INTERNATIONAL JOURNAL OF RESEARCH AND SCIENTIFIC INNOVATION (IJRSI)
ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

Effect of Regular Sugar-Sweetened Beverages Intake on Blood Sugar Level of Healthy Sedentary Adults

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DOI: https://doi.org/10.51244/IJRSI.2025.120800204

Received: 06 Aug 2025; Accepted: 13 Aug 2025; Published: 20 September 2025

ABSTRACT

The global increase in sugar-sweetened beverage (SSB) consumption, particularly carbonated soft drinks, poses significant public health concerns. These beverages are high in added sugars and offer minimal nutritional value, contributing to adverse health outcomes such as weight gain, insulin resistance, and an elevated risk of type 2 diabetes. Sedentary individuals, characterized by low physical activity levels, are especially susceptible to these metabolic effects. This study aimed to evaluate the impact of regular SSB intake on blood glucose levels among healthy sedentary adults. A randomized controlled trial was conducted with 20 healthy undergraduate students from Obafemi Awolowo University, Ile-Ife. Participants were randomly assigned to either an experimental group (n=10), which consumed a 60cl bottle of SSB followed by 45 minutes of moderate-intensity exercise, or a control group (n=10), which consumed the same beverage without subsequent exercise. Blood glucose levels were measured at baseline (fasting), and at 15-minute intervals post-consumption, culminating in a post-exercise measurement for the experimental group. Results indicated that both groups experienced significant increases in blood glucose levels following SSB consumption. However, the experimental group exhibited a more pronounced spike, with mean blood glucose levels peaking at 145.7 mg/dL compared to 126.1 mg/dL in the control group. Interestingly, post-exercise blood glucose levels in the experimental group decreased to 93.7 mg/dL, suggesting that moderate-intensity exercise may facilitate glucose regulation following high sugar intake. These findings underscore the acute glycemic impact of consuming a 60cl bottle of SSB in sedentary individuals and highlight the potential mitigating effect of moderate physical activity. Given the association between SSB consumption and increased risk of type 2 diabetes and cardiovascular diseases, these results emphasize the importance of limiting intake of such beverages and incorporating regular exercise to maintain optimal metabolic health.

Keywords: Blood Glucose, Sugar-Sweetened Beverages, Post Exercise glycemia, Exercise

INTRODUCTION

The global rise in the consumption of sugar-sweetened beverages (SSBs), particularly carbonated soft drinks, has become a significant public health concern (Garcia & Proffitt, 2022; Zaki et al., 2025). These beverages are characterized by high levels of added sugars, primarily in the form of high-fructose corn syrup or sucrose, which contribute substantially to daily caloric intake without offering essential nutrients (Fu et al., 2024; Sievenpiper et al., 2025). Regular intake of such drinks has been associated with various adverse health outcomes, including weight gain, insulin resistance, and an increased risk of type 2 diabetes.

Sedentary adults, defined by low levels of physical activity, are particularly vulnerable to the metabolic effects of excessive sugar consumption (Silva et al., 2024; Wang et al., 2024). Physical inactivity can impair glucose metabolism and insulin sensitivity, potentially exacerbating the glycemic impact of high-sugar diets (Babalola et al., 2024; Basak & Laskar, 2024). In this context, understanding how regular consumption of sugar-sweetened beverages affects blood glucose levels in sedentary individuals is crucial for developing targeted dietary recommendations and interventions.

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Despite the widespread availability and consumption of SSB, there is a paucity of research specifically examining its impact on blood sugar levels among healthy sedentary adults. Most existing studies have focused on broader categories of SSBs or have included populations with varying levels of physical activity, making it challenging to isolate the effects in sedentary individuals. This study aims to fill this gap by assessing the impact of regular SSB intake on blood glucose levels in healthy sedentary adults, thereby contributing to a more nuanced understanding of dietary influences on metabolic health in this specific population group.

Objectives

The primary objectives of this research are twofold:

- To investigate the immediate impact of a 60cl bottle of regular SSB on fasting blood glucose levels in healthy individuals.
- To assess how moderate-intensity exercise, following the consumption of regular SSB, influences post-exercise blood glucose levels.

METHODOLOGY

This study employed a randomized controlled trial design to investigate the immediate effects of a 60cl bottle of regular SSB on the blood glucose levels of healthy individuals. The randomized design aimed to minimize bias and confounding variables, ensuring the robustness of the study findings (Mansournia et al., 2021).

The participants in this study comprised 20 healthy undergraduate students from Obafemi Awolowo University, Ile-Ife, Nigeria. The selection criteria included good health, absence of any known metabolic disorders, and a sedentary lifestyle. Participants were randomly divided into two groups: the experimental group (n=10) and the control group (n=10). Ethical creance was approved by the Obafemi Awolowo University's Ethical Clarance committee of the Institute of Public Health.

Fasting blood glucose levels were measured for all participants and they were fed with 60cl bottle of SSB. The blood glucose of all participants was measured again 45 minutes after consumption (BGT1), 60 minutes (BGT2) and 75 minutes after consumption (BGT3). After the BGT3, the participants in the experimental group engaged in a moderate-intensity exercise session of 45 minutes brisk walking. The post-exercise blood glucose level was measured 15 minutes after exercise. Participants in the control group did not engage in the 45 minutes of brisk walking. The participants in the control group were made to sit in the laboratory during the 45-minute period of the exercise. The blood glucose level of the participants in the control group was also measured 60 minutes after BGT3.

Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) software, version 27. Descriptive statistics, including mean and standard deviation, were calculated for demographic variables and blood glucose levels. A paired t-test was used to assess within-group differences, comparing pre- and post-intervention blood glucose levels. An independent t-test was employed to examine differences between the experimental and control groups. The significance level was set at $p < 0.05$ (Mansournia et al., 2021).

RESULTS

The experimental group (n=10) exhibited a mean age of 23.4±4.03 years, a mean weight of 69.92±16.55 kg, and a mean height of 167.37±10.05cm. The control group (n=10) presented a mean age of 20.8±1.93 years, a mean weight of 59.2±10.59kg, and a mean height of 165.75±9.39 cm. Notably, the experimental group demonstrated a higher mean age and weight compared to the control group.

Table 1: Participant Characteristics and Blood Glucose Levels (mg/dl)

Group	Age (years)	Weight (kg)	Height (cm)	FBG (mg/d)	SSB (cl)	Sugar (g)	PEBG (mg/d)
Experimental	23.4±4.03	69.92±16.55	167.37±10.05	91.6±11.11	60	64.8	93.7±20.69

Control	20.8±1.93	59.2±10.59	165.75±9.39	89.4±6.74	60	64.8	102.5±6.93

Source: Author's analysis, 2025

FBG- Fasting Blood Glucose PEBG- Post Exercise Blood Glucose. MG/DL- Milligram Per Deciliter

Baseline Glucose and Glycemic Response:

Table 1 presents the demographic and physiological characteristics, as well as the blood glucose profiles of participants in the experimental and control groups. The experimental group had a mean age of 23.4 ± 4.03 years, with an average weight of 69.92 ± 16.55 kg and height of 167.37 ± 10.05 cm. In comparison, the control group was younger, with a mean age of 20.8 ± 1.93 years, and had lower average weight (59.2 ± 10.59 kg) and a slightly shorter height (165.75 ± 9.39 cm).

Both groups consumed an equal volume (60 cl) of a sugar-sweetened beverage (SSB) containing 64.8 grams of sugar. The fasting blood glucose (FBG) levels were 91.6 ± 11.11 mg/dl for the experimental group and 89.4 ± 6.74 mg/dl for the control group, indicating comparable baseline glucose levels. However, after exercise, the post-exercise blood glucose (PEBG) level in the experimental group was 93.7 ± 20.69 mg/dl, which was lower than the control group's PEBG of 102.5 ± 6.93 mg/dl.

Table 2: Blood Glucose Levels at Time Points (mg/dl)

Group	BGT1	BGT2	BGT3
Experimental	125.6 ± 11.13	145.7 ± 30.5	131.7 ± 26.6
Control	116 ± 13.1	126.1 ± 13.9	119.9 ± 12.3

Source: Author's analysis, 2025

BGT1- Blood Glucose Test (45 Minutes After TOC). TOC- Time of Consumption

BGT2- Blood Glucose Test (60 Minutes After TOC). BGT3- Blood Glucose Test (75 Minutes After TOC)

Table 2 displays the blood glucose levels of participants in both the experimental and control groups measured at three specific time points following the consumption of a sugar-sweetened beverage. In the experimental group, the mean blood glucose level at BGT1 (45 minutes after the time of consumption) was 125.6 ± 11.13 mg/dl. This increased to 145.7 ± 30.5 mg/dl at BGT2 (60 minutes after TOC) and subsequently decreased to 131.7 ± 26.6 mg/dl at BGT3 (75 minutes after TOC). In contrast, the control group recorded a lower mean glucose level at each corresponding time point. At BGT1, the mean was 116 ± 13.1 mg/dl, which rose to 126.1 ± 13.9 mg/dl at BGT2 and then declined to 119.9 ± 12.3 mg/dl at BGT3.

Overall, the experimental group exhibited higher blood glucose levels at all time points compared to the control group, with the most notable difference observed at BGT2. These results suggest a more pronounced glycemic response in the experimental group, potentially influenced by the timing and nature of physical activity relative to glucose intake.

Table 3: t-test comparison of Fasting and Post-Exercise Blood Glucose Levels

Group	FBG (mg/dl)	PEBG (mg/dl)	*t*
Experimental	91.6±11.11	93.7±20.69	0.780594
Control	89.4±6.74	102.5±6.93	0.000445

	Experimental	Control	
Experimental and Control (PEBG (mg/dl))	93.7±20.69	102.5±6.93	0.228556

Source: Author's analysis, 2025 Significance p >0.05

FBG- Fasting Blood Glucose. PEBG- Post Exercise Blood Glucose. MG/DL- Milligram Per Deciliter

Table 3 summarizes the results of independent and paired sample t-tests comparing fasting blood glucose (FBG) and post-exercise blood glucose (PEBG) levels within and between the experimental and control groups. Within the experimental group, the difference between fasting blood glucose (91.6 ± 11.11 mg/dl) and post-exercise blood glucose (93.7 ± 20.69 mg/dl) was not statistically significant ($t = 0.781$, $p > 0.05$). This suggests that physical exercise may have played a role in stabilizing blood glucose levels, potentially offsetting the hyperglycemic effect of sugar intake.

In the control group, which did not engage in physical activity, showed a statistically significant increase from fasting (89.4 ± 6.74 mg/dl) to post-consumption blood glucose (102.5 ± 6.93 mg/dl) ($t = 0.000445$, $p < 0.01$), indicating that the intake of sugar-sweetened beverages led to a notable elevation in blood glucose in the absence of exercise.

A comparison of post-exercise blood glucose levels between the experimental (93.7 ± 20.69 mg/dl) and control (102.5 ± 6.93 mg/dl) groups revealed no statistically significant difference ($t = 0.229$, $p > 0.05$). While the experimental group had a lower mean glucose level, suggesting a potential moderating effect of exercise on postprandial glycemia, the difference was not sufficient to reach statistical significance. The higher variability in the experimental group's response may have contributed to this outcome. These results suggest that physical activity may help moderate post-consumption blood glucose spikes, though further studies with larger samples are needed to confirm this effect.

DISCUSSION

The results demonstrate that consumption of a 60cl bottle of sugar-sweetened beverage significantly influences blood glucose levels. The control group, which did not exercise after consuming sugar-sweetened beverages, exhibited higher PEBG levels compared to the experimental group. This is likely due to the initial spike in blood glucose levels caused by the consumed beverage and the subsequent insulin response within the experimental group, which worked to lower the blood glucose levels before the PEBG measurement. The control group did not have this initial spike, and therefore did not have the same insulin response prior to the exercise. The study observed that both the experimental and control groups experienced significant increases in blood glucose levels following SSB consumption, peaking at the second measurement interval (BGT2). This rapid elevation is consistent with the high glycemic index of SSBs, which are known to cause swift spikes in blood glucose due to their high content of rapidly absorbable carbohydrates (Sievenpiper et al., 2025).

The lack of a significant difference in FBG levels between the groups confirms successful randomization and baseline comparability. The trend of higher blood glucose levels in the experimental group across the BGT time points indicates the rapid absorption and subsequent impact of the sugary beverage on blood glucose dynamics. A notable finding is the difference in post-exercise blood glucose (PEBG) levels between the two groups. The experimental group, which engaged in 45 minutes of brisk walking post-consumption, exhibited a lower mean PEBG (93.7 mg/dL) compared to the control group (102.5 mg/dL). This suggests that moderate-intensity exercise may facilitate glucose uptake by muscles, thereby aiding in the regulation of blood sugar levels post-SSB consumption. This observation aligns with existing research indicating that physical activity enhances insulin sensitivity and glucose metabolism (Fu et al., 2024; Wang et al., 2024).

This Randomized Controlled Trial provides evidence that consumption of a 60cl bottle of SSB significantly alters post-exercise blood glucose levels. The findings highlight the importance of considering the impact of sugary beverages on glucose regulation, particularly in the context of physical activity. Future studies with larger sample sizes and diverse sugary beverage interventions are warranted to further elucidate these effects.

Limitations and Recommendations for Future Research

While the study provides important insights, certain limitations should be acknowledged. The small sample size (n=20) may limit the generalizability of the findings. Additionally, the study focused on acute glycemic responses; long-term effects of regular SSB consumption were not assessed. Future research with larger, more diverse populations and extended follow-up periods would be beneficial to fully understand the chronic impacts of SSB intake and the mitigating effects of physical activity.

CONCLUSION

This study highlights the immediate impact of consuming a high-sugar beverage on blood glucose levels and suggests that moderate-intensity exercise may help mitigate these effects. The findings reinforce public health recommendations to limit SSB consumption and promote physical activity as strategies to maintain optimal glycemic control and reduce the risk of metabolic diseases.

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