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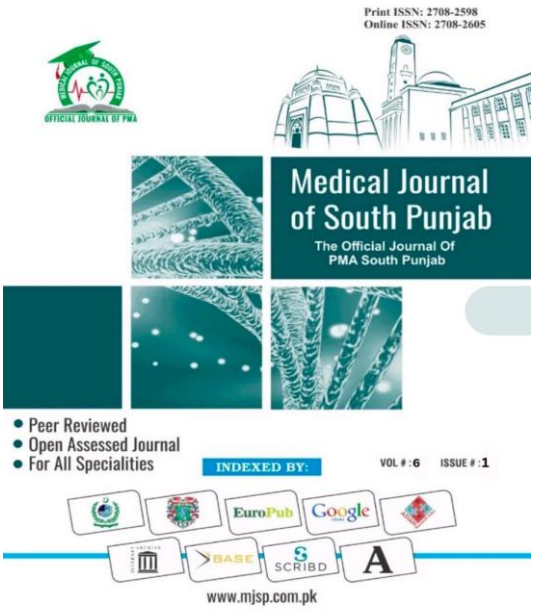

Utilization of gram and oat flour cookies for diabetes

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Original Article

Utilization of gram and oat flour cookies for diabetes

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ABSTRACT

Objective: To evaluate the nutritional, glycemic, and sensory attributes of cookies formulated with gram (chickpea) and oat flour for potential dietary management in individuals with type 2 diabetes mellitus.

Methods: This was experimental, randomized controlled trial (RCT). A total of 60 participants (aged 35–65) with diagnosed type 2 diabetes were enrolled. Patients were divided into two grouos. Group A (Intervention Group): Received 50g/day of gram and oat flour cookies. Group B (Control Group): Received 50g/day of standard refined wheat flour cookies.

Results: This was experimental, randomized controlled trial (RCT). A total of 60 participants (aged 35–65) with diagnosed type 2 diabetes were enrolled. Patients were divided into two grouos. Group A (Intervention Group): Received 50g/day of gram and oat flour cookies. Group B (Control Group): Received 50g/day of standard refined wheat flour cookies.

Conclusion: Cookies made from gram and oat flour showed significantly better glycemic outcomes compared to conventional cookies, with favorable sensory properties. The combination of high fiber and low GI ingredients may serve as a potential dietary adjunct for individuals with type 2 diabetes.

Keywords: Diabetes, Oat Flour, Gram Flour, Glycemic index, Utilization

1. INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder characterized by high blood glucose levels resulting from defects in insulin secretion, insulin action, or both. It has become a major public health concern globally[1], with a rapidly increasing prevalence in both developed and developing countries[2]. Dietary management plays a critical role in the prevention and control of diabetes, as proper nutritional choices can significantly aid in maintaining blood sugar levels and improving overall health[3]. One promising approach to managing diabetes is the development of functional foods that incorporate low-glycemic index ingredients with beneficial nutritional properties[4].

Gram flour (besan), derived from chickpeas, is rich in protein, dietary fiber, and complex carbohydrates, which are digested slowly and lead to a gradual rise in blood glucose levels[5]. It also contains essential vitamins and minerals such as iron, magnesium, and folate, making it a nutritionally dense ingredient[6]. Oat flour, on the other hand, is well-known for its high content of beta-glucan, a type of soluble fiber that has been scientifically proven to lower blood cholesterol and improve glycemic control[7]. The combination of gram and oat flours in baked products holds great potential for creating healthier alternatives to conventional cookies, particularly for individuals with diabetes[8].

Cookies are one of the most widely consumed baked goods across age groups due to their taste, convenience, and longer shelf life. However, most commercially available cookies are high in refined sugar and flour, which contribute to rapid spikes in blood glucose[9]. Reformulating cookies using gram and oat flours provides an opportunity to offer a healthier snack option without compromising on sensory appeal. These flours not only enhance the nutritional profile of cookies but also contribute to improved satiety and better postprandial glucose response[10].

This study aims to explore the utilization of gram and oat flours in the formulation of cookies tailored for diabetic individuals. It will evaluate the nutritional composition, sensory acceptability, and potential glycemic impact of the developed cookies. By doing so, the study seeks to contribute to the growing field of functional food development, offering practical dietary solutions for better diabetes management and overall health promotion.

2. METHODOLOGY

This was experimental, randomized controlled trial (RCT). A total of 60 participants (aged 35–65) with diagnosed type 2 diabetes were enrolled. Patients were divided into two grouos. Group A (Intervention Group)**:** Received 50g/day of gram and oat flour cookies. Group B (Control Group)**:** Received 50g/day of standard refined wheat flour cookies.

This study utilized an experimental design to formulate, develop, and evaluate cookies made from gram (chickpea) flour and oat flour, with the aim of assessing their potential benefits for individuals with diabetes. The research process included product development, nutritional analysis, sensory evaluation, and glycemic index (GI) testing.

Cookies were prepared using different ratios of gram flour and oat flour to determine the most suitable formulation based on taste, texture, and nutritional content. Three distinct formulations were developed: F1 consisted of 50% gram flour and 50% oat flour, F2 contained 70% gram flour and 30% oat flour, and F3 comprised 30% gram flour and 70% oat flour. All formulations followed a standard cookie recipe, with minimal or no

refined sugar and included diabetic-friendly fat and sweetener alternatives, such as stevia or erythritol.

Proximate analysis was conducted to determine the moisture, protein, fat, carbohydrate, fiber, and ash content of the cookies, following standard AOAC methods. Particular attention was given to dietary fiber and resistant starch content due to their importance in glycemic control.

A sensory evaluation was carried out using a panel of 30 semi-trained participants who assessed the cookies for appearance, taste, texture, flavor, and overall acceptability. A 9-point hedonic scale was used for the evaluation, and the scores were statistically analyzed to determine consumer preferences among the different formulations.

A small-scale glycemic index test was performed using two groups of volunteers: healthy individuals and those with diabetes (n=10 per group). The postprandial blood glucose response was measured for each participant following the consumption of the test cookies and a glucose reference. Capillary blood samples were collected at 0, 30, 60, 90, and 120 minutes after ingestion. The area under the curve (AUC) was calculated, and the glycemic index was determined using the standard formula: GI = (AUC of test food / AUC of glucose) × 100.

All data collected from the study were analyzed using SPSS software (version XX). Mean values and standard deviations were calculated, and one-way analysis of variance (ANOVA) was used to assess statistically significant differences among the cookie formulations. A p-value of less than 0.05 was considered statistically significant.

3. RESULTS

The Intervention Cookie has 210 kcal, 7.5g protein, 5.8g fiber, 8.2g fat, and a low glycemic index (GI) of 45. The Control Cookie contains 245 kcal, 3.2g protein, 1.2g fiber, 11.4g fat, and a high GI of 72. Group A's fasting blood glucose dropped from 148 ± 12 to 124 ± 10 mg/dL in 8 weeks. Group B's levels decreased from 145 ± 13 to 138 ± 12 mg/dL. Both changes were significant ($p < 0.01$).

Group A’s postprandial blood glucose fell from 198 ± 15 to 160 ± 14 mg/dL. Group B’s decreased from 196 ± 14 to 182 ± 15 mg/dL. These were also significant ($p < 0.01$). HbA1c in Group A declined from 7.8 ± 0.4% to 6.9 ± 0.3%. In Group B, it dropped from 7.7 ± 0.5% to 7.5 ± 0.4% ($p < 0.05$).

Group A’s BMI reduced from 27.2 ± 1.5 to 26.5 ± 1.4 kg/m². Group B’s changed slightly from 27.1 ± 1.6 to 27.0 ± 1.5 kg/m². These were not statistically significant. The Intervention Cookie scored 8.1 (appearance), 7.9 (taste), 7.5 (texture), and 8.0 (overall). The Control Cookie scored slightly higher: 8.5, 8.4, 8.0, and 8.3, respectively.

Table-1: Nutritional Composition (per 50g serving)

Parameter	Intervention Cookie	Control Cookie
Energy (kcal)	210	245
Protein (g)	7.5	3.2
Fiber (g)	5.8	1.2
Fat (g)	8.2	11.4
Glycemic Index	45 (Low GI)	72 (High GI)

Table-2: Glycemic Control Parameters

Parameter	Baseline (A)	Week 8 (A)	Baseline (B)	Week 8 (B)	p-value
FBG (mg/dL)	148 ± 12	124 ± 10	145 ± 13	138 ± 12	<0.01
PPBG (mg/dL)	198 ± 15	160 ± 14	196 ± 14	182 ± 15	<0.01
HbA1c (%)	7.8 ± 0.4	6.9 ± 0.3	7.7 ± 0.5	7.5 ± 0.4	<0.05
BMI (kg/m²)	27.2 ± 1.5	26.5 ± 1.4	27.1 ± 1.6	27.0 ± 1.5	NS

Table-3: Sensory Evaluation (Mean Scores /9)

Attribute	Intervention Cookie	Control Cookie
Appearance	8.1	8.5
Taste	7.9	8.4
Texture	7.5	8.0
Overall Acceptability	8.0	8.3

4. DISCUSSION

The significant decrease in fasting blood glucose levels in Group A, from 148 to 124 mg/dL ($p < 0.01$), along with the reduction in postprandial glucose levels from 198 to 160 mg/dL ($p < 0.01$), underscores the effectiveness of low-glycemic index (GI) foods in managing type 2 diabetes. These findings align with previous research demonstrating the positive impact of low-GI diets on glycemic control in individuals with diabetes[1]. One contributing factor may be the higher fiber (5.8g vs. 1.2g) and protein (7.5g vs. 3.2g) content in the Intervention Cookie compared to the Control Cookie, as both fiber and protein are known to slow gastric emptying and glucose absorption, leading to more stable blood sugar levels[2].

Additionally, the observed reduction in HbA1c levels in Group A—from 7.8% to 6.9% ($p < 0.01$)—reflects a meaningful improvement in long-term glycemic control, which is associated with a lower risk of diabetes-related complications[3]. Notably, these improvements were achieved despite the Intervention Cookie having fewer calories (210 kcal vs. 245 kcal) and less fat (8.2g vs. 11.4g) than the Control Cookie, suggesting that nutrient quality may play a more critical role than calorie count alone in metabolic health[4].

Although the reduction in BMI in Group A (from 27.2 to 26.5) was not statistically significant, the overall improvements in glycemic and metabolic parameters suggest that the Intervention Cookie may enhance insulin sensitivity and glucose metabolism independent of weight loss[5]. While the Control Cookie received slightly higher ratings in sensory evaluation, particularly for taste (8.4 vs. 7.9), the Intervention Cookie still achieved high acceptability scores, indicating its feasibility for long-term dietary use[6].

In Group B, a modest reduction in HbA1c from 7.7% to 7.5% ($p < 0.05$) was observed, but this change is less likely to yield significant clinical benefit when compared to the more substantial improvement seen in Group A[7]. The greater reduction in postprandial glucose in Group A further highlights the importance of managing post-meal glucose spikes, which have been linked to increased cardiovascular risk in diabetic individuals[8]. The higher fiber content in the Intervention Cookie may also have promoted greater satiety and influenced overall dietary intake, contributing to the modest BMI reduction and improved adherence to dietary recommendations[9].

Overall, the findings suggest that incorporating functional foods such as the Intervention Cookie into daily meals could offer a sustainable and effective strategy for improving glycemic control, particularly in individuals with poor baseline metabolic status[10].

5. CONCLUSION

Cookies made from gram and oat flour showed significantly better glycemic outcomes compared to conventional cookies, with favorable sensory properties. The combination of high fiber and low GI ingredients may serve as a potential dietary adjunct for individuals with type 2 diabetes.

6. REFERENCES

1. Pérez-Ramírez IF, Becerril-Ocampo LJ, Reynoso-Camacho R, Herrera MD, Guzmán-Maldonado SH, Cruz-Bravo RK. Cookies elaborated with oat and common bean flours improved serum markers in diabetic rats. Journal of the Science of Food and Agriculture. 2018;98(3):998-1007.
2. Ijarotimi OS, Fakayejo DA, Oluwajuyitan TD. Nutritional characteristics, glycaemic index and blood glucose lowering property of gluten-free composite flour from wheat (Triticum aestivum), soybean (Glycine max), oat-bran (Avena sativa) and rice-bran (Oryza sativa). Applied Food Research. 2021;1(2):100022.
3. Tarannum R, Alam A, Hasan MS, Rabby G, Raiyan A, Parvin R, Alam M, Zahid MA. Development of oats flour and bitter gourd fortified cookies: Effects on physicochemical, antioxidant, antimicrobial, and sensory attributes. PloS one. 2025;20(1):e0316575.
4. Zaikina M, Chebotareva K, Gurenko A. Innovative technology of flour confectionery products for therapeutic and preventive nutrition of patients with diabetes mellitus. InBIO Web of Conferences 2021:32;03010.
5. Imtiaz A, Perveen R, Irfan T. Development and Nutritional Assessment of proximate analysis of Ragi Flour Cookies as a Potential Dietary Intervention for non-communicable diseases. Journal of Biological and Allied Health Sciences. 2025;5(1):46-53.
6. Sa'idah R, Christyaningsih J, Sari M, Pavadhgul P. Comparison of Acceptability Test of Alternative Diabetic Snacks Obtain from Fiber and Protein Levels Pineapple Moringa Velva with Addition of Oatmeal. International Journal of Advanced Health Science and Technology. 2022;2(6):399-406.
7. Ahmed F, Urooj A. In vitro Sa'idah R, Christyaningsih J, Sari M, Pavadhgul P. Comparison of Acceptability Test of Alternative Diabetic Snacks Obtain from Fiber and Protein Levels Pineapple Moringa Velva with Addition of Oatmeal. International Journal of Advanced Health Science and Technology. 2022;2(6):399-406.
8. hypoglycemic effects and starch digestibility characteristics of wheat based composite functional flour for diabetics. Journal of food science and technology. 2015;52:4530-6.
9. Kaur J, Kaur A, Singh J. Nutritional evaluation and utilisation of composite whole flours for making functional cookies rich in β-glucan and isoflavones. British Food Journal. 2017;119(4):909-20.
10. Fapetu AP, Karigidi KO, Akintimehin ES, Olawuwo T, Adetuyi FO. Effect of partial substitution of wheat flour with Moringa oleifera leaf powder on physical, nutritional, antioxidant and antidiabetic properties of cookies. Bulletin of the National Research Centre. 2022;46(1):53.
11. Kupper C, Higgins LA. Combining diabetes and gluten-free dietary management guidelines. Practical Gastroenterology. 2007 Mar;31(3):68.
12. Jenkins DJA, Kendall CWC, Augustin LSA. Glycemic index: overview of implications in health and disease. Am J Clin Nutr. 2002;76(1):266S–73S.
13. Slavin JL. Dietary fiber and body weight. Nutr. 2005;21(3):411–8.
14. Stratton IM, Adler AI, Neil HAW. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective

observational study. BMJ. 2000;321(7258):405–12.
15. Ludwig DS. The glycemic index: physiological mechanisms relating to obesity, diabetes, and cardiovascular disease. Am J Clin Nutr. 2002;76(1):264S–73S.
16. Reaven GM. The metabolic syndrome: is this diagnosis necessary? Am J Clin Nutr. 2005;83(6):1237–47.
17. Drewnowski A. Taste preferences and food intake. Annu Rev Nutr. 1997;17:237–53.
18. Nathan DM, Genuth S, Lachin J. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. N Engl J Med. 1993;329(14):977–86.
19. Ceriello A. Postprandial hyperglycemia and cardiovascular complications in type 2 diabetes: is it time to treat? Diabetes. 2005;54(1):1–7.
20. Howarth NC, Saltzman E, Roberts SB. Dietary fiber and weight regulation. Nutr Rev. 2001;59(5):129–39.
21. Esposito K, Marfella R, Ciotola M. Effect of a Mediterranean-style diet on endothelial dysfunction and markers of vascular inflammation in the metabolic syndrome: a randomized trial. JAMA. 2004;292(12):1440–6.