

Effect of Low and High Glycemic Index Meals on Hunger and Satiety

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Abstract

Recently, people suffer from the inability to maintain weight with an increasing body mass, and this may be due to several reasons, including the type and quantity of food. In current study, the effect of the glycemic index of foods (high-low-medium) on the speed of return of hunger in adult women was discussed. Non-pregnant or lactating women who do not suffer from chronic diseases such as diabetes and pressure, for three days in a row for breakfast, lunch, and dinner, by calculating the number of hours preceding the feeling of hunger, as the results showed that the least hours of hunger were after eating foods with a low glycemic index and then followed by foods with a medium glycemic index, and the number of hours of starvation after eating foods with a high glycemic index was the least, and this leads to an increase in subsequent food intake and an increase in calories during the day. The results indicated: first day that are high in the glycemic index (breakfast). Highest percentage of feeling hungry was 30% after 4 h (lunch). The highest percentage of feeling hungry was 30% after 3 h, (dinner), the highest percentage of not feeling hungry by 50%. The second day with a low glycemic index (breakfast). The highest percentage of feeling hungry after 4 h was 30%, (lunch). The highest percentage of feeling hungry after 4 h was 30%, (dinner). The highest percentage of not feeling hungry was 80%. Third day with a medium glycemic index (breakfast). The highest percentage of feeling hungry was after 3 h and 4 h, with a percentage of 30%, (lunch), the highest percentage of feeling hungry after 4 h, with a percentage of 30%, (dinner), the highest percentage of not feeling hungry by 70%, which increases body mass and weight continuously, and this leads to an increase in vulnerability to chronic diseases. Therefore, it is important to preserve and be careful to eat meals with a low and medium glycemic index in the diets, with the addition of foods with a high glycemic index, without negligence or excess, and we look forward to increasing the research on the effect of the glycemic index of food on the speed of return of hunger while standardizing the quantity and type of food

for all volunteers.

Keywords

Increase in Body Mass, Feeling of Hunger, Medium Glycemic Index, Pressure, Diabetes

1. Introduction

Over the past few years, the consumption of foods with a high carbohydrate content has increased compared to foods with a variety of food sources, in addition to a decrease in the levels of motor activity. Accordingly, this problem has caused an increase in diabetes and obesity to maintain the ideal weight, the consumption and expenditure of energy must be balanced by eating appropriate quantities of food and daily sports movement. Carbohydrates are the most important and largest source of energy in the body. It is important to consume them in balanced proportions according to the body's needs, and in an optimal way by calculating the glycemic index of foods. It is a measure of the effect of foods containing carbohydrates on the level of sugar, and glucose in the blood, which is the area under the response curve for blood sugar within 2 h after consuming fifty grams of carbohydrates. Foods are divided into three sections according to the glycemic index: the first is foods with a high glycemic index, the second: foods with a Medium glycemic index, and the third: low glycemic index foods.

Some studies have found that foods with a high glycemic index lead to a rapid rise in blood glucose followed by a decrease, due to their speed of digestion and absorption. This leads to various hormonal and metabolic changes that have a negative impact on the body's health. In contrast, foods with a low glycemic index rise and fall in blood glucose slowly due to their slow speed of digestion and absorption [1]. In a previous study, it was indicated that the rapid absorption of glucose after eating meals with a high glycemic index led to a series of hormonal and metabolic changes that stimulate excessive food intake in obese patients [2].

In a study, it was reported that the consumption of foods with a high glycemic index led to a rapid return of hunger and increased subsequent energy consumption, which led to weight gain in individuals who were prone to obesity, in contrast to foods with a low glycemic index that helped in preventing weight gain [3].

Whereas, hormonal responses to high-GI diets reduce levels of metabolic fuel circulation, store fat, and stimulate hunger, which leads to weight gain at a high level [4] [5]. There are recommendations for low glycemic index diets as a healthy diet for preschool children [6]. In some studies, it is indicated that a promising therapeutic alternative to the standard dietary treatment of obesity in children is a low-glycemic index diet [7]. As low-glycemic index diets reduce energy intake compared to high-glycemic index diets, this is why these systems are likely to benefit weight loss systems [8].

As these diets have proven to be an effective way to reduce calorie intake and achieve long-term weight control [9].

According to Pi-Sunyer [10], this study recommends avoiding or reducing the intake of foods with a high glycemic index, as it can cause obesity, cardiovascular disease, and type 1 diabetes. On the other hand, this study revealed that there were no statistical differences in plasma glucose or insulin responses in rates of appetite or food expenditure in the use of diets with high or low glycemic index [11]. In this study, it was not possible to determine a clear relationship between the glycemic index and the hormones ghrelin and leptin, which are responsible for appetite, as after eating foods with a high glycemic index, blood sugar rises, as insulin works to allow sugar to enter the cells to carry out metabolic processes, and during the presence of sugar in the blood, the hormone is suppressed Ghrelin is responsible for hunger and appetite in the circulatory system. Similarly, foods with a low glycemic index may not necessarily suppress appetite or increase satiety or hunger due to a lack of stimulation of the hormone leptin, which is responsible for satiety by insulin, and inhibition of ghrelin [12].

Factors that can influence satiety and subsequent food intake are food type, appearance, palatability, and expectations of the food's satiating properties, energy and macronutrient content, energy density, and fiber. Even increasing the protein content of a meal neither increase satiety and nor reduce appetite and subsequent energy expenditure [13].

Contrary to previous reports, a recent study indicated that frequent consumption of high-GI foods reduced appetite more than low-GI meals in physically active, ideal-weight males [14].

The purpose of this short-term study is to examine the impact of low and high glycemic index diets on hunger and satiety levels following daily meals (breakfast, lunch, and dinner) in healthy individuals over a two-day period. The study aims to test the glucostat theory, which suggests that food consumption is influenced by temporary fluctuations in blood glucose levels. According to this theory, low blood glucose levels trigger hunger and initiate eating, whereas high blood glucose levels induce feelings of satiety, leading to cessation of eating and reduced energy expenditure [12].

A study was conducted on 15 overweight people to measure their blood sugar level after introducing a high-protein supplement with vegetable fiber in addition to milk to their daily meals. Where these supplements contributed to a decrease in blood sugar, and this may benefit their inclusion in the daily meals to reduce the response of blood sugar in the blood after eating and increase the rate of satiety. Hence, we can conclude that the glycemic index of foods is affected by many factors such as protein content, dietary fiber, fat, chewing time, cooking method, and the chemical composition of the main carbohydrates. The glycemic index of food is also affected when it is eaten alone or included and eaten with other foods, as the inclusion of fats, proteins and dietary fibers in foods leads to a decrease in the glycemic index of the food [15].

2. Materials and Methods

This study was conducted in 2023 in Qassim, Saudi Arabia. A group of 16 adult volunteers 6 of whom dropped out during the experiment, were recruited in the Qassim region from voluntary societies, with ages from 20 - 45, who were in good health, non-smokers, did not use medication, were not pregnant or breast-feeding, did not follow a therapeutic diet and had regular daily and dietary habits (breakfast, lunch, and dinner daily) and sleep. Early and not staying up late, were not suffer from chronic diseases, pressure, and diabetes, and have an average body mass index (34.01). Consent was obtained from the volunteers prior to their participation in the study.

This study was conducted for three days.

On the first day, the volunteers ate three high-glycemic index breakfasts, lunches, and dinners. On the second day, the volunteers ate three medium-GI breakfasts, lunches, and dinners. On the third day, the volunteers ate three low-glycemic index breakfasts, lunches, and dinners. The number of hours that the volunteers did not feel hungry was calculated after every meal for every day

3. Statistical Procedures

The Statistical Package for the Social Sciences (SPSS version 26) was used to analyze the data in this study. P-value of 0.05 was considered statistically significant.

- 1) Mean and standard deviation have been accomplished
- 2) Frequency, percentage, to identify the personal data and items
- 3) Chi-square test were conducted to examine the relationship

4. Results

Table 1 shows the minimum, the maximum, the mean, and the standard deviation for age and body mass index, where the age means of the respondents was 26.30, and the body mass index mean was 34.01.

Table 2 shows the meals of the first day that are high in the glycemic index (breakfast). The highest percentage of feeling hungry was 30% after 4 h.

Table 3 shows the meals of the first day with a high glycemic index (lunch). The highest percentage of feeling hungry was 30% after 3 h.

Table 4 shows the meals of the first day with a high glycemic index (dinner), the highest percentage of not feeling hungry by 50%.

Table 5 shows the meals of the second day with a low glycemic index (breakfast). The highest percentage of feeling hungry after 4 h was 30%.

Table 6 shows the meals of the second day with a low glycemic index (lunch). The highest percentage of feeling hungry after 4 h was 30%.

Table 7 shows the meals of the second day with a low glycemic index (dinner). The highest percentage of not feeling hungry was 80%.

Table 8 shows the meals of the third day with a medium glycemic index (breakfast). The highest percentage of feeling hungry was after 3 h and 4 h, with a percentage of 30%.

Table 1. Descriptive statistics for age and body mass index.

	N	Minimum	Maximum	Mean	Std. Deviation
Age	10	19	36	26.30	5.579
Body Mass Index	10	19.53	34.01	25.0350	4.14468

Table 2. On the first day, the high glycemic index (breakfast).

Hours	Frequency	Percent
1.50	1	10.0
2.00	2	20.0
3.00	1	10.0
3.50	1	10.0
4.00	3	30.0
5.00	2	20.0
Total	10	100.0

Table 3. On the first day, the high glycemic index (breakfast).

Hours	Frequency	Percent
2.50	2	20.0
3.00	3	30.0
4.00	1	10.0
4.50	1	10.0
5.00	1	10.0
6.00	1	10.0
7.00	1	10.0
Total	10	100.0

Table 4. On the first day, the high glycemic index (dinner).

Hours	Frequency	Percent
Didn't feel hungry	5	50.0
1.00	1	10.0
1.50	1	10.0
2.00	1	10.0
2.25	1	10.0
9.00	1	10.0
Total	10	100.0

Table 5. On the second day, the low glyceic index (breakfast).

Hours	Frequency	Percent
Didn't feel hungry	2	20.0
2.00	1	10.0
3.00	2	20.0
4.00	3	30.0
4.50	2	20.0
Total	10	100.0

Table 6. On the second day, the low glyceic index (lunch).

Hours	Frequency	Percent
2.00	1	10.0
3.00	1	10.0
4.00	3	30.0
4.50	2	20.0
5.00	1	10.0
6.00	1	10.0
7.00	1	10.0
Total	10	100.0

Table 7. On the second day, the low glyceic index (dinner).

Hours	Frequency	Percent
Didn't feel hungry	8	80.0
3.00	1	10.0
5.00	1	10.0
Total	10	100.0

Table 8. On the third day, the medium glyceic index (breakfast).

Hours	Frequency	Percent
Didn't feel hungry	1	10.0
3.00	3	30.0
4.00	3	30.0
5.00	2	20.0
9.00	1	10.0
Total	10	100.0

Table 9 shows the meals of the third day, medium glycemic index (lunch), the highest percentage of feeling hungry after 4 h, with a percentage of 30%.

Table 10 shows the meals of the third day, medium glycemic index (dinner), the highest percentage of not feeling hungry by 70%.

Table 11 shows that there is no statistically significant effect of age on the first day of high-GI meals (breakfast) (chi-square value 2.000, p-value 0.349 > 0.05), and the first day of high-glycemic index meals (lunch) (chi-square value of 2.600, p-value 0.857 > 0.05). For the first day, high-GI meals (dinner) (chi-square

Table 9. On the third day, the medium glycemic index (lunch).

Hours	Frequency	Percent
Didn't feel hungry	1	10.0
2.50	1	10.0
3.00	2	20.0
4.00	3	30.0
4.33	1	10.0
6.00	1	10.0
8.00	1	10.0
Total	10	100.0

Table 10. On the third day, the medium glycemic index (dinner).

Hours	Frequency	Percent
Didn't feel hungry	7	70.0
1.00	1	10.0
3.00	1	10.0
6.00	1	10.0
Total	10	100.0

Table 11. The relation between age group and the days of high and low glycemic index.

		Test Statistics								
Age		On the first day, the high glycemic index (Breakfast)	On the first day, the high glycemic index (lunch)	On the first day, the high glycemic index (dinner)	On the second day, the low glycemic index (Breakfast)	On the second day, the low glycemic index (lunch)	On the second day, the low glycemic index (dinner)	On the third day, the medium glycemic index (Breakfast)	On the third day, the medium glycemic index (lunch)	On the third day, the medium glycemic index (dinner)
Chi-Square	0.800 ^a	2.000 ^b	2.600 ^c	8.000 ^b	1.000 ^d	2.600 ^c	9.800 ^e	2.000 ^d	2.600 ^c	10.800 ^f
df	8	5	6	5	4	6	2	4	6	3
Asymp. Sig.	0.999	0.849	0.857	0.156	0.910	0.857	0.007	0.736	0.857	0.013

value of 8.000, p-value 0.136 > 0.05), and for the second day, low-glycemic-index meals (breakfast) (chi-square value of 1.000, p-value 0.930 > 0.05). On the second day, low-glycemic index meals (lunch) (chi-square value 2.600, p-value 0.857 < 0.05), while there is a statistical significance for age and the second-day low-glycemic index meals (dinner) (chi-square value 9.800, p-value 0.007 < 0.05). There is no statistically significant effect of age on the third day of medium glycemic index meals (breakfast) (chi-square value of 2.000, p-value 0.736 > 0.05), and for the third day of medium glycemic index meals (dinner), while there is a statistical effect of age and the second day of low glycemic index meals (dinner) (chi-square value 10.800, p-value 0.013 < 0.05).

5. Discussion

It will be concluded that on the first day containing high-glycemic-index meals, the volunteers felt hungry after 4 h of breakfast, after 3 h of lunch and dinner. Half of the volunteers did not feel hungry until bedtime.

On the third day with a low glycemic index, the volunteers felt hungry after 4 h of breakfast, 4 h after lunch, and 4 h after dinner. 80% of the volunteers did not feel hungry.

On the third day, the volunteers felt hungry after 3 - 4 hours, 4 hours after lunch, and after dinner, 70% of the volunteers did not feel hungry.

Hence, we note that the results apply to the glucostatic theory, that the glycemic index of food, depending on its preparation, type, and energy ratio, affects the return of hunger to adults who suffer from obesity and those of normal weight alike, and it is clear here that we must reduce foods with a high glycemic index and be careful. You must eat foods with a low and medium glycemic index, respectively, because the first work to increase the return of hunger faster than the second and third, and this affects the increase in energy consumption and eating more food, which in turn increases obesity and exposure to chronic diseases such as pressure and diabetes [16] [17].

6. Conclusion

With the increasing rise in obesity in recent years and the increase in body mass, it is important to regularly eat daily meals that are balanced in the glycemic index in order to avoid the problem of the rapid return of hunger and the subsequent intake of energy. This helps to confirm the effectiveness of the low and medium glycemic index in maintaining or reducing weight. Previous research has worked on many topics related to the effect of the glycemic index on healthy adult individuals, but there is a need to search for the effect of the glycemic index on the speed of return of hunger by determining the type and quantity of food for all volunteers.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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