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THE BISCUIT AND RICE CAKEAN ALTERNATIVES TO THE ORAL GLUCOSE TOLERANCE TEST

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The Oral Glucose Tolerance Test (OGTT) has been the mainstay for diagnosing diabetes for decades. Recently, the American Diabetes Association (ADA) suggested abandoning the OGTT, while resorting to a simpler screening test, exclusively based on baseline fasting blood glucose concentration. We have developed a novel product which equalizes 75 g of oral liquid glucose with biscuit and rice cake which is palatable for the person. Rice cake ranked number one according to palatable, low amount of product intake as test and storing for higher period. Digestibility of the product was 50% according to the study. Rice cake will be used for future studies in OGTT test in Sri Lanka after proper screening with patients.

Keywords: Glucose tolerance test, Biscuit, Rice cake, American diabetes association

INTRODUCTION

Worldwide, type 2 diabetes are increasing alarming speed, and number of patients is projected to increase from 171 million in 2000 to 366 million by the year 2030 (Wild *et al.*, 2007). Rapid increase of type 2 diabetes closely linked to the increase of obesity, which may represent cardiovascular disease in long run, may cause high risk patients worldwide (Tuomilehto *et al.*, 2001; Knowler *et al.*, 2002; and Hossain *et al.*, 2007). The current procedure of evaluating glucose homeostasis relies on an overnight fast followed by a 75-g OGTT with liquid glucose and 2-hour measurements of glucose. Although the OGTT provides useful diagnostic information, it is indeed very difficult to drink after fasting. Therefore we hypothesized that the replacement of traditional liquid glucose with a standard food item such as a biscuit and muffin would provide clinically comparable insight into glucose homeostasis as provided by a standard OGTT.

MATERIALS AND METHODS

Preparation of Confectionary Items

Biscuits are made primarily from sugar, corn syrup, modified cornstarch, and dextrose. Biscuits performed a nutritional assessment on 2 separate packages at Industrial Technology Institute confirm consistent carbohydrate content among mixed samples. Further it consists with known mixtures of rice flour, sucrose, margarine, egg, baking powder and vanilla. 250 grams consist with 45 small biscuits. Rice cake consisted with known mixtures of rice flour, glucose, Astra margarine and eggs. One average cake weight about 75 g.

Digestibility Test

Flour sample (0.5 g) were thoroughly mixed with 15 mL distilled water and α -amylase (200 μ L) was added to the sample and mixed thoroughly (2 Mh, India). Well mixed samples were heated in a 100 °C boiling water bath (OLS 200, England) for 25 minutes. After incubation the samples

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were cooled to room temperature and added to a 50 mL volumetric flask and volume adjusted to 50 mL by adding distilled water. The contents in the volumetric flask were mixed thoroughly. An aliquot (1 mL) of above sample was mixed with 2 mL of sodium acetate buffer (pH = 4.75) and amyloglucosidase (100 µL). The mixture was covered with an aluminum foil and incubated at 60 °C for 30 minutes and mixture shaken every 10 minutes. After cooling the mixture to the room temperature, 1 mL of mixture was added to 10 mL volumetric flask and the volume adjusted to 10 mL (Holm *et al.*,1986).

From the above mixture 10 µL was added to 1 mL glucose oxidase solution and mixed. The reaction mixture was incubated at 37 °C for 10 minutes in a shaking water bath (Eyela Unithermo Shaker NTS-1300, Japan). Absorbance of sample was measured using the double beam spectrophotometer at 500 nm against a reagent blank. Starch content was determined using following equation. The glucose standard (100 mg/dL) was used as the standard solution.

$$\text{Starch \%} = \frac{\text{Absorbance of test} \times 0.9 \times 10 \times 50 \times 100}{\text{Absorbance of standard} \times \text{Fresh weight of sample}}$$

Overall Quality and Color

A set of 5 biscuits and muffins were then packed and stored in a aluminum foil pack. Observations were made at the end of the storage of 4 days and overall quality (1-2 not marketable, 3 = of limited marketability, 4-5 fair, 6-7 good, with slightly defect, 8-9 = excellent) were assessed. The quality were rated hedonically (from 1 = poor to 5 = excellent) for quality of appearance and taste by a group of six panelists familiar with the confectionary.

Table 1: Digestibility Test

	Value	SD
Starch dry matter (%)	63.25	9.2
Starch fresh food (%)	50.48	7.34

Statistical Analysis

The results were analyzed by ANOVA and means were compared by DMRT at p = 0.05

RESULTS

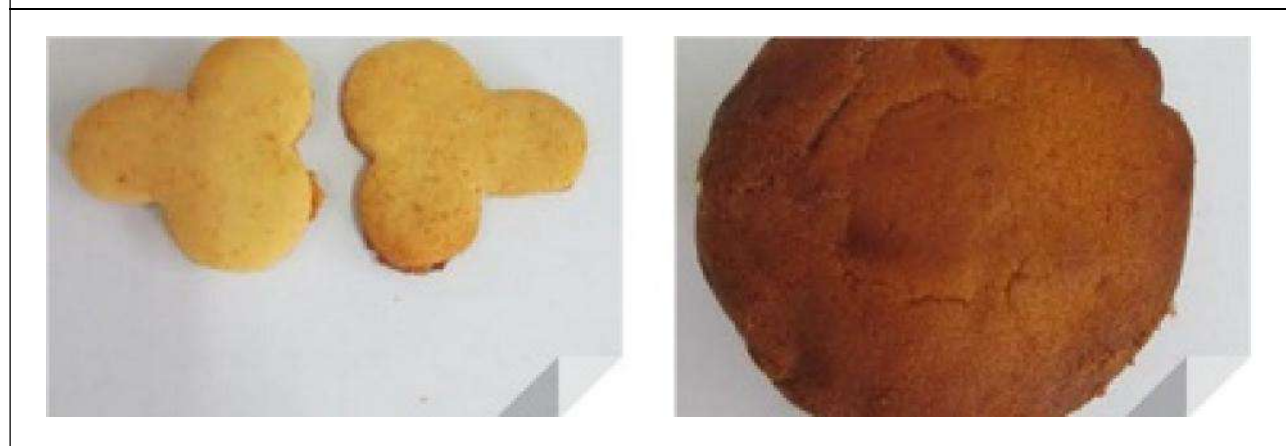
The alternative product of rice cake and biscuits for OGTT test was well illustrated in this study (Figure 1).

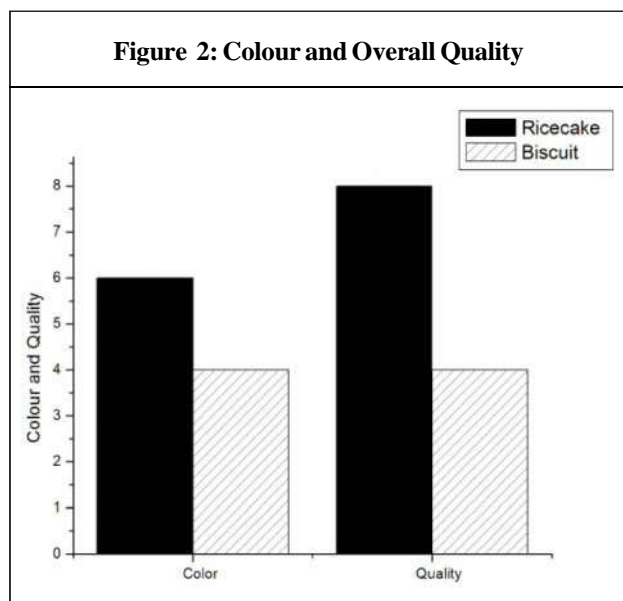
The color and overall quality of the rice cake were significantly higher than the biscuits, and disease incidence is lower in both the product due to packaging (Figure 2). It gives more storage time without addition of any preservative. Furthermore we checked the digestibility test and it gave 50% of starch digested from the both products, which reflect the actual Sucrose amount. 75 g of rice cake gives 37.5 g of glucose and to compensate 75 g of Glucose in OGTT test only required 2 rice cakes. In case of the biscuits it needed more and gives away the palatability.

DISCUSSION

The purpose of this study was to explore the possibility that a standardized dose of biscuits or rice cake can be an effective and well-tolerated alternative to the 75-g glucose beverage for the screening of women for gestational diabetes. In this study what we found was it can be effectively used in the rice cake model. Boyd *et al.* (1995)

Figure 1: A) Biscuit and B) Rice Cake





previously demonstrated that jelly beans can be used to screen for gestational diabetes mellitus and it was not done in the Sri Lankan community. Our results show that a standardized dose of rice cake that provides a “dose” of simple carbohydrate similar to that delivered by the 75-g glucose beverage may provide a better-tolerated alternative sugar source in screening for gestational diabetes and this may be a gold standard for this country. Further research is going on to optimize the conditions to get similar results which we are expecting from 75 g Glucose beverage.

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