) was calculated. The beaker was then reweighed with the remaining solids. Analysis of the cooking quality was done three times.

Cooking Loss (%) = Dried residue in cooking water / Weight of noodles before cooking × 100

**Water absorption**

On unripe banana noodles, the Ojure and Quadri technique (2015) was used to examine the water absorption of the noodles. The weight difference between uncooked and cooked noodles, stated as a % of the weight of uncooked noodles, is known as water absorption (%). Noodles that had been cooked had been rinsed with water, drained for 30 seconds, and then weighed to determine the weight gain. This analysis shows how much water the noodles absorbed during the cooking process. It was determined using the following formula:

Water absorption (%) = (Final weight – Initial weight) / Initial weight × 100

**Swelling index**

It is determined by the measurement of swelled starch granules and occluded water, swelling power is a measure of hydration capacity. According to Ocloo et al. (2010), the retention of water in inflated starch granules is frequently linked to food quality. Following the procedure outlined by Chen et al. (2002), the SI of noodles was calculated. Noodles weighing 10 g were boiled for the recommended amount of time, weighed, then dried at 105 °C for 16 hours. Three times the measurements were taken. The SI value was noted as follows:

Swelling index = (W2 - W1) / W1

Where,
W1 – Weight of cooked noodles, W2 – Weight of noodles after drying

**Sensory evaluation**

Noodles were given auxiliary treatment with spice mixture. Noodles with auxiliary treatment were evaluated for color and appearance, aroma, texture, taste using a 9 point hedonic scale by the assistance of 10 qualified panel members from the department of food technology, sensory evaluation of the newly made noodles was done in the middle of the morning. Average of the scores for all the sensory characteristics was expressed as over all acceptability score.

**Statistical analysis**

The tests were performed in triplicates and MS Excel was used to assess significant differences between the analysed data of JSF proximate analysis and ANOVA was used for treatment samples.

**Result and Discussion**

The present study on incorporating processed jackfruit seed flour into noodles which added nutritional value and unique flavour to the final product was carried out at the Dept. of Food Technology GJUS&T, Hisar. When evaluating the quality of noodles using processed jackfruit seed flour, several factors should be considered. Preparation of noodles from JSF after processing and its result obtained enclosed under the following heading;

**Proximate composition of JSF**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture %</td>
<td>7.5 ± 1.20</td>
</tr>
<tr>
<td>Total ash %</td>
<td>0.05 ± 0.01</td>
</tr>
<tr>
<td>Crude protein %</td>
<td>13.25 ± 0.05</td>
</tr>
<tr>
<td>Crude fat %</td>
<td>1.16 ± 0.03</td>
</tr>
</tbody>
</table>

The value expressed in mean of triplicates ± SD

**Pasting characteristics of JSF**

JSF processed by autoclave were used to measure the pasting properties and the RVA range of pasting properties of flour mean ± SD were shown in Table 3. RVA analysis can provide valuable insights into the functional properties of JSF and its potential applications in food product development.
Table 3. Pasting properties of JSF

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak viscosity</td>
<td>1571.66 ± 788.94</td>
</tr>
<tr>
<td>Trough viscosity</td>
<td>1187 ± 595.59</td>
</tr>
<tr>
<td>Peak time</td>
<td>5.42 ± 2.71</td>
</tr>
<tr>
<td>Break down viscosity</td>
<td>384.33 ± 193.67</td>
</tr>
<tr>
<td>Final viscosity</td>
<td>1484.66 ± 746.21</td>
</tr>
<tr>
<td>Set back</td>
<td>296.66 ± 151.11</td>
</tr>
<tr>
<td>Pasting temperature</td>
<td>87.83 ± 43.91</td>
</tr>
</tbody>
</table>

The value expressed in mean of triplicates ± SD

Functional Properties of noodles

The flours and blends were coded as:
- T1; 0% JSF and 100% refined wheat flour
- T2; 10% JSF and 90% refined wheat flour
- T3; 20% JSF and 80% refined wheat flour
- T4; 30% JSF and 70% refined wheat flour

Table 4. Functional Properties of Noodles

<table>
<thead>
<tr>
<th>Parameters</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooked weight</td>
<td>30.37 ± 15.18</td>
<td>32.38 ± 16.19</td>
<td>33.16 ± 16.58</td>
<td>33.55 ± 16.77</td>
</tr>
<tr>
<td>Cooking time</td>
<td>7.31 ± 3.65</td>
<td>8.35 ± 4.75</td>
<td>8.69 ± 4.35</td>
<td>9.46 ± 4.46</td>
</tr>
<tr>
<td>Cooking loss</td>
<td>1.03 ± 0.02</td>
<td>1.14 ± 0.05</td>
<td>1.21 ± 0.60</td>
<td>1.23 ± 0.1</td>
</tr>
<tr>
<td>Water absorption</td>
<td>30.37 ± 15.18</td>
<td>32.38 ± 16.19</td>
<td>33.16 ± 16.58</td>
<td>33.55 ± 16.77</td>
</tr>
<tr>
<td>Swelling index</td>
<td>1.03 ± 0.05</td>
<td>1.17 ± 0.05</td>
<td>1.21 ± 0.60</td>
<td>1.23 ± 0.61</td>
</tr>
</tbody>
</table>

Values in each column followed by different letters are significantly different (p ≤ 0.05)

Sensory analysis of noodles

Ten semi-trained panels from the Food Technology Department at Guru Jambheshwar University of Science and Technology, Hisar (Haryana), did the sensory study of the noodles utilising a 9-point hedonic scale. Noodles prepared using JSF and refined wheat flour in the different combination (0:100, 10:90, 20:80, 30:70). Noodles prepared from these blends were assessed for various sensory attributes. Result outcomes has been shown in Table 6.

Table 6. Sensory Analysis of Noodles

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>7.45 ± 0.65</td>
<td>7.38 ± 0.25</td>
<td>7.12 ± 0.15</td>
<td>7.31 ± 0.15</td>
</tr>
<tr>
<td>Texture</td>
<td>8.35 ± 0.85</td>
<td>7.34 ± 0.10</td>
<td>7.33 ± 0.12</td>
<td>7.76 ± 0.62</td>
</tr>
<tr>
<td>Taste</td>
<td>7.10 ± 0.2</td>
<td>7.0 ± 0.15</td>
<td>6.66 ± 0.27</td>
<td>7.83 ± 0.80</td>
</tr>
<tr>
<td>Aroma</td>
<td>7.16±0.8</td>
<td>7.25±0.09</td>
<td>7.16±0.16</td>
<td>7.44±0.37</td>
</tr>
</tbody>
</table>

Values in each column followed by different letters are significantly different (p ≤ 0.05)

Average value of three readings, mean value with different (a, b, c, d, e) subscript were significantly different (p≤0.05). [T1= Control sample 100% refined wheat flour, T2 = Blend of JSF and refined wheat flour noodles 10:90, T3 = Blend of JSF and refined wheat flour noodles 20:80, T4 = Blend of JSF and refined wheat flour noodles 30:70].

Conclusions

The purpose of the study was to find out the incorporation of processed jackfruit seed flour in noodles offers promising potential as a functional ingredient. The quality evaluation of noodles with processed jackfruit seed flour has shown several positive outcomes. The addition of jackfruit seed flour enhances the nutritional profile of noodles. Jackfruit seeds are rich in dietary fiber, protein, and essential nutrients, which contribute to the overall nutritional value of the final product. This addition can be particularly beneficial in improving the protein content of noodles, which is important for digestive health and overall well-being. The use of jackfruit seed flour positively impacts the textural properties of noodles. The flour acts as a natural binder, enhancing the firmness and elasticity of the noodles. It also helps to maintain the desirable texture during cooking, preventing excessive softening or stickiness. Formulation was done by using autoclave method by which various changes in physiochemical properties were examined. Noodles prepared by incorporating 30% of JSF in refined wheat flour showed the improved quality of noodles and were acceptable for color, texture, taste and aroma. Overall acceptability of noodles prepared (T3) were higher as compared to other combinations. Various functional properties analysis were done. Analysis of these data contributed the refined wheat flour utilization in food products. Increased consumption needs to be eating nutritional food for a healthy lifestyle.

Future aspect of this study to enhances the nutritional profile of noodles. Thus, from the present study the nutritional benefits of JSF in meeting the dietary requirements of the population, it focuses specifically on assessing JSF can contribute to fulfilling the nutritional needs of the population. It can also the income of the local population.

References