ATTENUATION OF POST PRANDIAL GLYCEMIC RESPONSE OF Refined FLOUR CHAPATI WITH PROBIOTIC CONTAINING SOYA BASED YOGHURT

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ABSTRACT

Role of soya foods and probiotics as functional foods is gaining popularity in modern society. The concept of synbiotics has been proposed as a functional food ingredient in humans. For the glycemic index evaluation of yoghurt; 200 ml yoghurt from bovine milk/finger millet milk/soya bean milk/ combination of 50 per cent soya and finger millet milk were administered along with refined flour ‘chapathi’ to the diabetic subjects and rise in post prandial glycemic response was observed after an overnight fast for a period of 3 hours. The response in each dietary group was compared with and without addition of probiotic. The reduction in the glycemic index of ‘chapathi’ was maximum when fed with soya yoghurt (36 to 39); followed by soya and finger millet yoghurt (54 to 58) and least with bovine milk yoghurt alone (64 to 71).

Key words : Probiotics, Yoghurt, Soya bean, Synbiotics, Glycemic index.

INTRODUCTION

Diabetes is growing as an epidemic in both developed and developing countries (Rahman and Rao, 2002). The prevalence of diabetes in all age groups worldwide was 2.8 per cent in 2008 and is estimated to be 4.4 per cent by 2030 and the total number of people with diabetes is projected to rise from 220 million in 2010 to 366 million by 2030 (Wild et al., 2004). India is the leading country for diabetes, with 31.7 million cases in 2000. It is expected to rise 79.4 million by 2030 (Mishra et al., 2007 and Neal, 2008).

Diabetes mellitus is a chronic disorder, primarily of carbohydrate metabolism and with alterations in fat and protein metabolism. Diet has long been the used in the management of non-insulin dependent diabetes mellitus. The goals of diet therapy in this disorder being the normalization of blood glucose, lipid levels and the maintenance of optimal body weight (Franz et al., 1994). Low glycemic foods have been shown to improve glycemic control in diabetics (Jarvi et al., 1999; Giacco et al., 2000) and in non-diabetic (Frost et al., 1998) subjects. These foods appear to improve glycemic control by reducing plasma cholesterol, fructoseamine and hemoglobin A1c levels (Blair et al., 2006).

The synbiotics are recently used for enhancing as functional properties of food ingredients in humans. Therefore, soya products with added benefits of probiotics and producing a symbiotic effect will become an ideal supplement for diabetic subjects. Antidiabetic effects of probiotics in experimental animals has been reported by (Matsuzaki et al., 1997). The present study focused on developing probiotic enriched soya milk based yoghurt and to determine its glycemic index in diabetic type II subjects.

MATERIALS AND METHODS

Selection of subjects : A total of 15 subjects in the age group of 50-55 years, weight ranging from 50-
60 kg were selected from various localities of Anantapur. Information on dietary patterns and medical history was collected using structured questionnaire. Volunteers who met the study criteria were enrolled for the study.

**Experimental design** : Selected subjects were randomly distributed into 10 groups (8 experimental groups and 2 control) each group containing 5 subjects. Each of the experimental diets groups (bovine yoghurt, soya yoghurt, finger millet yoghurt, soya milk and finger millet yoghurt (50:50) were sub classified into two groups one with probiotic and another without probiotics.

For the glycemic index evaluation of yoghurt; 200 ml yoghurt from bovine milk/finger millet milk/soya bean milk/combination of 50 per cent soya and finger millet milk was administered along with refined flour ‘chapathi’ to the diabetic subjects and rise in post prandial glycemic response was observed after an overnight fast for a period of 3 hours. The response in each dietary group was compared with and without addition of probiotic. The subjects in the standard group received 50g of glucose.

Finger prick capillary blood samples were taken prior to the meal (0 minute) and at 30, 60, 90, 120, 150 and 180 minutes after the meal. The increment in the blood glucose was analysed at an interval of 30 min. using automatic glucometer (one touch horizon II model). The GI was calculated from 3 hours incremental glucose with glucose as reference.

**RESULTS AND DISCUSSION**

Table 1 presents the effect of feeding soya based yoghurts on the mean blood glucose levels of the diabetic subjects. The mean plasma glucose levels increased in all groups fed test products and the glucose control meal. The levels declined in all groups after the appearance of peak values. The glycemic response as revealed from the incremental glucose levels observed during the 3 hour period was found to be significantly (p<0.01) less with refined flour ‘chapathi’, soya milk based yoghurts and germinated soya based powders in comparison to the standard glucose. The addition of soya based yoghurts significantly (p < 0.01) reduced the glycemic response of refined flour ‘chapathi’.

All the experimental diets elicited significantly (p<0.01) lower peak values than the standard glucose. Feeding of yoghurt along with ‘chapathi’ caused decrease in the peak values in comparison to ‘chapathi’ alone; the peak values were significantly less with finger millet yoghurt than soya and bovine milk yoghurt. The addition of probiotics in to the respective diets doesn’t appear to affect the peak values.

The mean area under the blood glucose curve for soya based yoghurts and germinated soya based powders is presented in Table 2. The incremental area under the glucose response curve (AUC) for subjects consuming experimental diets were found to be significantly (p<0.01) lower than that observed with the AUC of subjects consuming standard glucose. The feeding of ‘yoghurt’ along with refined flour ‘chapathi’ reduced (p<0.01) the area under the blood glucose response curve irrespective of the type of yoghurt. The maximum reduction in the response curve was achieved with the feeding of soya yoghurt followed by combination of soya and finger millet and least with bovine milk yoghurt.

Though the peak values did not show variation with the addition of probiotics in the experimental diets, there was significant (p<0.01) reduction in the glycemic response areas consequent to the addition of probiotics in the yoghurt samples.

The glycemic index (GI) was significantly (p<0.01) lower for the experimental diets compared with refined wheat flour ‘chapthi’ alone (Table 3). The reduction in the GI of ‘chapathi’ was maximum when fed with soya yoghurt (36 to 39); followed by soya and finger millet yoghurt (54 to 58) and least with bovine milk yoghurt alone (64 to 71).
Present study also demonstrate a remarkable reduction of post prandial glycemic response with the addition of probiotic is respective of the type of food supplement. The results are consistent with other reports. The phytochemicals implicated to produce glucose lowering impact in soya could be attributed due to its substantial amounts of phytochemicals and other bioactive components viz., protein, fiber, polyphenols, tannins, isoflavones, lectins and heamagglutinins etc. and the factors such as the nature as starch, the food form, particle size, starch protein, starch lipid interaction.

It is well known that protein decreases the blood glucose response and enhances insulin secretion when added to a carbohydrate test meal (Estrich et al., 1967). When 10, 30 or 50 g protein was added to 50 g glucose loads in NIDDM, insulin secretion was significantly increased only after 30 and 50 g and the glycemic response was significantly reduced only after addition of 50 g protein (Nuttall et al., 1984). The amount of protein contributed by the bovine and soya curds ranged from 3.25 to 4.62 gram.

The variation in the glycemic responses after addition of soya and bovine curds was dependent on the type of protein. Soya protein affects glycemic response by different mechanisms: High protein content in soya bean enhances gastric inhibitory polypeptide (GIP) which potentiate glucose induced insulin secretion (Vallar et al., 1982). Soya protein is a high quality protein. A study conducted by Blair et al., (2006) reported that soya food products generally have low glycemic index where the glycemic index values ranged from 25 to 51 per cent. Legumes have higher amylose content (30 to 40%) which is more resistant to cooking and digestion than amylopectin.

Polyphenols in soyabean inhibit the activity of digestive enzymes especially of trypsin and amylase and thereby reduce glycemic response to carbohydrate foods (Anderson et al., 1999).

**TABLE 1**: Effect of feeding soya milk based yogurt on the blood glucose levels of the diabetic subjects.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Blood glucose (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 min</td>
</tr>
<tr>
<td>Standard glucose</td>
<td>125±4.9</td>
</tr>
<tr>
<td>Bovine yogurt With probiotics</td>
<td>116±4.40</td>
</tr>
<tr>
<td>Without probiotics</td>
<td>121±4.9</td>
</tr>
<tr>
<td>Soya milk yogurt</td>
<td>117±3.08</td>
</tr>
<tr>
<td>With probiotics</td>
<td>114±5.97</td>
</tr>
<tr>
<td>Without probiotics</td>
<td>107±4.4</td>
</tr>
<tr>
<td>Finger millet milk yogurt</td>
<td>110±2.108</td>
</tr>
<tr>
<td>With probiotics</td>
<td>112±3.9</td>
</tr>
<tr>
<td>Without probiotics</td>
<td>108±5.32</td>
</tr>
<tr>
<td>‘Chapathi’</td>
<td>112±5.7</td>
</tr>
</tbody>
</table>

*(Anderson et al., 1999)*
Isoflavones in soyabean inhibit glucose uptake into the brush border membrane vesicles (Vedavanam et al., 1999). This could be attributed to their α-glucosidase inhibitor action, tyrosine kinase inhibitor properties and multiple actions on insulin release from pancreatic islet cells (Mezei et al., 2003).

**CONCLUSIONS**

The observations indicate that soya based foods in general have low glycemic index which could be attributed to their excellent bioactive components profile such as isoflavones, fiber, protein, tannins, lectins and haemagglutinins and the factors such of the nature as starch, the food form, particle size, starch protein, starch lipid interaction, may show their interactive influences.

**REFERENCES**


