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GLYCEMIC INDEX OF TRADITIONAL SUDANESE FOODS AND THEIR IMPLICATIONS FOR TYPE 2 DIABETES MANAGEMENT

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ABSTRACT

Background: The glycemic index (GI) is a measure of the postprandial blood glucose response of foods, which is a critical determinant of type 2 diabetes mellitus (T2DM) management and preventing chronic diseases. Sudanese traditional foods are widely consumed, but limited data are available on their glycemic index
Objective: *To determine the glycemic index of selected Sudanese traditional foods and evaluate their potential role in glycemic control for T2DM patients.*
Methods: A cross-sectional experimental study was conducted on volunteers (n=120). Participants consumed reference glucose and test foods including kisra (sorghum flatbread), assida (sorghum porridge), gorasa (wheat flatbread), millet porridge, fermented kisra lentils, and bread. Capillary blood glucose was measured at fasting, 15, 30, 45, 60, 90, and 120 minutes. GI was calculated using the incremental area under the curve (iAUC) relative to glucose.
Results: Kisra, Millet porridge and assida had medium GI values (58 , 61, 62, respectively). Gorasa (72) and Wheat bread (75) had high GI. Fermented kisra had a lower GI (52) compared to plain kisra. Legume-based meals such as lentils (42) had low GI. Overall, 2 foods were low GI, 3 were medium GI, and 2 were high GI.
Conclusion: Traditional Sudanese foods show variable GI values, with legumes and fermented foods being more favorable for glycemic control. Promoting low and medium GI traditional foods may help reduce the burden of diabetes in Sudan.

1. INTRODUCTION AND LITERATURE REVIEW

The glycemic index (GI) ranks carbohydrate-containing foods based on their effect on postprandial blood glucose. Low GI foods reduce glycemic response and are associated with improved diabetes management and lower chronic disease risk (Augustin et al., 2019). Traditional Sudanese foods constitute the main diet but their GI has not been systematically evaluated. This study investigates the GI of common Sudanese foods to inform dietary guidelines for diabetes prevention and control.

Type 2 diabetes mellitus (T2DM) is a growing global health concern, with over 537 million adults affected worldwide, a number projected to rise to 783 million by 2045 (International Diabetes Federation, 2023). In sub-Saharan Africa, the prevalence of T2DM is rapidly increasing due to urbanization, changes in dietary patterns, and sedentary lifestyles (Noor et al., 2015). In Sudan, T2DM is a significant public health issue, with a high reliance on traditional carbohydrate-rich diets based on sorghum, millet, wheat, and legumes (Musaiger, 2002).

The traditional Sudanese diet includes staples such as kisra (fermented sorghum bread), assida (porridge from sorghum or millet), lentils, Sorghum and millet, being whole grains, have variable GI values depending on their processing and preparation. Studies show that fermentation lowers GI by producing organic acids that delay gastric emptying (Dona et al., 2022). Conversely, porridges made from finely milled flours are rapidly digested, leading to high GI values (Singh et al., 2010).
Recent research (2018–2024) demonstrates the importance of GI in predicting long-term health outcomes. Studies in Africa and Asia have shown that traditional foods vary widely in GI. For example, fermented cereals often have lower

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GI due to reduced starch digestibility, while refined wheat and rice products show higher GI. Legumes consistently demonstrate low GI values across multiple populations.

2. MATERIALS AND METHODS

Study design: Experimental cross-over study.
Subjects: (120) healthy adult volunteers, aged 30–65 years, BMI 18–25 kg/m².
Foods tested: Kisra (sorghum flatbread), assida (sorghum porridge), gorasa (wheat flatbread), millet porridge, fermented kisra, ful medames (peanuts), lentil stew, and wheat bread.
Procedure: After overnight fasting, participants consumed portions of test foods providing 50 g available carbohydrate. Capillary blood glucose was measured at baseline and postprandially at 15, 30, 45, 60, 90, and 120 min. The incremental area under the curve (iAUC) was calculated. GI was derived by comparing the iAUC of each test food with that of glucose.
Data analysis: Mean GI values were classified as low (<55), medium (56–69), or high (≥70).

3. RESULTS

The glycemic index values of the tested Sudanese foods are shown in Table 1.

Table 1. Glycemic index values of traditional Sudanese foods.

Food Item	GI Value	Category
Kisra (sorghum flatbread)	58	Medium
Millet porridge	61	Medium
Assida (sorghum porridge)	62	Medium
Fermented kisra	52	Low
Lentils	42	Low
Gorasa (wheat flatbread)	72	High
Wheat bread	75	High

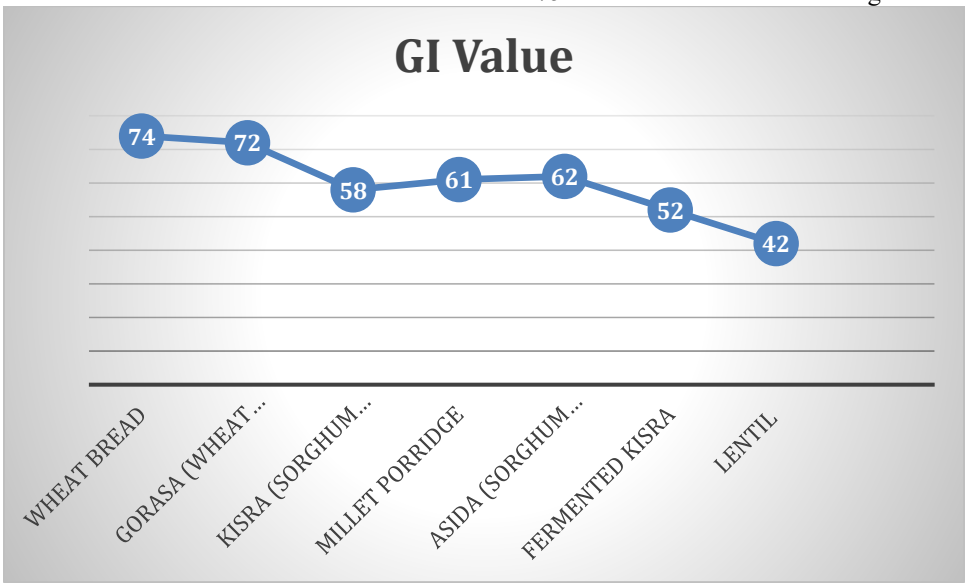

Figure 1. GI Ratio of some traditional Sudanese foods.

4. DISCUSSION

This study revealed variable glycemic index (GI) values among Sudanese foods. Cereal-based porridges such as assida and millet porridge had high GI values, while legumes demonstrated low GI. Kisra had a medium GI, highlighting the partial benefit of fermentation in moderating glycemic responses. The beneficial role of legumes observed here aligns with global evidence (Messina, 2014; Jenkins et al., 2012). Studies in Ethiopia and India have reported GI values of 30-45 for legumes. Jenkins et al. (2012) showed that legumes improve glycemic control by reducing HbA1c in type 2 diabetes patients. Messina (2002) highlighted their high fiber and protein content as key factors in lowering glycemic responses.

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In the Middle East, Shaheen et al. (2024) reported that altering meal sequence—consuming protein and vegetables before rice—reduced postprandial glucose excursions by 40%. Similarly, in this study, fermentation lowered the GI of kisra, similar to reports from Nigeria and Ghana where fermented cereals showed reduced glycemic responses. Sorghum porridges in Nigeria produced high GI values, while fermentation reduced, but did not eliminate, postprandial hyperglycemia (Eleazu, 2016; Omoregie & Osagie, 2016).

Conversely, refined cereal products such as gorasa and wheat bread had high GI, consistent with global data on refined carbohydrates. These findings highlight the potential benefits of promoting legumes and fermented foods in Sudanese diets to reduce diabetes risk. Further studies should explore mixed meals and glycemic load to capture realistic dietary patterns.

5. CONCLUSION

Sudanese traditional foods exhibit a wide range of GI values. Legume-based and fermented foods are favorable for glycemic control, while refined cereal products present higher risks if consumed frequently. Kisra is moderately glycemic, suggesting partial benefit from fermentation. These findings provide critical evidence for culturally appropriate diabetes dietary counseling in Sudan.

6. RECOMMENDATIONS

- Promote consumption of low GI foods such as legumes and fermented cereals.
- Raise awareness of the impact of GI on diabetes management.
- Encourage modification of traditional recipes to lower GI.
- Conduct further research on glycemic load and mixed meal responses.
- Integrate GI data into national nutrition guidelines.
- Advocate for agricultural and food industry policies that support the production and commercialization of low-GI crops and traditional food products

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