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ORIGINAL ARTICLE

Assessment and Comparative Analysis of Glycemic and Satiety Indices of locally available biscuits

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ABSTRACT

Background: Glycemic index is a relative ranking that tells how fast or slow carbohydrates alter your blood sugar level, While Satiety index is a ranking that describe the feeling of fullness after eating specific food.
Aim: To determine GI & SI of different biscuits *(chocolate chip, chocolato and candy)*.
Methods: The GI and SI of 25 people were tested by giving them 3 types of different local biscuits. Their blood glucose level was monitored for 3 hours. Same way their Satiety level was observed for 3 hours. For satiety level, 5 people were given white bread as standard value.
Results: Results showed that glycemic indices are 116.34±3.164, 108.93±3.874 and 110.99±7.18 of candy biscuit, chocolato biscuit and chocolate chip biscuit respectively. While their satiety indices are 52.66±6.38, 42.89±3.23 and 47.45±3.29 of candy biscuit, chocolato biscuit and chocolate chip biscuit respectively.
Conclusion: From experiments it is concluded that Glycemic indices of biscuits are 110.99±7.18, 108.93±3.874 and 116.34±3.164 of chocolate chip, chocolato and candy biscuit respectively.
Keywords: Glycemic indices, satiety indices, chocolate chip, candy

INTRODUCTION

Glycemic index *(GI)* is measured to check effect of carbohydrates on blood glucose level[1]. Fasting blood glucose level lies between 95 to 100mg/dl. Purpose of this study is to check alleviation in blood glucose level after eating listed products. Also how much energy it provides to body. (2)Satiety index *(SI)* is measured to check does the food gratify the person's appetite, or in other words it is about fullness after eating biscuits. This study reveals specified amount of biscuit (more precisely carbohydrates in biscuits) that is enough to bring a person in gratified state.

Other researches been done in the past to calculate different food's glycemic and satiety indexes. A recent study[3] Comparison of glycemic index of spelt and wheat bread in human volunteers revealed about how much glucose level alleviation occur when specified amount of white bread and spelt bread is taken containing same amount of carbohydrates. Other than this, hundreds of knowns food have been tested and are still tested to determine their GI as well SI to have better understanding about blood glucose rising levels including almost all fruits and vegetables.

Sole purpose of the study is to determine whether biscuits have same in vivo effects in diabetic people as well as in non-diabetic. Biscuits are usually used as snacks or sometime as a temporary solution to hunger. Mostly, people do eat biscuits with tea or coffee that might also count as an increased GI or SI due to added sugar in coffee or tea. Today hundreds of types of biscuits are available in market that shows biscuits are widely used as temporary fullness. As biscuit does contain a lot of carbohydrates so it's important to take in account the glycemic index of it. Idea of glycemic index was first time proposed by physician David Jenkins in 1981 to examine the effect of glucose on one's blood. It does not give more information about the blood glucose response but it surely does tell the blood insulin response toward the glucose in body at specified condition. So for this study[4] 50g glucose was used as reference food for GI measurement and then 5 people, for each biscuit's GI measurement, were given biscuits containing equal amount of carbohydrate. Same procedure was repeated for SI measurement. Only the reference food for SI measurement was white bread containing same 50g of carbohydrate[5].

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METHODOLOGY

It is an observational study in which different 3 groups, each containing 5 people. GI and SI of 3 biscuits were tested: chocolate chip, chocolatto and candy biscuits. True check glucometer was used to check their blood glucose level after every 30 minutes. This study was approved by Departmental Ethical Committee.

Biscuits were local products purchased in pack forms. 3 biscuits of chocolato contained 16.0g of carbohydrates, 2 biscuits of chocolate chip contained 15.6g of carbohydrates while 3 biscuits of candy contained 13.1g of carbohydrates. As 50g glucose was given as standard product so biscuits were given in amount containing equal amount of carbohydrates. People were divided in 3 groups. 1 group contained 5 people. 1st group was given chocolate chip, 2nd group was given chocolato while 3rd group was given candy biscuit. Other 2 groups were given 50g glucose and white bread containing 50g of carbohydrates as standard referral groups[6]. Their blood glucose level was checked before eating biscuits; also satiety level was checked. A simple scale ranging from 1 to 10 was used to describe

how gratify they are after eating the biscuits and how this gratification decreases long after eating[13]. All subjects were given 50g of glucose containing white bread as a reference product for SI. After that they were given biscuits to check do these biscuits gratify their appetite or just provide temporary effect for a short interval of time. After eating biscuits their blood glucose and satiety level was checked every 30 minutes up to 3 hours. Satiety level was checked using rating method, and GI was checked using True check Glucometer. After checking blood sugar level at interval, GI was measured individually using trapezoid method[7]. *AUC* is measured using formula = $\frac{A+B}{2}$

After evaluating each person's GI, their Glycemic Loads[8] were calculated using formula:

GL= GI × Carbohydrates (g)/100

As reference glucose level was 50g so GI is multiplied by 50 and then divided by 100. After evaluating indices, their mean were calculated and final GI was obtained. Their indices are given in fig 1.1 & 2.1[10].

RESULTS

Fig 1: Glycemic Index

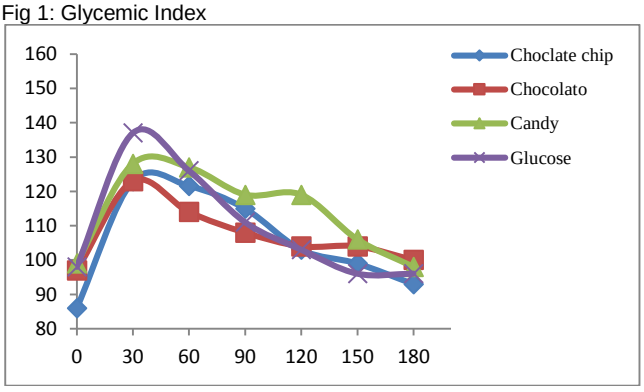


Fig 2: Satiety Index

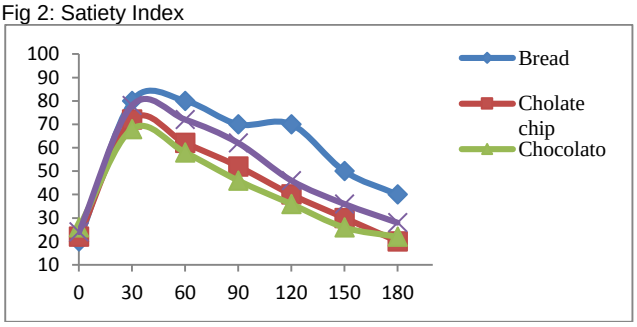


Table 1:

Treatment	Glycemic Index *P (0.0963)*	Satiety Index *P(0.0174)*
Chocolate chip	110.99±7.18	47.45±3.29[ab]
Chocolatto	108.93±3.874	42.89±3.23[b]
Candy	116.34±3.164	52.66±6.38[a]

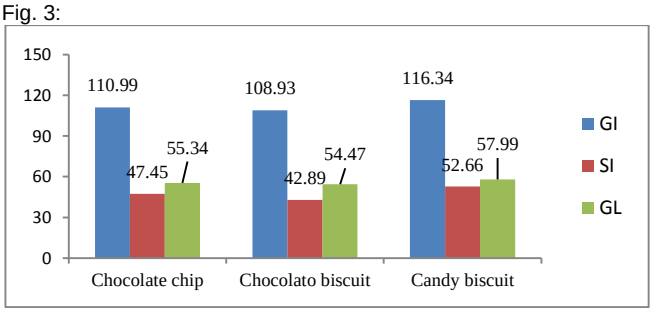
Referral question's answers:

- Among all biscuits, Candy biscuit showed highest Glycemic and Satiety index.
- There is no significant difference between GI because p >0.05 using ANOVA[9]. In SI there is significant difference between Chocolato and Candy biscuit. While Chocolate chip biscuit is both like Chocolato biscuit and Candy biscuit.
- As each person was given biscuits in equivalent 50g of carbohydrates so according to it, their glycemic loads are in the following table 2

Table 2:

Products	Glycemic Loads
Chocolate chip biscuit	55.34±3.49
Chocolato biscuit	54.47±1.98
Candy biscuit	57.99±1.40

Fig. 3:



DISCUSSION

Foods are classified as low GI food, high GI food and medium GI food based on their measurement from 0 to 100. Hundreds of studies have been drawn on determining the GI and SI of all 5 food groups given in food pyramid. Of all, glucose and white bread are used as reference GI food because they both have 100 glycemic index. Biscuits usually contain most of carbohydrates and fibers in it. Fiber plays its vital role as providing a fuel to gut's microflora to maintain digestibility of food. It was thought to be a source of low GI level as it decreases the occurrence of many other lethal diseases such as ischemic heart disease and obesity. Glycemic index is measured specifically right after eating specific food and kept measured till 2 hours with regular intervals of 30 minutes. Which mean immediate digestion of carbohydrates and immediate absorption in blood of glucose is what actually the measurement of glycemic index. Soluble Dietary fiber is broken down in the body after digestion and then it decreases the glycemic index which is not considered the part of this whole procedure.

Other than fiber, foods contain other macromolecules i.e. proteins and fats which are not instant source of energy in body. Some food such as steak does contain majorly protein instead of carbohydrates. 50% of protein is converted into the carbohydrates after 3-4 hours of consumption. But it does not count as part of glycemic index measurement. Biscuit does not contain pile of fat like other foods but it does contain a little amount of protein of which bioavailability is different for each biscuit. Candy biscuit contains 6.0g of protein in 50g glucose containing portion while chocolate chip and chocolatto contain 5.6g and 6.2g protein respectively.

Other than this these biscuits contain more than 20g of fats in it. Fats (saturated) are thought to be root causes of fatal diseases i.e. hypertension, myocardial infarction, obesity and increased intravenous cholesterol level or LDL.

Usually palm oil or mid fraction palm oil and margarine are used in biscuits especially for presiding it a structure and texture. But the fat which is used to knead the dough of biscuits needs to be considered[12]. No study has ever proved that fat in biscuit has any association with CVD or obesity. It is considered that fats in biscuits are safe to consume. In a study[11] it was analyzed that biscuits do contain a little high amount of fats than required because it might cause obesity if consumed by children. According to label provided by manufacturers, these biscuits do contain more than 20g of fats in tested amount of biscuit.

Other than carbohydrates, fats, proteins and fibers which thing might have an effect on blood glucose level is the way they prepare the biscuits. Their kneading of dough and which type of flour is being used does matter[11]. Either the flour they are using is gluten free or wheat because gluten can never be digested by a person with celiac disease. In case if an affected person does ingest this type of biscuit then it might cause intolerance and GI cannot collected so as SI. In addition, as the people have a habit of eating biscuits with tea or coffee or might be with milk, oligosaccharides in sugar and sucrose in coffee and tea might alter the glycemic index of required food. In this case glycemic index is increased more than its actual level as oligosaccharides is an instant source of energy.

All the subjects were chosen on the base of their BMI to test whether they are valid to use for GI and SI measurement. Subjects had normal BMI in between 20-24.5kgm^{-2}. All subjects were found negative for any physical disability and psychological disorder. None of them had a history of type II diabetes or CVDs so that their satiety and glycemic indexes are measured accurately up to the mark. To carefully measure their SI, subjects were bound to stay stick to their places and not to wander in an alert from preventing their calories by burning.

CONCLUSION

From experiments it is concluded that Glycemic indices of biscuits are 110.99±7.18, 108.93±3.874 and 116.34±3.164 of chocolate chip, chocolato and candy biscuit respectively. While Satiety indices of biscuits are 47.45±3.29, 42.89±3.23 and 53.48±6.90 of chocolate chip, chocolato and candy biscuit respectively.

Graph revealed that all cookies have high GI & low SI. For SI, we used rating method. Most people were very full and rated 80 score right after 30 min of eating White bread. But later on their level decreased soon. This showed that biscuits were not enough to bring them in gratified state.

P value[9] of GI is greater than 0.05 so their GI are not significant to each other. While P value of SI is smaller than 0.05 that shows their satiety values are significant to each other.

Conflict of interest: None

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