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Comparison of Glycemic Index between Honey and Mixture of Honey and Sesame Seed

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ABSTRACT

Glycemic index indicates the physiological effects of dietary carbohydrates on postprandial blood glucose. In the present study beside the determination of glycemic index of Bushehr region Thyme honey, the effect of sesame seed on glycemic index of this variety of honey and postprandial blood glucose changes of mixture of honey and sesame seed had been surveyed. In this study, 10 healthy subjects were studied. Subjects referred to the laboratory in 3 different days ,with 1 week interval, after 10-12 hours overnight fasting and their blood glucose was measured in the fasting , 15, 30, 45, 60, 90 and 120 minutes after intake of glucose, honey or mixture of honey and sesame seed solutions. Incremental area under the blood glucose changes curve (IAUC) was calculated using trapezoid formula. Data were analyzed with SPSS version 17 by Paired samples t-test, ANOVA and repeated measure tests. Glycemic indexes for Thyme honey and mixture of honey and sesame seed were 65.9 and 73.5; respectively which their difference was not statistically significant (p=0.482). Incremental area under the blood glucose changes curve after intake of Thyme honey and mixture of honey and sesame seed were significantly lower than glucose(P=0.001). According to results of this study Glycemic index of Thyme honey from Bushehr region was in moderate range. Furthermore, adding sesame seed had no significant effect on the glycemic index of this variety of honey.

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INTRODUCTION

Consumption of equal amounts of carbohydrate containing foods does not increase postprandial blood glucose equally. Glycemic index (GI) concept is used to illustrate this difference [1]. This concept was introduced by Jenkins in the early 1980s as a ranking system for carbohydrates based on their immediate impact on blood glucose levels [2]. Operationally, GI is the incremental area under the blood glucose response curve (IAUC) produced by a standard amount of available carbohydrate in a food, usually 50 grams, relative to the incremental area produced by the same amount of available carbohydrate from a standard food, usually white bread or glucose expressed as a percentage [1]. Based on this index which indicates the physiological effects of dietary carbohydrates on postprandial blood glucose [2], foods are classified into three categories, as follows: low GI (<55), moderate GI (55-69) and high GI (≥70) [1]. Low GI foods contribute to less changes in blood glucose. Therefore using of lower GI foods is widely applicable and helpful for diabetic patient's meal planning [3].

Honey is one of the natural and sweet foods that has anti-inflammatory, antibacterial and antioxidant properties [4]. According to the international table of glycemic index, the GI of different varieties of honey is in 32 - 87 range [5]. This range represents differences among GI of different varieties of honey and also their different effects on postprandial glucose concentration. Because of the importance of GI in meal planning of

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diabetic patients, the GI of many Iranian foods has been determined, but just the GI of one variety of honey from Azerbaijan region [6] has been determined in Iran. The GI of other Iranian honey is not determined.

Some studies have shown that adding nuts to carbohydrate containing foods reduces their GI [7, 8]. In addition to improvement of lipid and glucose profile, the antioxidant properties of nuts have also been reported [9-11]. Sesame seed is largely used in the Middle East diet such as Iranian diet [12]. Sesame seed is commonly added to honey. To the best of our knowledge no study investigated the blood glucose responses after intake of the mixture of honey and sesame seed. So it is not clear that postprandial blood glucose how will be changed after adding the sesame seed to honey. The aim of this study was to determine the GI of Thyme honey from Bushehr region and compare its glycemic response with glucose. Also the effect of adding sesame seed on GI of honey was examined.

In the present study Thyme honey was randomly selected among several varieties of honey to investigate the effect of sesame seed on its GI.

MATERIALS AND METHODS

This study was a basic research. Sample size and sampling method were determined according to the instruction of GI determination [13]. Ten healthy subjects (6 women and 4 men) aged 24-32 years participated in this study. Subjects who were participated in this research had normal fasting blood glucose and lipid profile. Participants were not smoker, pregnant, or diabetic and didn't have metabolic disorders and didn't use medications that affect glucose metabolism. Written informed consent was obtained from all subjects. Weights and heights were measured by trained nutritionist. Weights were measured with light clothing and without shoes, using a portable Scale (Seca; Germany) with an accuracy of 0.1 kilogram. Heights were measured in standing position, using a fixed tape meter with an accuracy of 0.5 centimeter. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared (kg/m^2). Bushehr region Thyme honey was approved by Khuzestan agriculture administration. Chemical composition of Thyme honey was determined by food chemistry laboratory of Khuzestan food and drug administration in order to determine the carbohydrate amount of it. The portion size that was required to provide 50 grams available carbohydrates was determined from these results. Finally, 64.9 grams Thyme honey was used in this study. Also 10 grams sesame seed was used to mix with honey. Sesame seed was approved by horticulture department of faculty of agriculture in Shahid Chamran university of Ahvaz. Subjects didn't have vigorous physical activity in the study days and one day before study days. Throughout the study, each subject ate the same dinner on the night before the study days. Subjects refer to nutritional research laboratory of Jundishapur university of Ahvaz in three different days (with one week intervals) at 8 o'clock after 10-12 hours overnight fasting. Then, subjects intaked 50 grams glucose (dextrose mono hydrate; HACCP C-LABD; China) that had been dissolved in 250 ml water or solution of honey (64.9 grams honey plus 250 ml water or mixture of honey and sesame seed (64.9 grams Thyme honey plus 10 grams sesame seed) that had been dissolved in 250 ml water; randomly. Solutions were given to individuals randomly in each of days and finally in the end of study each participant had consumed three solutions. Subjects consumed solutions over 5 to 10 minutes period [13]. Finger prick blood samples were taken fasting and at 15, 30, 45, 60, 90 and 120 minutes after starting to intake solutions by glucometer (ACCU-CHEK Performa; America) auto lancet and then blood glucose concentration was determined.

Incremental area under the blood glucose changes curve (IAUC), ignoring area beneath the fasting level, were calculated geometrically by using of trapezoid formula [14]. The GI of honey and mixture of honey and sesame seed were determined by using of this formula [13]:

$$GI = \frac{IAUC_t}{IAUC_g} \times 100$$

GI means glycemic index of test food, $IAUC_t$ means incremental area under the blood glucose changes curve after intake of test food. $IAUC_g$ refers to IAUC of blood glucose changes after intake of glucose (reference food).

In order to glucometer calibration, glucose concentration of 62 serum samples which had been determined by auto analyzer (alcyon-300) were measured by glucometer. The correlation coefficient between analyzer and glucometer was 0.990.

Data were analyzed by statistical methods using SPSS statistical software version 17. Differences of glycemic index among test foods and differences among IAUC of blood glucose changes were compared by analysis of variance (ANOVA), Paired samples T-test and repeated measure tests and $p<0.05$ was the significance threshold.

Results:

The mean age of participants (6 women and 4 men) was 28 ± 2.7 years (Range 24- 32 years). In addition, the mean BMI was 24.3 ± 2.6 kg/m^2 and the mean fasting blood glucose was 4.85 ± 0.4 mmol/L.

The chemical composition of thyme honey is displayed in Table 1. Glycemic index of thyme honey and mixture of honey and sesame seed were 65.9 and 73.5; respectively. Based on the repeated measures test there was no significant difference among blood glucose changes after intake of glucose, thyme honey and mixture of thyme honey and sesame seed (p= 0.33). The results of the paired samples t-test showed that adding 10grams sesame seed had no effect on the glycemic index of honey.

The Glycemic response after intake of glucose, thyme honey and mixture of honey and sesame seed have been shown in Figure 1. According to ANOVA test there was a significant difference between the mean of incremental area under the blood glucose curve (IAUC) after intake of glucose (214.4 ± 53 mmol.min /L) and mean of IAUC of blood glucose after intake of thyme honey (140.2 ± 36.5 mmol.min /L) and also mixture of honey and sesame seed (147.64 ± 39.7 mmol.min /L) (p=0.001, p=0.002; respectively). But there was no significant difference between the mean of incremental area under the blood glucose curve after intake of thyme honey and mixture of honey and sesame seed (p=0.712).

The maximum concentration of blood glucose was observed 30 minutes after intake of thyme honey (8.5 ± 0.9 mmol/ lit). But after intake of glucose and mixture of honey and sesame seed solutions maximum concentration of blood glucose was observed 45 minutes after intake of solutions (8.2±0.4mmol/lit and 7.9 ±1 mmol/lit; respectively). Blood glucose concentration was significantly lower 60 minutes after intake of honey than intake of glucose (p=0.045). Also 90 minutes after intake of honey and mixture of honey and sesame seed blood glucose concentration was significantly lower than intake of glucose (p=0.001).

Table 1: Chemical Composition of Bushehr Thyme Honey.

Measured Factors	amount
Reducing sugars; gr/100gr	76
Sucrose; gr/100gr	1
PH	4.35
Acidity; mEq/Kg	7.5
Glucose; gr/100gr	34.26
Fructose; gr/100gr	41.74

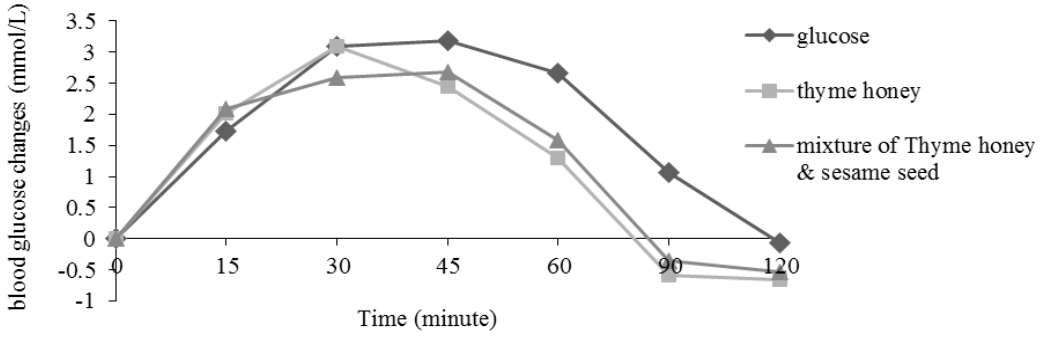

Fig. 1: Glycemic Response after Intake of Glucose, Thyme Honey and Mixture of Thyme Honey and Sesame Seed.

Discussion:

According to the results of the present study the glycemic index of Bushehr region thyme honey is 65.9 that is in moderate range and is close to the GI of Azerbaijan region honey (GI=65)[6]. GI of Malaysian wild honey (GI=65) and the Australian honey (GI=59) also are in the moderate range [15]. But GI of Bangladeshi honey is in high range [16]. GI of three varieties of American honey were determined in high range and one variety was determined in moderate range [17]. Although in some studies the reference food amount and glycemic index calculation method were different but other factors such as honey composition and plant that honey bee has feed from it can effect on honey glycemic index. So the different GI values of honey has been reported [5-6, 15-18]. Therefore the glycemic index of honey can be in low, moderate or high range. Although in this study no statistically significant difference was observed between the GI of honey (GI=65.9) and mixture of honey and sesame seed (GI=73.5) (p=0.482), but adding the sesame seed to honey led to increase of its glycemic index from moderate range to high range. Because of protein (20.45%), fat (61.21%) and fiber content of sesame seed, it has been expected that adding the sesame seed to honey reduced the glycemic index of honey, because adding the protein to a carbohydrate containing food by stimulating insulin [19], gastric inhibitory peptide [20-22] and glucagon – like peptide -1 [23, 24] secretion, adding fat through delaying gastric emptying [25] and adding fiber by interfering with the absorption of glucose will lead to glycemic response reduction. But the results of present

study were in contrary to our expectations. Because the available carbohydrate amount in 10 grams sesame seed is very low (1.173 gr), increase of honey glycemic index after adding the sesame seed is not because of sesame seed carbohydrate content. To the best of our knowledge no study has examined the effect of sesame seed or similar seeds on postprandial blood glucose and it is difficult to compare the results of studies. Some studies have shown that adding nuts to a high carbohydrate food lower the glycemic index of food. Jenkins et al. (2006) in their study showed that adding almonds decreased blood glucose increment after eating white bread [7]. Josse et al. (2007) in a study observed that adding various amounts of almonds (30 , 60 and 90 grams) reduced the glycemic response after eating white bread dose-dependently [8]. Kendall et al.(2011) in their study surveyed the effect of pistachio intake with a high carbohydrate food on postprandial blood glucose changes, they showed that intake of pistachio with high carbohydrate foods such as rice and potato puree led to the glycemic response reduction [26]. In studies that adding nuts reduced postprandial blood glucose and glycemic index, the amount of added protein and fat to the test food were more than present study. In the josse et al. study there were 5.58 grams protein and 16.26 grams fat in 30 grams added almonds. In the Kendall et al. study 56 grams pistachio was used, pistachio fat and protein content were 10.8 and 30.07 grams; respectively. In our study, protein and fat content were 2.04 and 6.12 grams, respectively. Therefore, it is likely that adding more amounts of sesame seed reduces postprandial blood glucose and glycemic index of honey. Therefore, further studies are necessary in this regard. Difference of incremental area under the blood glucose changes curve (IAUC) shows that honey can make lower changes in blood glucose than glucose. This difference can be attributed to differences in the metabolism of glucose and honey. Honey because of phytochemicals, fermentable and non-fermentable carbohydrates and hydrogen peroxide content, which is known as insulin imitator factor, makes a lower glycemic response than glucose [27] and thus protects the body from the adverse effects of postprandial hyperglycemia.

Although the glycemic index of thyme honey in the present study didn't have great difference with glycemic index of sucrose (GI=68±5), but because of higher fructose percent has more sweetening effect and lower glycemic load than sucrose and it has been expected that thyme honey consumption compared with equal amount of sucrose has lower effect on blood glucose increment. Several studies suggested that honey contains antioxidants and catalase, which can reduce oxidative stress in humans [28,29]. Thus, with respect to the potential effects of honey on health, it can be used as a substitute for sugar in diet.

Conclusion:

In the present study the glycemic index of Bushehr region thyme honey was 65.9 that is in moderate glycemic range. Furthermore, adding the sesame seed to honey caused no significant changes in the GI of this variety of honey.

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