Amylose, Gluten and Moisture Content of Non-waxy Rice (Bahadur), Waxy Rice (Aghuni bora) and Buckwheat for Development of Rice Based Gluten Free Biscuit

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ABSTRACT

Background: Rice and buckwheat, due to their gluten free nature, is an important crop to cope up with increasing worldwide high demands for gluten free foods. Therefore, before making product, amylose, gluten and moisture content of the flours were investigated.

Methods: Two varieties of rice, non waxy (Bahadur) and waxy (Aghuni bora) and buckwheat flour were selected to investigate amylose, gluten and moisture content by following standard methods for developing a rice based gluten free biscuit which will be suitable for celiac patient.

Result: Amylose content of waxy rice was found to be 0.81 per cent, non waxy rice was 27.2 per cent and buckwheat flour 25 per cent. Moisture content ranged from 10.80g/100g to 12.20g/100g in all ingredients. Highest moisture content was found in buckwheat flour being 12.20g/100g and lowest in non waxy rice flour 10.80g/100g. Gluten was not detected in any of the flours. Thus, flours which were tested for amylose, gluten and moisture content are found to be suitable for making gluten free biscuit by substituting wheat flour with rice flour and the judicious combination of waxy and non waxy rice flour will also be very good to overcome problems of dough handling and binding.

Key words: Amylose, Buckwheat, Gluten, Moisture, Rice flour.

INTRODUCTION

Biscuit is the oldest bakery item which is consumed by almost all age group of population globally. Hence, consumer demand has been increasing day by day (Masoodi et al., 2012). Due to increased demand for healthy, natural and functional products, attempts are being made to improve nutritive value of biscuits and functionality by modifying their nutritive compositions. Biscuit can be prepared by using wheat flour as a base ingredient which is not suitable for celiac patient is emerging to use composite flours in biscuit making (Kiin-Kabari and Giani, 2015). Composite flours of food sources like rice flour, buckwheat flour etc. are desirable for making of biscuit due to its gluten free nature (Nedeljkovic et al., 2013).

Rice which is gluten free in nature is a staple food for 65 per cent of country’s population and thus an important pillar for food security of India. It is utilized mostly at household level where it is consumed as cooked intact grains. The kernel shape, size, nutritional value, aroma and cooking characteristics are important for judging the quality and preferences of rice from one group of consumer to another. Therefore, determination of physical, cooking and nutritional qualities of rice is very important. Starch properties are important factors to determine the grain quality, its cooking and eating characteristics. Rice with many nutrients is usually gets digested quite rapidly, compared with other starchy foods. It is characterized by low prolamin, low sodium, hypoallergenic activity and high digestible carbohydrate contents (Mona et al., 2015). The starch granules of rice are small (2-5µm) and are found as aggregates in the rice grain. Besides this, buckwheat is the pseudo-cereal which is consist of valuable nutrient and gluten free in nature. It is also a good source of starch and contains many other compounds such as proteins, antioxidants, trace elements and dietary fibre. Thus, in rice based gluten free biscuit content of amylose, moisture as well as gluten is very essential. Moreover, amylose content is an important criteria of cooking and pasting properties.

Therefore, by considering above facts, present investigation was done to find out amylose, gluten and moisture content of two rice varieties and buckwheat for developing a rice based gluten free biscuit.

MATERIALS AND METHODS

The experiment was conducted in Department of Food Science and Nutrition, Assam Agricultural University, Jorhat, Assam during the period of January, 2018 to March, 2018.
Procurement of raw materials

For carrying out the study required samples like two varieties of rice namely, Bahadur which was a non waxy grain collected from local market of Jorhat town and Aghuni bora was a waxy grain collected from Regional Agricultural Research Station (RARS), Titabor, Jorhat. Buckwheat was collected from Gosaigaon, Krishi Vigyan Kendra (KVK), Kokrajhar.

Processing of raw materials

All the raw materials were processed to make them ready for developing the product. Ingredients i.e. two varieties of rice and buckwheat were processed into flour in order to use them as base ingredient for development of rice based biscuits.

Processing of rice varieties into flour

Rice were cleaned and soaked for 2 hours. After that water was drained off and soaked rice were dried for 1 hour in the sunlight. Rice flour was obtained by grinding it to fine powder in an electric grinder and sieved through 72 size sieve and stored in airtight container.

Processing of buckwheat into flour

Buckwheat (Fig 1) was cleaned and washed properly and dried in full sunlight for 2 days. After drying the grains were subjected to milling (Fig 2) and winnowing was done for separating the kernels from husk. Buckwheat flour was obtained by grinding it to a fine powder and stored in airtight container.

Analysis of raw ingredients

Amylose content (Sowbhagya and Bhattacharya, 1979)

Reagents

- NaOH : 1N and 0.1N
- HCl : 1N and 0.1N
- Iodine solution
- Phenolphthalein 0.1% in 95% alcohol
- Distilled ethyl alcohol
- Acetic acid - 1N
- Standard amylose

Procedure

Hundred mg standard amylose was weighed accurately into a stoppered conical flask and 1ml distilled alcohol was added to wet the powder. Then 10ml of 1N NaOH was added with gentle mixing. Heated on a boiling water bath for a few minutes and cool it. About 50 ml distilled water was added and about ¾ the calculated amount of HCl required to neutralize the solution. Volume was made upto 100ml. Then stored in a refrigerator for a week, usually a month. Defatted 100mg of rice powder was weighed accurately into a 100ml stoppered conical flask. 1 ml distilled alcohol was added to wet the powder. 10ml of 1N NaOH was added gently by the side and kept overnight. Next day it was heated on a boiling water bath for 2-3 minutes and cooled. Volume was made upto 100 ml. Five ml of the above dispersion was taken in a 100ml volumetric flask and 50ml water was added followed by 1 ml of 1N acetic acid and 2 ml iodine. Again volume was made upto 100 ml. Then one ml of the standard solution was taken and treated the same way as the rice dispersion has been treated. 2ml iodine solution was made up, which serves as a blank. Reading was taken by observing colour in a spectrophotometer at 630 nm after 30 minutes against blank.

Calculation

\[ \text{Amylose Content} = \frac{R}{A} \times \frac{a/r}{1/5} \times 100 \]

Where,
- \( R \) = Reading of rice or buckwheat flour dispersion.
- \( A \) = Reading of standard amylose solution.
- \( a \) = amount of standard amylose.
- \( r \) = amount of rice powder or buckwheat flour weighed (mg).

Gluten content

Gluten content was assessed using a manual method of washing dough (AACC, 2000).

Procedure

Ten g each of rice flours and buckwheat flour samples were weighed and seven ml of distilled water was added to it. A dough ball was prepared by adding additional quantity of water. Prepared dough ball was dipped in water for one hour. Dipped dough ball was removed and was washed under the tap water gently using muslin cloth. The washed mass ‘wet gluten’ was weighed. The wet gluten was stretched properly and kept in petri plate and dried in oven at 130-135°C to a constant weight. It was cooled in dessicator for 30 minutes and weighed.
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RESULTS AND DISCUSSION

Foods are chemically analyzed for different purposes. It is usually a concern over the chemical composition and the effect this has on its value to the consumer that generates the need for analysis. The data are most useful when they represent foods in the forms generally consumed (Greenfield and Southgate, 2003). Waxy and non waxy rice flours and buckwheat flour were analysed for moisture, amylose and gluten content to check its water content, stickiness of the flours and whether there is a presence of gluten which is not suitable for celiac patient respectively. The amylose, gluten and moisture content of raw flours are presented in Table 1.

Amylose content

Amylose content is the most important criterion of grain quality of milled rice and is an indicator of amylose/amylopectin ratio. It is usually expressed as a percentage of milled rice dry weight rather than as starch basis. Data presented in Table 1 depicts the percentage of amylose being 0.81 per cent in waxy rice flour, 27.20 per cent in non waxy rice flour and 25 per cent in buckwheat flour. Amylose content may be classified on a milled-rice basis as waxy or glutinuous (< 2%), very low (2-10%), low (10-20%), intermediate (20-25%) or high (>25%) (IRRI, 1979). According to this classification, non waxy rice falls under high amylose category and waxy rice falls under waxy or glutinuous category. Buckwheat flour contains 25 per cent which falls under intermediate amylose. Amylose content of flours were analyzed to verify at what level suitable product can be obtained.

Gluten

The gluten is a protein complex develop during processing of dough or batter for bakery which is present in wheat, barley and rye. Gluten content of non waxy and waxy rice flour and buckwheat was not detected in all the ingredients except wet gluten which is also a negligible amount that can be used for product development. In Kataria, 2014 found similar results in rice flour, soya bean flour, maize flour and sesame flour for wet gluten content which was very negligible and for dry gluten it was totally nil. Therefore, these flours are found suitable for celiac patient as they cannot tolerate gluten.

Moisture

The moisture content of the raw flours are presented in Table 1. Moisture generally refers to the presence of water, often in trace amounts. Water is an important part of all cells and fluids in the plants and animal kingdom. Moisture content

Moisture (g/100 of sample) = \( \frac{\text{Initial weight- final weight (g)}}{\text{Weight of the sample (g)}} \times 100 \)

| Ingredients                  | Amylose | Wet gluten | Dry gluten | Moisture       |
|------------------------------|---------|------------|------------|----------------|
| Waxy rice flour (Aghuni bora)| 00.81   | 0.02       | 00.00      | 11.20±0.70     |
| Non waxy rice flour (Bahadur)| 27.20   | 0.03       | 00.00      | 10.80±0.30     |
| Buckwheat flour              | 25.00   | 0.01       | 00.00      | 12.20±0.15     |

Values are mean ± SE of three independent determinations.
varies with variety, humidity and various environmental conditions.

Rice flour
Estimated moisture content in rice flour reveals that it contains 11.2g/100g in waxy rice flour and 10.8g/100g in non-waxy rice flour on dry matter basis. Paucean et al. (2014) analyzed the moisture content of raw non-waxy rice flour and reported as 9.86 per cent. In another study by Chandra et al. (2015) observed that moisture content of raw non-waxy rice flour was 11.22% per cent while in Kaur et al., 2014, reported moisture content of raw non waxy rice flour was 12.5% per cent on dry matter basis. Similar result with the present study was reported by Chay et al. (2017) for waxy rice (11.7g/100g) on dry matter basis.

Buckwheat flour
In the present study, moisture content in buckwheat flour was 12.20g/100g. In Milicevic et al. 2014, found 10.15 per cent moisture content in buckwheat flour. In an another study Baljeet et al. (2010) observed 11.60 per cent moisture content in raw buckwheat flour on dry matter basis.

CONCLUSION
Two varieties of rice flours and buckwheat flour were selected to make flour mix for developing a rice based gluten free biscuit which will be suitable for celiac patient. Amylose, gluten and moisture content of raw ingredients were analyzed. Amylose content of waxy rice was found to be 0.81 per cent, non waxy rice was 27.2 per cent and buckwheat flour 25 per cent. Moisture content ranged from 10.80 to 12.2g/100g in all ingredients. Highest moisture content was found in buckwheat flour being 12.2g/100g and lowest in non waxy rice flour 10.80g/100g. Gluten was not detected in any of the flour. Thus, flours which were tested for amylose, gluten and moisture content are found to be suitable for making gluten free biscuit by substituting wheat flour with rice flours. By seeing the amylose content of both waxy and non waxy rice flours it was found that the judicious combination of these two flours will also be very good to overcome problems of dough handling and binding.

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