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Full Length Research Paper

Effects of polypeptide-k supplemented soft bun on blood glucose level in healthy adults

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The aim of this study is to evaluate the effects of Polypeptide-k (Ppk) supplemented soft roll on the blood glucose level of 18 healthy individuals as compared to control soft roll alone. Healthy individuals were fasted overnight and blood was taken at baseline (0 min) before consumption of control soft roll, and at 0, 30, 90, 150 and 210 min. Glucose level was then determined. This procedure was repeated with Ppk supplemented soft roll on the same individuals the next day. Ppk supplemented soft roll showed significant decrement ($p<0.05$) in glucose level when compared to control soft roll at 90, 150 and 210 min. Blood glucose level with Ppk supplemented soft roll requires statistically significant lesser time, 110 min, to drop to baseline glucose level as compared to control soft roll, which requires 190 min. Blood glucose level with Ppk supplemented soft roll further dropped to -0.9 mmol/L after 210 min while for control soft roll, blood glucose level only dropped slightly to -0.2 mmol/L. In conclusion, Ppk supplemented soft roll caused enhanced reduction in blood glucose level as compared to control soft roll in healthy adults.

Key words: Polypeptide-k, blood glucose, *Momordica charantia*.

INTRODUCTION

Diabetes mellitus (DM) has been considered a major health problem in the world today. DM is a metabolic disorder of carbohydrate, fat and protein metabolism characterized by elevation of both fasting and postprandial blood glucose levels (Yuan et al., 2008). DM is due to either insulin insufficiency and/or insulin dysfunction (Modak et al., 2007). The risk factors for diabetes include family history, age, obesity, sedentary lifestyle, abnormal levels of cholesterol and triglycerides in blood, high blood pressure and diet. Diet factor encompasses not only high sugar, high fat and high calorie diet, but also high Glycemic Index (GI) diets. The concept of the GI was introduced as a means to quantify the blood glucose response to an ingested quantity of carbohydrate in a food as compared to the response using a standard reference food (Martin et al., 2008). The effect of carbohydrate intake on blood glucose concentration is of increasing interest among researchers investigating its relationship with diabetes, coronary heart disease, obesity, cataracts, and some types of cancer (Schakel et al., 2008).

Although different types of synthetic oral hypoglycemic agents and insulin are available for the treatment of DM, insulin cannot be taken orally and the synthetic agents in use can produce serious side effects and toxicity (Yuan et al., 2008). In the past decade, therefore, research has been focused on scientific evaluation of traditional drugs of plant origin (Grover and Yadav, 2004). Bitter gourd (*Momordica charantia*) is one such plant that has been frequently used as medicine (Grover and Yadav, 2004). Fruit and seeds of bitter gourd are traditionally used as a

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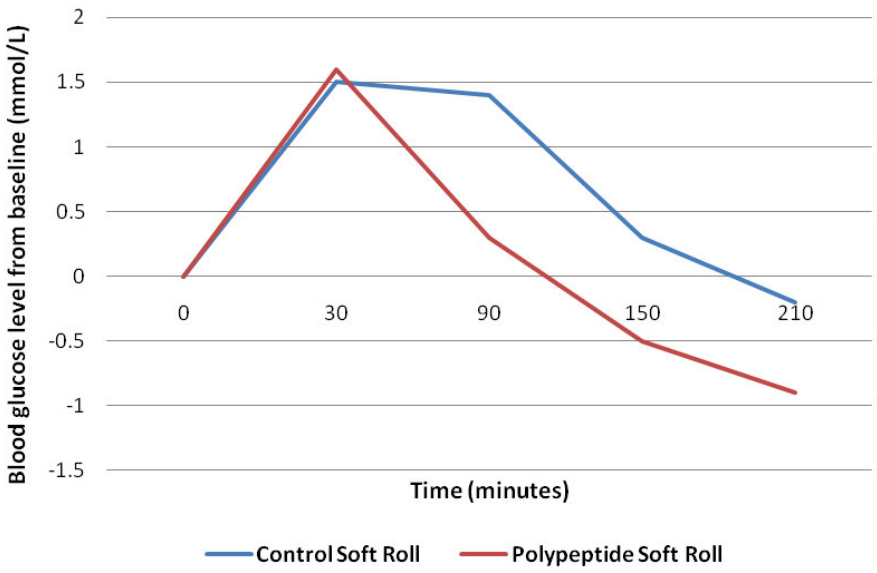

Figure 1. Graph of blood glucose level from baseline versus time.

medicinal herb and/or vegetable for treatment of diabetes in Southeast Asian countries (Senanayake et al., 2004). Its hypoglycemic activity has been reported in pulps, seeds and leaves *in vivo* (Xiang et al., 2007). Khanna et al. (1981) isolated an active protein (polypeptide-p) from seeds by acid ethanol extraction, which decreased bloodglucose in STZ-induced diabetic rats and increased the glycolytic enzymes activity. Polypeptide-p has also shown to have hypoglycemic effect in juvenile and maturity-onset diabetic patients (Khanna et al., 1981).

In-vitro study has also shown that bitter gourd extract to have reparative effect on pancreatic β-Cells (Xiang et al., 2007). Apart from its hypoglycemic activity, bitter gourd also has lipid lowering effect. Serum and liver lipids, especially triglyceride concentration was significantly lowered in rats fed diets containing 1% bitter gourd powder compared to those fed diets with no bitter gourd (Senanayake et al., 2004). There is increased interest in finding a naturally occurring, plant-based compound - a functional food ingredient, which could prevent and/or ameliorate DM (Schakel et al., 2008). One such food ingredient is said to have this potential is polypeptide-k. Polypeptide-k is a functional food ingredient that is extracted from seeds of bitter gourd. It has high homology with human insulin and helps in rejuvenating pancreas and activates inactive insulin. It contains 18 standard amino acids in a single molecule and its application as a food ingredient may help in reducing blood glucose level and prevention of diabetes (Khanna, 2004).

Therefore, the objective of this current study was to determine the effect of Polypeptide-k supplemented soft roll and control soft roll on blood glucose level in healthy individuals.

MATERIALS AND METHODS

Polypeptide-k (extracted from *M. charantia* was provided by Magna Bio-Laboratories, Malaysia). Soft rolls formulated and baked by Hiestand Malaysia with nutritional contents in Table 1. 18 healthy individuals (age 22 to 40 years old, 3 male and 15 female) were selected for this study. These individuals volunteered to be in this study and the project has been approved by the University Ethical Committee. The individuals were examined by a registered physician and exclusion factors were obese (Body mass index/BMI more than 30) and any prescribed medications. Panelist fasted overnight (10 h) after taking dinner. Only plain water was consumed during fasting period. The next morning, blood was taken and baseline blood glucose level was measured (before consumption of bun). Control soft roll (2 x 35 g each. Ingredient as in Table 1) was consumed immediately.

Blood was taken at 30, 90, 150 and 210 min. During this test period, only plain water is allowed to be consumed. All the procedures were repeated after 24 h with Ppk-supplemented Soft Roll (2 x 35 g each. Ingredient as in Table 1) in the same individuals.

Data were expressed as mean $\pm$ SD. Data of both control and experimental was subjected to 2 way ANOVA using SPSS v.15. Means with $p < 0.05$ is considered significant.

RESULTS AND DISCUSSION

Figure 1 illustrate the blood glucose level from 0 to 30 min, both control soft roll and Ppk-supplemented soft roll caused increment in blood glucose level from baseline glucose level by 1.5 mmol/L and 1.6 mmol/L respectively. From 30 to 210 min, blood glucose level for both control and Ppk-supplemented soft rolls decreased. This showed that digestion had taken place where carbohydrate was broken into glucose and insulin in blood has acted on the glucose allowing the glucose to get absorbed into the cells. However, blood glucose level with polypeptide soft

Table 1. Nutritional information of Polypeptide-k supplemented and control soft rolls.

	Ppk-Supplemented soft roll[1] quantity per 100 gm	Control soft roll[2] quantity per 100 gm
Energy	260.9 KCAL	268.9 KCAL
Protein	7.3 gm	6.9 gm
Fat	4.9 gm	4.9 gm
Carbohydrate	45.9 gm	49.1 gm

Ingredients list: [1]Wheat flour, water, butter, yeast, whole milk powder, pasteurized whole egg, bread improver, salt, stevia extract, polypeptide-k (ppk 2 mg). [2] Wheat flour, water, sugar, butter, fresh yeast, full cream milk powder, pasteurized whole egg, ascorbic acid (E300), Emulsifier (E472e).

Table 2. Blood glucose level of 18 panels with control and polypeptide-k supplemented Soft Rolls at 0, 30, 90, 150 and 210 min.

Panel	Control soft roll					Polypeptide soft roll				
	Time (min)					Time (min)				
	0	30	90	150	210	0	30	90	150	210
1	4.8	6.7	6.7	4.4	4.5	6.1	6.2	5.4	5.4	4.4
2	4.3	6.7	4.7	4.9	3.9	4.8	7.8	4.8	4.3	3.7
3	5.6	6.7	6.8	6.1	5.1	5.5	8.8	7.9	7.3	5.2
4	5.4	7.1	6.0	4.8	5.1	5.2	8.6	6.4	5.1	4.3
5	6.2	6.2	10.5	5.9	3.6	6.2	6.1	8.9	5.8	4.9
6	4.9	7.3	3.3	4.8	5.1	5.3	8.7	4.7	4.1	5.0
7	4.4	5.2	5.3	5.3	4.8	5.0	5.5	5.0	4.6	4.9
8	5.4	7.1	6.5	5.9	5.1	5.7	7.3	6.6	5.6	4.8
9	5.0	7.0	5.4	5.1	4.9	5.4	7.8	5.4	4.8	5.6
10	5.2	6.6	6.1	5.4	5.3	5.5	6.4	5.1	4.8	5.4
11	5.2	5.2	7.2	5.2	4.6	5.7	7.3	4.7	5.7	4.8
12	4.8	5.6	6.9	6.3	4.7	5.8	6.2	4.5	4.8	4.0
13	5.0	5.6	6.4	5.1	5.2	5.8	6.9	5.6	5.8	5.2
14	4.7	6.7	6.4	6.1	5.1	5.1	6.6	5.4	4.8	4.8
15	5.6	6.4	9.7	5.8	4.8	9.1	8.6	7.4	5.7	5.0
16	5.4	8.3	6.9	5.4	5.4	5.6	9	7.6	5.6	4.9
17	5.4	7.6	5.7	4.9	5.5	5.2	7.8	7.8	4.5	4.9
18	5.3	5.9	6.7	5.7	5.4	5.5	5.7	5.3	4.9	5.2
Average blood glucose (mmol/L)	5.1	6.6	6.5	5.4	4.9	5.7	7.3	6.0	5.2	4.8
Standard deviation	0.46	0.83	1.61	0.54	0.50	0.92	1.15	1.35	0.75	0.48

roll required lesser time, 110 min to drop to baseline glucose level as compared to control soft roll, which required 190 min.

Paired samples test shows that at 90, 150 and 210 min, Ppk-supplemented soft roll give significant decrement ($p<0.05$) in glucose level when compared to control soft roll.

Blood glucose level with polypeptide soft roll further dropped to -0.9 mmol/L after 210 min while for control soft roll, blood glucose level only dropped slightly to -0.2 mmol/L. There is a different of 0.7 mmol/L drop in blood glucose level with these two test breads. This clearly shows that the 3 mg polypeptide-k in soft roll caused the greater drop in blood glucose level. The difference also reflected that ppk was present and acting over the test period of 210 min (3½ h). Indeed, Khanna (2004) reported that Ppk able to reduce blood glucose level in diabetic patients. However, the exact mechanism for Ppk induced reduction of blood glucose has yet to be elucidated. It contains 18 standard amino acids in a single molecule and its application as a food ingredient may help in reducing blood glucose level and prevention of diabetes which was proposed previously (Khanna, 2004).

Based on the Table 2, only 50% of the panels (9 panels) experienced reduction in blood glucose level after 90 min of consuming control soft roll whereas for Ppk-supplemented soft roll, 100 % of the panels (18 panels) experienced reduction in blood glucose level after 90 min. The onset of action for Ppk is between 30 to 90 min.

While for control soft rolls, only after 150 min, 100 % of the panels experienced drop in blood glucose. This is because the pancreas will only respond to release insulin when glucose is in excess in blood and this account for the longer response time for blood glucose reduction (Khanna et al., 1981). Results from the current study showed that Ppk in the supplemented soft buns accelerated carbohydrate metabolism resulting in rapid reduction of glucose level as compared to control soft roll in healthy adults.

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