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COMPARATIVE STUDY ON THE GLYCEMIC INDEX BETWEEN DATE SUGAR AND COMMERCIAL SUGAR

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Abstract

The present study endeavors to investigate and compare the glycemic indices of date sugar and commercial sugar in healthy adult participants, with a particular focus on assessing their respective effects on blood glucose levels over a two-hour postprandial period. The objective of the research was to compare the glycemic index between date sugar and commercial sugar in students of PAMO University of Medical Sciences. The experiment was conducted involving a sample size of n=30. Each participant underwent two separate trials, where they consumed a controlled quantity of date sugar and commercial sugar dissolved in a standardized solution at different times. Capillary blood samples were collected at fasting state and at 30 minutes intervals after sugar consumption for 2 hours. The samples were measured for glucose level using glucometer (a strip method). The results showed that the mean glycemic index (fasting = 5.0±0.4; 30 minutes = 6.7±0.6; 60 minutes = 5.9±0.6; 90 minutes = 5.4±0.6 and 120 minutes = 4.9±0.5) of date sugar in the 2 hours period was significantly different (p-value<0.05). The mean glycemic index (fasting = 4.7±0.5; 30 minutes = 6.6±0.9; 60 minutes = 6.0±0.8; 90 minutes = 5.4±0.6 and 120 minutes = 5.2±0.5) of commercial sugar in the 2 hours period was significantly different (p-value<0.05). Comparing the glycemic index between both sugar revealed no significant difference (p-value>0.05) until at 2hours where there was a significant decrease (Date sugar = 4.9±0.5; commercial sugar = 5.2±0.5; p-value<0.05) in glycemic index in date sugar. This study has thus shown that although both sugars similar impact on glycemic index but at 2 hours, date sugar had lower glycemic index than the commercial sugar.

Keywords: *Diet, food, glucose, meal, oral glucose tolerance*

Introduction

An innate preference for sugary substances appears to be inherent among humans globally. Throughout history, individuals fulfilled their craving for sweetness by consuming honey in ancient times. In contemporary society, sugar stands as the predominant and extensively utilized sweetening agent [1]. The term "sugar" pertains to a collective designation for soluble carbohydrates characterized by a sweet taste, a number of which find application in the place of food consumption.

A well-known carbohydrate called sucrose is a disaccharide, a complex sugar made of two different monosaccharides called glucose and fructose. According to Britannica Kids [1], sucrose, known for its extreme sweetness, is one of the most potent naturally occurring sweeteners. Other sugars are frequently compared to sucrose as the reference standard for sweetness. A basic energy source, glucose, rates between 0.5 and 0.6 on the sweetness scale, while lactose, a sugar present in dairy products, rates 0.27. Another disaccharide, maltose, has a 0.6 glucose-like molar ratio. Fructose surpasses the other sugars, taking the title of sweetest with a sweetness index ranging from 1.03 to 1.5.

In the latter decades of the 20th century, as sugar consumption increased, scientists began exploring whether a diet high in sugar, particularly refined sugar, was harmful to human health with obesity [2-5], and tooth decay have all been linked to excessive sugar consumption. White granulated sugar, the outcome of careful processing carried out in refineries, predominates in commercial marketplaces. This all-purpose sugar substitute is a mainstay in our culinary culture and has a wide range of uses.

Phoenix dactylifera, commonly known as date or date palm, [6] is a flowering plant species in the palm family, Arecaceae, cultivated for its edible sweet fruit called dates. The species is widely cultivated across northern Africa, the Middle East, and South Asia, and is naturalized in many tropical and subtropical regions worldwide [7]. P. dactylifera is the type species of genus Phoenix, which contains 12–19 species of wild date palms [8]. In dates, glucose accounts for roughly 55% of the total sugar content, while fructose accounts for about 45% and sucrose barely counts [9]. Date sugar is made from the date palm plant, date sugar is a less refined sugar than typical white sugar. Date sugar can be substituted in many foods and beverages [10,11]. Date sugar is a type of sugar found most commonly in natural food stores since it is less processed than more conventional sugars. It is made from dried dates and adds a rich sweetness to recipes, although it will not dissolve when added to drinks. It also does not melt like granulated sugar which can limit its use. It is sometimes promoted as a healthier alternative to brown sugar, although it can be quite expensive. Date sugar is derived from the whole date fruit; therefore, can be called a whole food.

The glycemic index (GI) compares the potential of foods containing the same amount of carbohydrate to raise blood glucose. However, the amount of carbohydrate contained in a food serving also affects blood glucose concentrations and insulin responses. Considering the soaring prevalence of diabetes in the world and in Nigeria today, studying dietary alternative to processed sugar may be helpful in mitigating the menance. Since both commercial sugar and date sugar may contain various degrees of glucose which may impact on the overall glycemic index, comparing the glycemic index between commercial sugar and date may be necessary to identify which sugar is relatively better in terms of causing spikes in blood glucose level. Therefore, this study intends to compare the glycemic index between commercial sugar and date sugar.

Materials and Methods

Study Design

This work was an experimental study design. A total 30 students were recruited for the study and they were given date sugar and commercial sugar solution to drink in two different phases. In phase 1, the subjects were given 75g/300ml of date sugar. Prior to the date solution administration, a baseline glucose level was determined and after the administration, glucose determination was done on 30 minutes intervals for 2 hours. In phase 2, same subjects were subjected to similar treatment and assessment using commercial sugar a week after the first phase. The glycemic index in both phases were assessed and compared.

Study Area

This research was carried out in the Research Laboratory of PAMO University of Medical Sciences (PUMS). PAMO University of Medical Sciences is a private Medical University located along Aba-Port Harcourt Expressway, Rivers State.

Date sugar and commercial sugar preparation

The date sugar used for the study was produced by following these procedures:

Halving the dates and removing the pits. The halved dates were arranged in a single layer on a baking tray lined with parchment paper. The tray was placed in an oven and the dates was allowed to dry at 80°C until they are dried, within 3 days. The oven was turned off and the dates was left to cool and dry out. After several hours, the dried dates were transferred to a strong blender. Processing was done until dates broke into sugar-like granules or powder. When the date sugar seems too clumpy or sticky, it was then spread on a baking tray lined with parchment paper and baked/dehydrated at a low temperature until the granules are very crusty and dry. The date sugar was then used immediately, or transferred to an airtight container and stored. For use, the 75g of the date powder was dissolved in 300ml of water.

The commercial sugar solution was also prepared by weighing 75g of the commercial sugar and dissolved in 300ml of water [12,13].

Eligibility Criteria

The inclusion and exclusion criteria are stated as follows;

Inclusion Criteria

Healthy, students PAMO University of Medical Sciences who were not diabetic and whose consents were given were included in this study.

Exclusion Criteria

This study excluded students in PAMO University of Medical Sciences who were diabetic, Staff of PAMO University of Medical Sciences and students of PAMO University of Medical Sciences who did not give their consent.

Ethical Approval/Informed Consent

Ethical approval for this research was obtained from PAMO University of Medical Sciences. Also, a written consent was obtained from the participants of the study.

Sampling Method

The sampling method that was used for this study was the simple random sampling method where consenting participants were allowed to choose from a numbering system of "0" and "1" such that all those who picked "1" was recruited for the study while those who picked "0" was not selected [14].

Laboratory Procedure

The five fingers of the left hand were used for after administering the commercial sugar solution and during capillary puncture after administering date sugar solution. The capillary puncture was used when collecting blood samples at fasting state, 30 minutes after administering the sugar solution, 60 minutes after sugar solution administration, 90 minutes mark after sugar administration and 120 minutes after the sugar solution administration. The capillary blood collected was measured for glucose using glucometer strip.

Statistical Analysis

Data collated from this study was analyzed for descriptive and inferential statistics using SPSS version 25.0. Descriptive statistics was expressed as mean ± SD while the hypotheses were tested using Paired T-test and ANOVA. The tests were considered significant at p value ≤ 0.05.

RESULTS

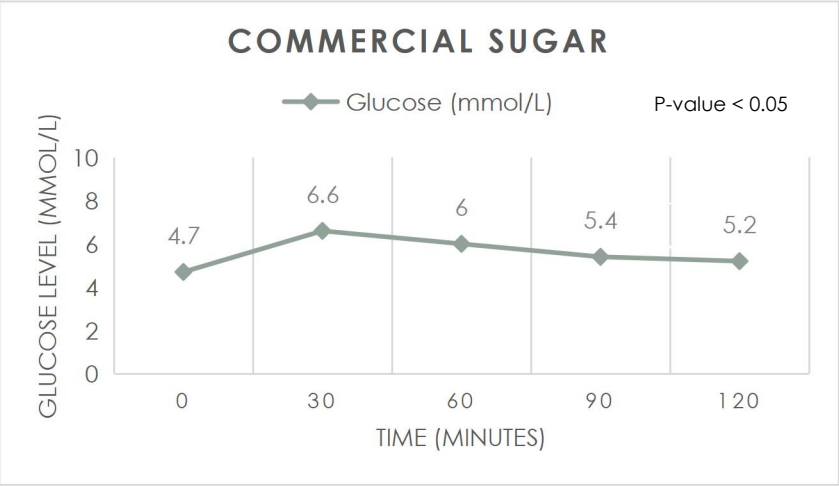

Fig. 1: Figure showing glycemic index of commercial sugar

Figure 1 shows the results of students administered with commercial sugar for 2 hours at intervals of 30 minutes from fasting state. The results showed that the mean glucose level at fasting condition was 4.7 ± 0.5; mean glucose level at 30 minutes was 6.6 ± 0.9 mmol/L; mean glucose level at 60 minutes was 6.0 ± 0.8 mmol/l; mean glucose level at 90 minutes was 5.4 ± 0.6 mmol/L; mean glucose level at 120 minutes was 5.2 ± 0.5mmol/L. The ANOVA results showed that there was a significant difference (p value < 0.05) among the time-based interval groups.

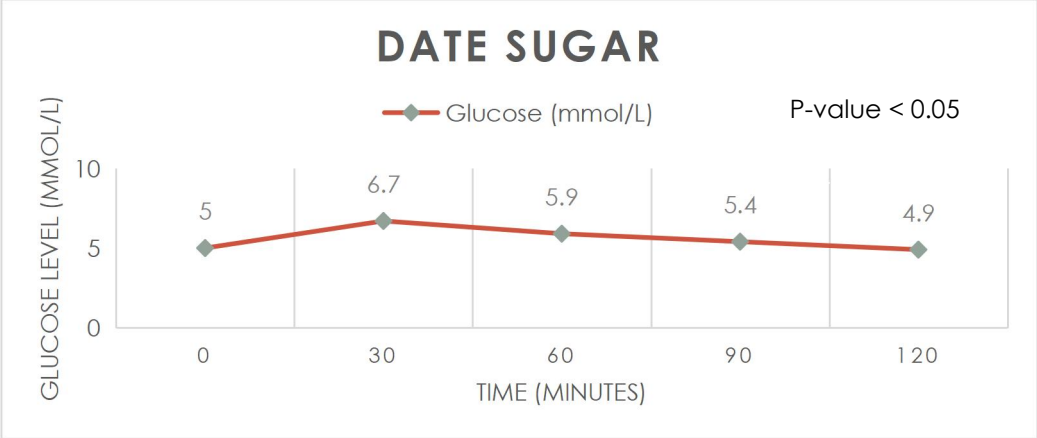

Fig. 2: Figure showing glycemic index of date sugar

Figure 2 shows the results of students administered with date sugar for 2 hours at intervals of 30 minutes from fasting state. The results showed that the mean glucose level at fasting condition was 5.0 ± 0.4; mean glucose level at 30 minutes was 6.7 ± 0.6 mmol/L; mean glucose level at 60 minutes was 5.9 ± 0.6 mmol/l; mean glucose level at 90 minutes was 5.4 ± 0.6 mmol/L; mean glucose level at 120 minutes was 4.9 ± 0.5mmol/L. The ANOVA results showed that there was a significant difference (p value < 0.05) among the time-based interval groups.

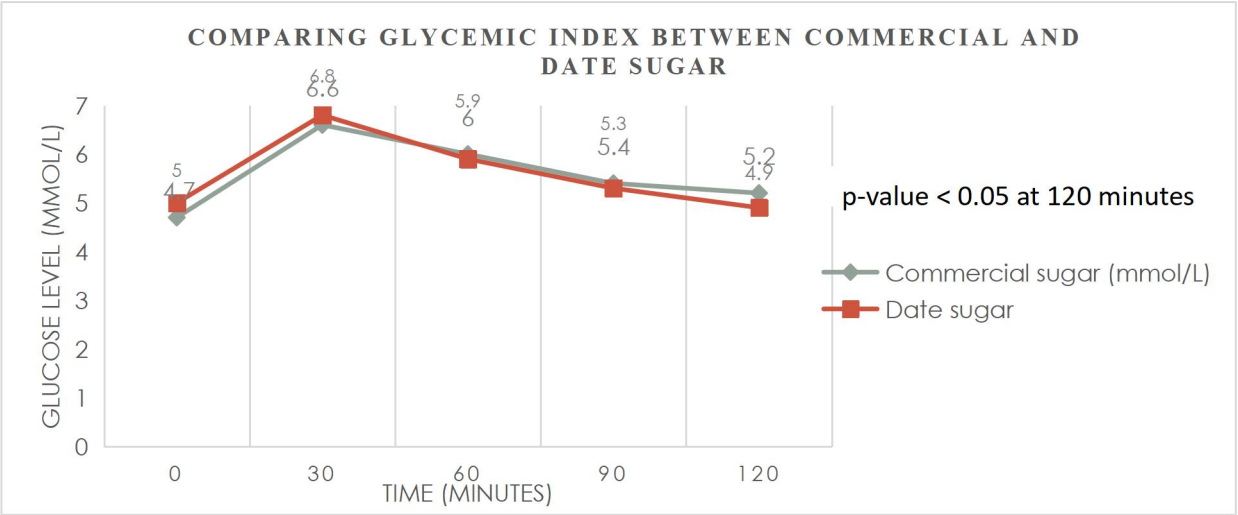

Fig 3: Figure comparing glycemic index between commercial sugar and date sugar

Figure 3 presents a comparison of glycemic index between commercial sugar and date sugar. The results showed that there was no significant difference (p-value = 0.05) in the mean glucose levels between both groups (commercial sugar and date sugar) at fasting condition. Similarly, there was no significant difference (p-value>0.05) in the glucose level at 30 minutes, 60 minutes and 90 minutes between both groups. But there was a significant decrease (p-value=0.01 in the glucose level at 120 minutes in the date sugar group.

Discussion

The study's findings showed a significant difference between the various time points after consuming commercial granulated sugar, demonstrating the substance's strong impact on the metabolic landscape. The observed phenomenon can be explained by the inherent properties of sugar as a food. When a sugar solution is consumed, especially one high in simple sugars like glucose, sucrose, or fructose, it affect the blood glucose level and the body triggers a complex series of physiological reactions to control blood sugar levels. The results showed a significant increase in glucose levels starting around 30 minutes after delivery. The body's coordinated efforts to restore homeostasis were symbolized by the repetitive descent that followed this upward trajectory. This dynamic pattern of glucose kinetics is consistent with similar trends from the Oral Glucose Tolerance Test (OGTT), in which the sugar analog glucose D was used. The monophasic curve-shaped graph of the OGTT data [15,16], which meaningfully correlates with the observed trends attests to the validity of the study's findings.

Similarly, investigation of data sugar administration revealed a significant changes in glucose level among the various time periods, highlighting similar effect of date sugar on glycemic trends. The use of date sugar is closely linked to the observed rise in glucose levels. This elevation gradually reached a peak after being clearly noticed beginning around 30 minutes after intake. Subsequently, a gradual decline ensued, aligning seamlessly with the outcomes of the Oral Glucose Tolerance Test (OGTT), where glucose D, an analogous sugar compound, was employed as a substrate. The congruence between these findings and those established by other researcher [15,16] and underscores the consistency of glucose response patterns in the face of diverse sugar sources. The body's impressive regulatory abilities are exemplified by the observed decrease in blood sugar levels after the peak. This planned decrease serves as an illustration of the complex metabolic mechanisms used to keep glucose levels in balance.

In the current study, the results comparing glycemic index between date sugar and commercial sugar have shown that there was no difference in mean glucose levels between the two groups during fasting conditions up to the 90-minutes period. However, at two hours the glycemic index of date sugar significantly lower than that of commercial sugar among the subjects. This shows that comparatively, date has a lower impact on blood glucose level but this effect becomes obvious at two hours after data sugar drink. This intriguing outcome can be attributed to the established classification of commercial sugar as a medium or average glycemic index (GI) food according to the GI scale, as supported by Healthline report in 2019 [17] and the research conducted by Atkinson [18]. On the other hand, dates are classified as low GI foods on the same scale, as substantiated by studies conducted by other authors [10-20]. Notably, our findings align with the conclusions drawn from previous investigations. For instance, Brand reported a marked enhancement in glycemic control among individuals following a low-GI diet compared to those on a high-GI diet [21]. Moreover, their work highlighted that those individuals consuming a high-GI diet exhibited elevated levels of glycated hemoglobin and 8-hour glucose levels. In light of these observations, the researchers concluded that a low GI diet offers superior long-term benefits for glycemic control in contrast to diets with a high glycemic index. Similarly, the research conducted by Brand-Miller [22] delved into the impact of meals with equivalent energy content but differing GI values on blood glucose responses among individuals with diabetes. Their investigation revealed that meals with a low glycemic index induced lower blood glucose responses compared to those with a high glycemic index. The observations made by Leathwood and Pollet [23] further supported our results, as they noted that individuals consuming a low-GI meal experienced lower and more stable plasma glucose levels.

Conclusion

Having compared the glycemic index of date sugar and commercial sugar among students of PAMO University of Medical Sciences, the study has thus revealed that athough both sugars had similar glycemic curve, date sugar has a lower glycemic index compared commercial sugar.

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