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Original article

Drinking water with consumption of a jelly filled doughnut has a time dependent effect on the postprandial blood glucose level in healthy young individuals

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SUMMARY

An elevated postprandial glucose (PPG) level in plasma or blood is a risk factor for chronic disorders like obesity, diabetes mellitus type II and related cardiovascular conditions. Therefore, it is important to identify mechanisms that increase the value of postprandial glucose PPG levels. Hence in the present study we investigated the time dependent effect of drinking water during a meal on the level of PPG.

Thirty-five volunteers were randomly assigned to five groups. Group A was given a jelly filled doughnut and group B, C, D and E had a similar doughnut in combination with a bottle of water along with the doughnut, thirty minutes before, thirty minutes after, and a second doughnut with water thirty minutes after the first one, respectively. Glucose was measured in capillary blood at intervals of 30 min up to 150 min (reg # FMeW 725B/17).

PPG versus fasting glucose (Means ± SD, mmol/L) was for group A 5.4 ± 0.6 vs 4.6 ± 0.4, B 7.2 ± 0.7 vs 4.9 ± 0.4, C 5.5 ± 0.7 vs 4.4 ± 0.3, D 5.5 ± 0.6 vs 4.6 ± 0.3 and E 5.7 ± 0.5 vs 4.7 ± 0.2. The increase in group B was significantly higher than in all other groups (ANOVA, Dunnet's posttest).

These results show that drinking water with consumption of a jelly-filled doughnut increases the postprandial blood glucose levels significantly compared to no drinking at all or thirty minutes before or after the consumption. It is therefore advisable that we should reconsider our eating and drinking habits to lower the PPG and consequently reduce the risks of abovementioned chronic disorders. Further assessment is necessary to evaluate this in more detail.

1. Introduction

Repeated high postprandial plasma glucose levels may lead to chronic disorders like obesity [1], diabetes mellitus type II [2,3] and related cardiovascular conditions [2]. In addition to these conditions that are worldwide among the highest ranking causes of death and have a huge burden on economic development of developed and underdeveloped countries [4], researchers also found a direct relation between maternal postprandial glucose and gestational weight of new born children [5].

Clearly in the past decades, research concentrated on factors that may lead to an increased level of postprandial glucose [6]. These factors include the amount [7] and type [8] of consumed carbohydrate, the composition [9] of the meal, but also physical factors like the temperature and viscosity [10,11] of the consumed food. In addition to these abovementioned factors, the water content of the food may also affect the postprandial level of plasma glucose [12–14]. Apart from properties of the food itself, behavioral factors like the way an individual is standing or sitting influence the increase of postprandial glucose after a meal [15].

Since it is a habit that water or other drinks are regularly consumed with our meals, we assessed the time dependent influence of this behavior on the postprandial glucose level. Blood glucose was measured at regular time intervals in a population of healthy young individuals who received a dry meal alone or in combination with water before, during or after the meal. The obtained results are discussed within the context of the current knowledge of this habit during eating.

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2. Materials and methods

2.1. Selection of research subjects

Volunteers were selected from the medical school of the Anton de Kom University of Suriname. They had to be in good health in general and particularly not suffering from any chronic metabolic disorder. Furthermore, they were requested to abstain from intense physical activity, alcohol ingestion and excessive food intake one day prior to the testing. Body weight and height were measured, and the body mass index was calculated at the moment of reporting. The procedures for selection and experimental procedure were approved by the office of the Dean of the faculty (FMeW 725B/17). Eventually, forty volunteers entered the study. From these four were excluded because of either a high body mass index or a high fasting glucose level (>6.1 mmol/L). One person suffering from thyroid disease was also excluded from the study. The remaining were randomly assigned to one of the five groups of experiments. All subjects had given their oral and written consent to participate in the investigation. During the procedure at least one physician and four assistants were present. Furthermore, the emergency service of the Academic Hospital was readily available. The study was carried out in accordance with the '*Code of Ethics of the World Medical Association*'.

2.2. Experimental procedure

Subjects were requested to fast overnight for a period of approximately 10 h. In addition, they should abstain from intense physical activity for at least 24 h before the testing. If necessary, they could break the fasting prematurely and withdraw from participation. Blood glucose levels were determined in capillary blood obtained from either the middle or the index finger at 0 min. Group 1 was given a jelly filled doughnut (90 g, 290 Calories, 16 g fat 35 g

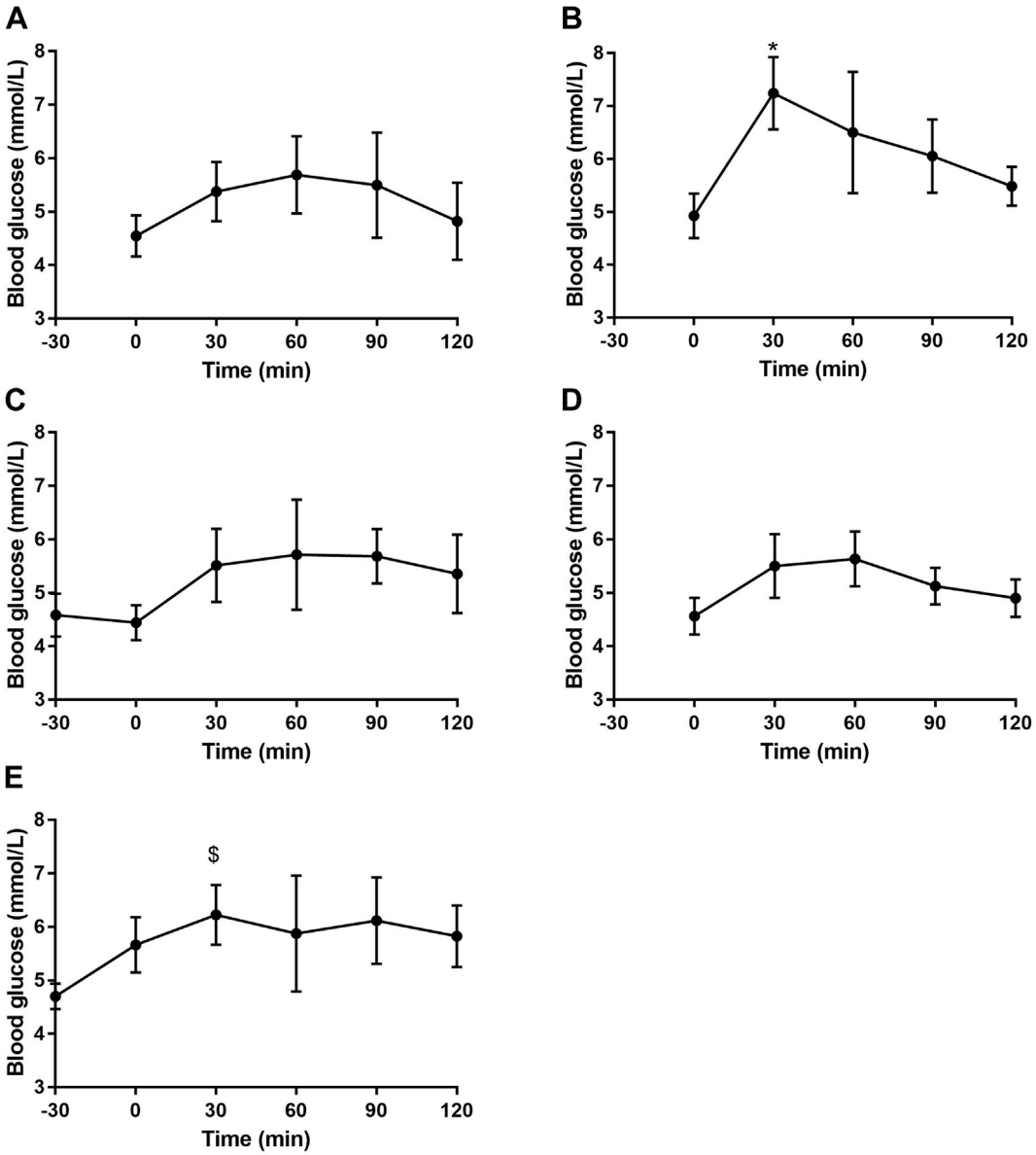

Fig. 1. A: Blood glucose level with consumption of a single doughnut at 0 min (n = 7). B: Blood glucose level with consumption of a single doughnut along with water at 0 min (n = 7). *p < 0.0001 vs groups A, C, and D. C: Blood glucose level with consumption of water thirty minutes before consumption of a doughnut alone at 0 min (n = 7). D: Blood glucose level with consumption of water thirty minutes after consumption of a doughnut alone at 0 min (n = 7). E: Blood glucose level with consumption of a doughnut thirty minutes before another doughnut along with water at 0 min (n = 7). $p < 0.0001 for increase in glucose compared to group B.

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