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Glycemic index profiling of germinated quinoa (*Chenopodium quinoa wild*)

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Abstract

Quinoa has potential health benefits and exceptional nutritional value like high concentration of protein, unsaturated fatty acids and low glycemic index (35- 53). Studies on glycemic index (GI) profile of germinated quinoa are lacking, so the present study was carried out to assess the glycemic index of germinated quinoa. Quinoa was germinated, cooked and was given to the subjects, blood glucose levels were examined for every 15mins upto 120mins. The mean fasting blood glucose level was 84.2 mg/dl and blood glucose levels after consumption of germinated quinoa was ranged from 114 to 68.4 mg/dl. The glycemic index of 75gm of germinated quinoa (having 50g of carbohydrates) ranged from 51.2 – 64.7 with an average of 59. The glycemic load of germinated quinoa was ranged from 25.6 to 29.7 with an average of 29.54. Hence, concluded that germinated quinoa can be categorized into medium GI and high Glycemic Load (GL) food.

Keywords: Quinoa, germination, IAUC, glycemic index, glycemic load

Introduction

Consumption of starch-based high-energy low-nutrient-dense foods raises blood sugar rapidly and are termed as high glycemic foods. High glycemic foods are reported to play a role in increasing obesity and diabetes (Onwulata *et al.*, 2010) [5]. The glycemic index (GI) is a ranking of carbohydrates on a scale from 0 to 100 according to their impact on blood sugar levels during the 2 hours following consumption.

Low GI (<55) foods produce gradual rises in blood sugar and insulin levels. Low GI diets have been shown to improve glucose and lipid levels and weight control because they help control appetite. Low GI diets also reduce insulin resistance and the risk of cardiovascular diseases, diabetes and some cancers. It is reported that fasting insulin is lower in individuals with higher dietary fiber intakes and that the ingestion of complex carbohydrates promotes longevity and also that a high GI diet increases the levels of inflammation biomarkers.

Diets based on complex carbohydrate foods that are more slowly digested, absorbed, and metabolized (i.e., low glycemic index [GI] diets) have been associated with a reduced risk of type 2 diabetes and cardiovascular disease (Marsh, K *et al.*, 2011) [4]. In patients with celiac disease, following a low GI diet could meliorate this disease by reduced inflammatory state by providing certain protective mechanisms (Gordillo-Bastidas *et al.*, 2016) [3].

Quinoa has proteins of high biological value, carbohydrates of low glycemic index (35- 53), phytosteroids, and omega-3 and 6 fatty acids that bring benefits to the human health (Farinazzi-Machado *et al.*, 2012) [2]. Studies on glycemic index (GI) profile of germinated quinoa are lacking, thus present study was conducted to study the glycemic index of germinated quinoa.

Materials and methods

Preparation of sample: Quinoa seeds are cleaned, washed for 5 to 6 times to remove the saponin content and soaked in water for 10hrs and incubated at 20 °C for 4hrs. The germinated quinoa was cooked by pressure cooking method taking double the quantity of water.

Selection of subjects: Initially fifteen college going students were selected from D hostel at PJTSAU campus with the age group of 19-22 years. Subjects were excluded if they reported a history of gastrointestinal disorders, were taking medication for any chronic disease conditions, or intolerant or allergic to any of the foods. Finally, 10 healthy subjects were identified for study from initial 15 members. Before starting the glycemic index trial, subjects were explained about the study and few instructions were given to follow.

Glycemic Index Profiling: The method used for measuring and calculating the GI of the germinated quinoa was in accordance with WHO/FAO recommendations (FAO/WHO, 1998). Subjects attended each testing session after 10hrs overnight fast but not exceeding 16 hrs and had been instructed not to consume unusually large meals and exercise vigorously on the previous day. On the first occasions, the subjects were given the standard reference food (glucose). The 50g glucose was made up with 250 ml water, and subjects were given 250 ml of water to drink. Again on the next occasion, 65gm of experimental germinated cooked quinoa was given to provide 50 g of carbohydrates for each subject. Blood glucose levels were measured by using Horizon one touch Glucometer in capillary whole blood obtained by finger prick in the fasted state and at 30, 60, 90 120 mins after the consumption of the sample.

Determination of Glycemic Index: The incremental area under two hour glucose response curve (IAUC) was calculated according to the formula used by Wolever *et al.* (1991) [6]. Glycemic index of the test sample cooked germinated quinoa (DGQ) were calculated by applying the following equation 1 and glycemic load was calculated using equation 2

Equation 1

$$\text{Glycemic Index} = \frac{\text{IAUC of test food}}{\text{IAUC of reference food}} \times 100$$

Equation 2

$$\text{Glycemic load} = \text{GI} / 100 \times \text{dietary carbohydrate content of serving}$$

Results and Discussion

The GI is a ranking of carbohydrates on a scale from 0 to 100 according to their impact on blood sugar levels during the 2 hrs following consumption. Low GI (<55) foods produce gradual rises in blood sugar and insulin levels. Low GI diets also reduce insulin resistance and the risk of cardiovascular diseases, diabetes and some cancers. It is reported that fasting insulin is lower in individuals with higher dietary fiber intakes and the ingestion of complex carbohydrates promotes longevity (Gordillo-Bastidas, *et al.*, 2016) [3].

The glycemic index consists of scale ranging from 1 to 100, indicating the rate at which 50 g of carbohydrate in a particular food is absorbed into the blood stream as blood sugar. Glucose is used as reference food and is rated 100. Classification of GI i) High glycemic index foods (GI > 70) ii) Medium glycemic index foods (GI in between 56- 69) and iii) Low glycemic index foods (GI ≤ 55) as reported by Gordillo-Bastidas, *et al.*(2016) [3].

The study on glycemic index profile of germinated quinoa was carried out and the results are presented as IAUC, GI and GL in Table 1. The mean scores of blood glucose levels taken during study are presented in Figure 1. The mean fasting blood glucose level was 84.2 mg/dl and blood glucose levels after consumption of germinated quinoa was ranged from 114 to 68.4 mg/dl. The glycemic index of 65gm of germinated quinoa (having 50g of carbohydrates) ranged from 51.2 – 64.7 with an average of 59. Results show that germinated quinoa can be classified under medium GI food (Gordillo-Bastidas, *et al.*, 2016) [3]. The glycemic load of germinated quinoa was ranged from 25.6 to 29.7 with an average of 29.54 which falls into the category of high GL food as classified by (Aziz, 2009) [1] as High GL foods (GL ≥20), ii) Medium GL foods

(GL in between 11-29) and Low GL foods (GL ≤ 10). Gordillo-Bastidas *et al.* (2016) [3] reported GI of unprocessed quinoa between 35- 53. When compared with the study, GI values were more indicating that germination will increase GI values due to breakdown of carbohydrates.

Table 1: Glycemic index and glycemic load of germinated quinoa

S. No	IAUC sample	IAUC glucose	GI	GL
1.	9405	17107	54.9	27.45
2.	9562	14767	64.7	32.35
3.	9600	18720	51.2	25.60
4.	10965	19747	55.5	27.75
5.	10140	17992	56.3	28.15
6.	49672	17347	57.6	28.80
7.	10462	12675	82.5	41.25
8.	10537	17737	59.4	29.70
9.	9750	18165	53.6	26.80
10.	9765	17692	55.19	27.59
Mean	13985	17194	59.08	29.54

Note Values are expressed as mean ± standard deviation for all the three determinants.

IAUC - Incremental area under the curve

GI – Glycemic index

GL- Glycemic load

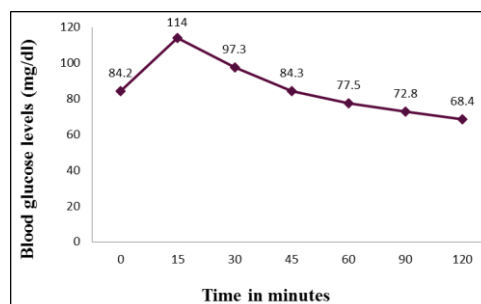


Fig 1: Mean blood sugar levels after consumption of germinated cooked quinoa



Plate 1: Cooking of sample for GI estimation



Plate 2: Estimation of blood glucose levels

Reference

1. Aziz A. The glycemic index methodological aspects related to the interpretation of health effects and to regulatory labelling. *Journal of AOAC International*. 2009; 92:879-887.
2. Farinazzi-Machado FMV, Barbalho SM, Oshiiwa M, Goulart R, Junior OP. Use of cereal bars with quinoa (*Chenopodium quinoa* W.) to reduce risk factors related to cardiovascular diseases. *Ciência e Tecnologia de Alimentos*. 2012; 32(2):239-244.
3. Gordillo-Bastidas E, Díaz-Rizzolo DA, Roura E, Massanés T, Gomis R. Quinoa (*Chenopodium quinoa wild*), from nutritional value to potential health benefits: an integrative review. *Journal of Nutrition and Food Sciences*. 2016; 6(3):1-10.
4. Marsh K, Barclay A, Colagiuri S, Brand-Miller J. Glycemic index and glycemic load of carbohydrates in the diabetes diet. *Current Diabetes Reports*. 2011; 11(2):120-127.
5. Onwulata CI, Thomas AE, Cooke PH, Phillips JG, Carvalho CWP, Ascheri JLR *et al.* Glycemic potential of extruded barley, cassava, corn, and quinoa enriched with whey proteins and cashew pulp. *International Journal of Food Properties*. 2010; 13:1-22.
6. Wolever TMS, Jenkins DJA, Jenkins AL, Josse RG. The glycemic index: methodology and clinical implications. *American Journal of Clinical Nutrition*. 1991; 54:846-54.