CHAPTER II

Optimization of processing conditions for the preparation of slowly digestible noodles.
2.1. INTRODUCTION

Food is a term which is basically related to the component necessary for several life sustaining functions like production of energy, supply of nutrients, support of various metabolic activities besides growth and maintenance of the body. In the early 20\textsuperscript{th} century, nutrition science was engrossed with preventing deficiencies and supporting body growth. During last two decades the knowledge of the dietary influence on health and wellbeing has been highly increased which has led to design new and healthier foods reducing the risk of several chronic diseases. The foods thus designed are called functional foods which are traditional foods modified in such a way that they have health benefits compared to the non-modified products. A direct relationship between food and health has led to various scientific studies to find the significance of food or food ingredients on specific functions in the body (Kaur, 2011).

Due to constant health awareness and readily available information on use fullness of different diet and their direct link with health, the demand of functional food is increasing day by day. The concept of functional foods includes foods or food ingredients that exert a beneficial effect on host health and/or reduce the risk of chronic disease beyond basic nutritional functions. Increasing awareness of consumer health and interest in functional foods to achieve a healthy lifestyle has resulted in the need for food products with versatile health-benefiting properties. Cereal and cereal component based food products offer opportunities to include probiotics, prebiotics, and fibers in the human diet (Das, 2011). Additives are used in bakery to facilitate processing, to compensate for variations in raw materials, to guarantee
constant quality, and to preserve freshness and food properties. (Pablo Ribotta, 2010). There are lots of new ingredients used to develop new novelty product but still there is need of innovations to develop product for diseased population that is of health food.

Noodle processing operations include mixing raw materials, dough sheeting, compounding, sheeting /rolling and slitting. This series of processes remains constant among countries for all noodle types. Noodle strands are further processed to produce different kinds of noodles, and this can be a means of classification.

Hence, the present investigation were undertaken to optimize the noodle preparation using the health and nutritional benefits of brown rice/husked rice (pigmented and non-pigmented) and whole chick pea along with selected additives by cold extrusion with slow carbohydrate digestibility for the better and effective dietary management in diabetes.
2.2. MATERIALS AND METHODS

2.2.1. Materials

   Red-pigmented paddy variety viz. Jyothi and non-pigmented variety, IR-64 was procured from the Agriculture Produce Market committee (APMC), Bandipalya, Mysore, Karnataka, India. These two paddy varieties were cleaned and stored at 4–6°C until use. Whole Bengal gram/chick pea and whole fenugreek seeds were procured locally. Food grade - xanthan gum and guar gum was procured from Hi-Media, Mumbai. The paddy varieties were de-hulled, the husked (pigmented and non-pigmented) rice, whole Bengal gram and fenugreek were pulverized in a mixer (Johnson Lady Bird plus) and the flour was passed through 60-mesh sieve (250 microns). Pepsin and pancreatin were procured from M/s Sigma Chemical Co., St. Louis, MO, USA. All other chemicals used were of analytical grade.

2.2.1a. Noodle Press

   It is a simple machine fabricated at CFTRI workshop (Fig 6). The press stands on four legs provided with rollers to facilitate movement. Dampers are also provided to prevent ant motion during extrusion. The important parts of the press are as follows:

   A. Piston – It is a mild steel rod having screw threads and arrangement for vertical movement. A solid brass cylinder is attached at the bottom. The piston can move freely inside the barrel and is used for pushing the dough through the die. Piston is attached to a tilting mechanism for sideways movement.
B. **Barrel** – It is a hollow cylinder made of brass. Threads are provided at the lower end which holds the die assembly.

C. **Platform** – it is made of mild steel plate placed below the die assembly. A wooden tray is kept over it for collecting the extruding noodles.

The main features of the noodles press are:

- Total height – 4’
- Piston length – 1’ 6”
- Barrel length – 6”
- Distance between die assembly and platform – 6”

### 2.2.2. Methods

#### 2.2.2a. Shelling/De–husking

A weighed sample (100 g) of paddy from each variety was husked using the Laboratory Satake Sheller (Satake corporation Tokyo, Japan) with rubber rolls adjusted to grain size so as to minimize the breakage. The husked rice and husk were weighed separately for determining the yield of brown rice/husked rice.

#### 2.2.2b. Processing of Noodles

The different processing treatments (Fig 5) which gave satisfactory quality noodles are described as follows:

A. **Steaming/conditioning of flour** – To 100 g of flour blends (pigmented/non-pigmented, chick pea, fenugreek and additives) was conditioned with water (20%) and salt (2%) was mixed thoroughly. The lumps were broken by passing the flour through 16 mesh sieve. The
material was transferred to muslin cloth placed over wire mesh trays and steamed for 15 minutes at atmospheric pressure in laboratory autoclave. The conditioned flour was then cooled to room temperature.

B. Dough preparation – The conditioned flour (100 g) was added to 108 mL of boiling water. The dough was prepared with continuous stirring on low flame, for about 2 – 3 minutes to obtain smooth and non-sticky dough.

C. Extrusion of Noodles - The prepared dough was extruded using noodle press. The piston lower end, barrel, inner surface and die were smeared with refined oil to avoid sticking of the dough. The die assembly was attached and hot dough was transferred to the barrel. The piston was brought down which forced dough through the die. The noodles were collected in wooden trays (Fig 7) and then transferred to aluminium trays for further processing.

D. Steaming of Extruded noodles – The extruded noodles strands were collected in wooden trays and transferred to wire mesh trays for steaming. The wire mesh trays were placed in laboratory autoclave one above the other and the top tray was covered with filter paper. The steaming was done for 30 minutes under atmospheric pressure conditions.

E. Drying of Steamed Noodles – After steaming the noodles are transferred to the drier trays previously smeared with refined oil. The material was dried at 60° C for 1 hour. After drying the noodles were transferred to air tight containers.
Table 6. Formulations for low glycemic index/slow carbohydrate digestible Noodles (pigmented and non-pigmented).

<table>
<thead>
<tr>
<th>Ingredients (g)</th>
<th>Noodles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pigmented</td>
</tr>
<tr>
<td>Rice flour (red pigmented-husked) raw</td>
<td>45 – 55</td>
</tr>
<tr>
<td>Rice flour (Non-pigmented-husked/brown) raw</td>
<td>–</td>
</tr>
<tr>
<td>Whole chick pea flour</td>
<td>40 – 45</td>
</tr>
<tr>
<td>Fenugreek powder</td>
<td>5 – 10</td>
</tr>
<tr>
<td>Xanthan gum</td>
<td>1.5 – 2.5</td>
</tr>
<tr>
<td>Guar gum</td>
<td>0.25 – 0.5</td>
</tr>
<tr>
<td>Iodised salt</td>
<td>2</td>
</tr>
<tr>
<td>Water (ml) for conditioning</td>
<td>20</td>
</tr>
<tr>
<td>Water (ml) for dough preparation</td>
<td>100</td>
</tr>
</tbody>
</table>
Fig 5. Flow Chart of Noodle Preparation
Fig 6. Photograph of Noodle Press
Fig 7. Photograph of Extrusion of Noodles
A. Pigmented Noodles (Dry)

B. Non-Pigmented Noodles (Dry)

Fig 8 (A & B). Photographs of Noodles (Dry)
2.2.2c. Cooking Quality of the Noodles:

The parameters related to cooking quality viz. Cooking time and solid loss of noodles were 3.6±0.2, 8.2±0 for PN and 3.8±0.3, 8.5±0.1 for NPN respectively.

2.2.2d. In-vitro Starch Digestibility

The procedure was followed as per Goni et al., 1997. The starch digestibility of Pigmented noodles was 52±0.3% and 54±0.2% for Non-pigmented noodles. Factors such as starch granule morphology, amylose to amylopectin ratio, molecular structure, degree of branching in terms of steric hindrance and consequently mass transfer resistance and their effects on the digestibility and absorption of digested carbohydrates. The physical state of the starch ingested has a major impact on the digestibility therefore effects the processing techniques (thermal processing, extrusion cooking, autoclaving, etc.,) and starch modification.

The other constituents of the food matrix, such as proteins, lipids and polysaccharides, play a significant role during processing which affects the physico-chemical characteristics of digesta and the final digestibility of starch.