A Comparative Study on The Hypoglycemic Potentials of The Roasted And Germinated Ragi

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Abstract- *Foods with a low glycemic index are useful to manage maturity onset diabetes, by improving metabolic control of blood pressure and plasma low density lipo protein cholesterol levels due to less pronounced insulin response. In the present study, we made an attempt to analyse the impact of millets by traditional processing methods such as roasting and germination in the management of NIDDM. The millet diet is known for high sustaining power and is usually recommended for diabetics. Germinated ragi exhibits a potent hypoglycemic effect due to its high phenolic and dietary fiber. Regular consumption of millet is known to reduce the risk of diabetes mellitus and gastrointestinal tract disorders and these properties were attributed to its high polyphenols and dietary fiber contents. Several millet based novel food products can be developed and traditional recipes need to be promoted for the well being of the public.*

Keywords- alpha amylase, alpha glucosidase, roasted ragi, germinated ragi

I. INTRODUCTION

Millions of people all over the world suffer from Diabetes mellitus, a common endocrine disorder. This disorder is characterized by hyperglycemia which occur due to absolute or relative lack of insulin secretion. There are two forms of DM. Type I (IDDM) and type II (NIDDM) among which type II is the major form of diabetes which reflects from defects in insulin secretion or rather insulin resistance.

Millet has been shown to be helpful in type 2 diabetes mellitus, cardiovascular disease and cancer due to its low glycemic index and antioxidant activity (Hathan and Prasanna, 2011). Research priorities on type II diabetes are now -a-days becoming more prevalent with increased emphasis on its management through dietary practice. Considering the diet-linked challenge of type II diabetes, consumption of foods rich in α-amylase and α-glucosidase inhibitors - so called hypoglycemic foods - are receiving more attention and being investigated extensively.

One of the strategies employed to manage type 2 DM is the use of the drugs which inhibit the enzymes responsible for carbohydrate metabolism. α-Amylase and α-glucosidase are well-known key enzymes, playing a vital role in the management of hyperglycemia linked type II diabetes. Acarbose, miglitol and metformin are certain examples of commercially available enzyme inhibitors for the clinical treatment of type II diabetes. They slow down the absorption of carbohydrate through the inhibition of enzymes responsible for the digestion viz., pancreatic alpha amylases and glucosidase. There are used to treat diabetes as they reduce post prandial hyperglycemia. However, these drugs are reported to cause various side effects such as abdominal distention, flatulence and possibly diarrhea due to the excessive inhibition of pancreatic α-amylase, which resulted in the abnormal bacterial fermentation of undigested carbohydrates in the colon (Ranilla *et al.*, 2008). Hence, at present there is an increasing interest among the food scientists to find out an alternative natural source of α-amylase inhibitor with potential antioxidant activity without any side effects for the dietary management of type II diabetic patients (Kwon *et al.*, 2006; Cheplick *et al.*, 2007; Ranilla *et al.*, 2008).

Keeping these in mind an attempt was made in the present study to evaluate the activity of the enzyme alpha amylase and glucosidase in the roasted and germinated form of ragi.

II. MATERIALS AND METHODS

Processing of the millets: The ragi millets were first cleaned thoroughly and made free from dust, dirt, and foreign matter. Any seeds which were spoiled or with cracked hull were discarded and the remaining seeds were surface sterilized with 0.1% (w/v) potassium permanganate solution. Millets are roasted in a open dry pan at 60^{o} C for 3 mins till a pleasant aroma develops. For sprouting, seeds were soaked in distilled water for 4h at room temperature (RT). The excess water was drained, sample further rinsed with distilled water, seeds placed in a single layer on filter paper in sterile petri dishes and placed in the muslin cloth at the room temperature, 90%

RH for 24h. After sprouting the seeds were dried in an oven overnight at 60°C. They were then cooled in a desiccator. The processed millets were then powdered using a electric blender at moderate speed (5,000 rpm) and sieved through mesh size of 600 microns.

Determination of alpha amylase inhibitor activity

The assay mixture containing 200 µl of 0.02M sodium phosphate buffer, 20 µl of enzyme and the ragi extracts in concentration range 20-100 µg/ml were incubated for 10 minutes at room temperature followed by addition of 200 µl of starch in all test tubes. The reaction was terminated with the addition of 400 µl DNS reagent and placed in boiling water bath for 5 minutes, cooled and diluted with 15 ml of distilled water and absorbance was measured at 540 nm. The % inhibition was calculated according to the formula [Jung *et al* 2006]

Inhibition (%) = Abs 540 (control) – Abs 540 (extract) * 100
Abs 540(control)

The IC 50 values were determined from plots of percent inhibition versus log inhibitor concentration and were calculated by non linear regression analysis from the mean inhibitory values. Acarbose was used as the reference alpha amylase inhibitor. All tests were performed in triplicate

Inhibition of alpha-glucosidase activity

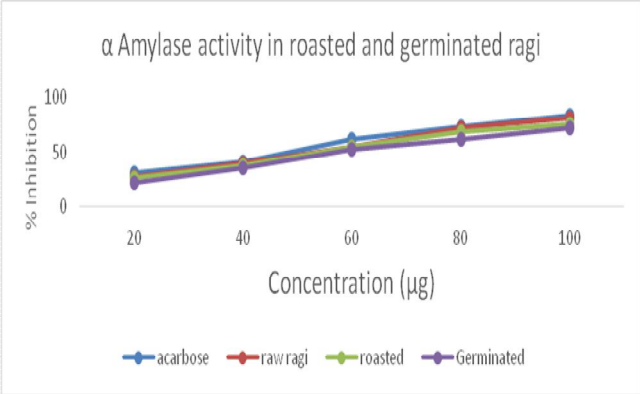
The inhibitory activity was determined by incubating a solution of starch substrate (2 % w/v maltose or sucrose) 1 ml with 0.2 M Tris buffer pH 8.0 and ragi extract for 5 min at 37 °C. The reaction was initiated by adding 1 ml of alpha glucosidase enzyme (1U/ml) to it followed by incubation for 40 min at 35 °C. Then the reaction was terminated by the addition of 2 ml of 6N HCl. Then the intensity of the colour was measured at 540 nm [Jung *et al* 2006].

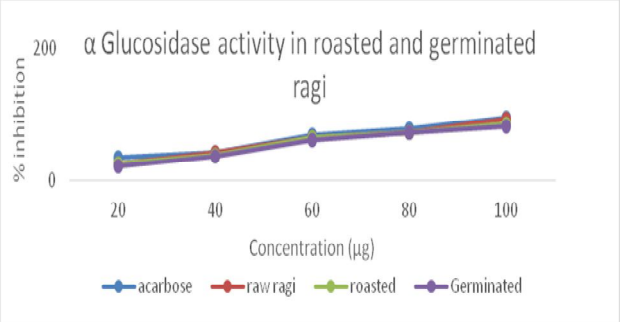
$$\text{Inhibition (\%) A} = \frac{\text{Abs 540 (control)} - \text{Abs 540 (extract)}}{\text{Abs 540 (control)}} * 100$$

Where Abs (C) is the absorbance of the control (without extract or standard) and Abs (Ex) is the absorbance in standard.

III. RESULTS AND DISCUSSION

The potential benefits of millets is that they inhibit the enzyme α—glucosidase, and pancreatic amylase that reduce postprandial hyperglycemia by partially inhibiting the enzymatic hydrolysis of complex carbohydrates Shobana *et al.* (2009). The potential of whole millets as natural sources of antioxidants could be due to varietal differences existed in the contents of phenolics as well as antioxidant capacities between soluble and insoluble bound phenolic fractions (Chandrasekara and Shahidi 2010). The beneficial effect of phenolics is due to partial inhibition of amylase and α glucosidase during enzymatic hydrolysis of complex carbohydrates and delay the absorption of glucose, which ultimately controls the postprandial blood glucose levels (Shobana *et a*l. 2009). In the present study we found that these phenolics gets reduced due to the roasting process but found to 2 fold increase in germinated millets.





Processing methods such as cooking by roasting and boiling, germination and/or fermentation decreased the free radical quenching activity which might be due to hydrolysis of tannins and the white varieties of millets showed lower activity than their coloured counterparts, indicating that phenolics in the seed coat could be responsible for the antioxidant activities.

α-Amylase inhibitors are starch blockers, which can binds with the reactive sites of amylase enzyme and alter its catalytic activity and thus reducing the blood sugar level. IC 50 of Alpha amylase levels in the roasted and the germinated ragi exhibited 55% and 47 % respectively when compared to the raw controls (59%). These values are lower than the standard acarbose under *in vitro* assay conditions. Alpha glucosidase levels in the roasted and the germinated ragi

exhibited 51% and 46 % respectively when compared to the raw controls (57%). These values are lower than the standard acarbose under *in vitro* assay conditions.

Alpha glucosidase and alpha amylase are the important enzymes involved in the digestion of carbohydrates. Alpha Amylase is involved in the breakdown of long chain carbohydrates and alpha glucosidase breaks down starch and disaccharides to glucose. They serve as the major digestive enzymes and help in intestinal absorption. Alpha amylase and glucosidase inhibitors are the potential targets in the development of lead compounds for the treatment of diabetes. Low level of α-amylase inhibitors from natural fruits, vegetables and legume grains are reported to offer a good strategy to control postprandial hyperglycemia (McDougall *et al.,* 2005; Kwon *et al.,* 2006). In this connection, the α-amylase inhibition activity observed in raw , roasted and germinated grain of the present study seems to be suitable to implement in the dietary practice of type II diabetes.

Studies by Itagi *et al* 2012, suggests that The hypoglycemic effect of millets with their high crude fiber, dietary fibre, antioxidant, low carbohydrate content, low digestibility and also glucans, which are water soluble gums helpful in impairing glucose metabolism.

IV. CONCLUSION

The nutritive factors may regulate the glucose uptake from the intestinal lumen by inhibiting carbohydrate digestion and absorption, leading to glucose homeostasis and reduce postprandial hyperglycemia. From the present study, germinated form of ragi can be suggested as amylase and α-glucosidase inhibitors for modulation of carbohydrate breakdown and regulation of glycemic index of foods thus reducing the chronic pathologies such as diabetes mellitus.

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