Pan Africa Science Journal
ISSN 2709-1473 | Open Access

RESEARCH ARTICLE: Public Health

Volume 02 – Issue 03

Utilization of glycemic index values of commonly consumed foods in the provision of nutrition care to patients with diabetes: a case study at Bungoma county referral Hospital

Maureen Gacheri Nyongesa[1], Rabin Denis Barasa[2] , Alex Kiptoo[1] and Darius Riziki Martin [3,*]

[1] Medical Unit Department, Nakuru Level 6 Hospital, , P.O. Box 71-20100; nyongesagacheri@gmail.com; ropalexkiptoo@gmail.com
[2] Intensive Care Unit, Nairobi Hospital, , P.O. Box 1413 00606, Nairobi Kenya rabindenisoffice@gmail.com
[3] South African Medical Research Council Bioinformatics Unit, South African National Bioinformatics Institute, University of the Western Cape, Private Bag X17, Bellville 7535, South Africa; 3517594@myuwc.ac.za

***Corresponding author:** 3517594@myuwc.ac.za

Received: 29th July 2023; Accepted: 6th September 2023; Published: 11th September 2023

DOI: https://doi.org/10.47787/pasj.v3i02.24

Abstract

The estimated prevalence of diabetes in Kenya is around 2.2%. There is a lack of awareness on diabetes in Kenya, leading to delayed diagnosis and management. This lack of awareness hinders early intervention and control of the disease. The adoption of a more Westernized diet, which is often high in processed foods and low in nutritional value, coupled with a decrease in physical activity, has contributed to the rise in diabetes cases. Access to affordable medications, regular blood glucose testing, and specialized diabetes care can be challenging for many Kenyans. This can lead to inadequate glycemic control and increased risk of complications. Knowledge of the glycemic index is therefore key in managing the conditions; therefore, we explore how well healthcare providers understand and apply GI values of widely consumed foods together with the patients. Data was collected and analyzed using a descriptive cross-sectional study design, involving both care providers and patients. Most care providers had knowledge of GI but only 3/4 reported utilizing its utilization. Patients, therefore, had issues because of ignorance and consumed food with high GI. Healthcare providers should be better equipped and acquainted with the G.I concept to provide the right information to patients and follow up in management.

Keywords: glycemic index values, diabetes, diet, lifestyle, prevalence

1 Introduction

Diabetes, often known as diabetes mellitus, refers to a set of metabolic diseases marked by hyperglycemia caused by insulin secretion complications (1). Hyperglycemia is a chronic condition in diabetics that is associated with long-term microvascular difficulties affecting the eyes, kidneys, and nerves, as well as an increased risk of cardiovascular disease. Prediabetes is characterized by impaired fasting glucose (IFG), impaired glucose tolerance (IGT), or glycated hemoglobin (HbA1c) readings ranging from 6.0 to 6.4%. Each of these variables increases a person's chance of developing diabetes and related complications (2). Diabetes mellitus has long-term repercussions, including retinopathy, which can result in blindness, nephropathy, which can result in renal failure and ulcers, amputations, and autonomic dysfunction, which can result in sexual dysfunction (3). Diabetes is characterized using clinical descriptive criteria as well as a distinct etiological classification (4). Diabetes mellitus, regardless of its cause or etiology, progresses through several clinical stages in its natural history, as defined by clinical staging or

categorization. According to the WHO categorization, is the result of a better knowledge of the causes of diabetes mellitus. Type 1 diabetes mellitus cases include those caused by an autoimmune illness, those with beta-cell loss, and those who are prone to ketoacidosis and have no known etiology, origin, or pathophysiology. Type 2 diabetes mellitus, the most common and dangerous form of diabetes, is characterized by insulin secretion challenges with insulin resistance playing a significant role. Gestational diabetes is a kind of diabetes in which a woman's glucose intolerance develops hyperglycemia of varied severity after she gets pregnant (4). According to the World Health Organization, the global diabetes population rose from 108 million in 1980 to 420 million in 2014, with a global prevalence ranging from 4.7 percent to 8.5 percent among individuals over the age of 18. Diabetes was anticipated to affect 34.2 million people in the United States in 2020, accounting for 10.5 percent of the adult population (5). According to the WHO, 60 million Europeans over the age of five are diagnosed with diabetes, accounting for 10.3% of men and 9.1% of women. While the International Diabetes Federation (IDF) reports 19 million people living with diabetes in the African region, Kenya has 552,400 people living with diabetes, representing 2.2 percent of the adult population (6). Diabetes mellitus is treated and managed using a combination of both pharmacological and non-drug therapies non-drug therapy and management of diabetes mellitus is comprised of both diet and exercise (7). Current nutrition therapy guidelines for diabetes mellitus treatment and management are based on thorough examination of the data (8).

According to Franz, diabetic nutrition treatment seeks to encourage a nutritious diet while still meeting the optimum glucose, cholesterol, and blood pressure targets specific to individual needs. High glycemic index foods include carbohydrates that are quickly digested (like white bread) and absorbed into the circulatory system. The meal not only swiftly boosts blood glucose levels, but also raises insulin response after consumption. Foods with a low glycemic index, such as legumes, contain complex carbohydrates that are broken down and absorbed slowly during digestion. As a result, such meals gradually affect blood glucose levels and insulin response after ingestion (9). The glycemic index is defined as a percentage of the area under the curve (AUC) in relation to 2-hour blood glucose following consumption of the test food against a normal diet, typically glucose or bread (10). It may also be defined as a comparison of the available carbohydrate digestibility of the test item to that of a reference meal, which is often glucose (11). The primary objective of diabetes treatment and management diet is to enhance glycemic control or blood sugar level regulation. The glycemic index of a food is determined by the amount of food consumed rather than by an individual. As a result, a low glycemic index diet can help people living with diabetes achieve better glycemic control (including HbA1c and fasting blood glucose). Foods having a low glycemic index, as opposed to those with a high glycemic index, aid in glycemic management by enhancing insulin sensitivity, decreasing blood glucose fluctuations, and lowering daily insulin needs (12).

Jenkins et al. (13) published the first GI values for 62 items, advising that they be used in conjunction with nutritional composition tables to provide the foundation for diabetic diet prescription. Many following research or experiments aimed at determining the GI values of various meals and testing the therapeutic significance of the GI concept were influenced by their work. When it comes to diabetic dietary control, the technique was shown to be beneficial in most trials. As a result, the International Tables of Glycemic Index were developed, and various dietetic associations in some countries, including the European Association for the Study of Diabetes, the American Diabetes Association in the United States, and the Professional Advisory Committee of the British Diabetic Association,

adopted their use in dietary treatment of diabetes. Many diabetes education centers now employ the GI concept to instruct patients, and it has been shown to be more successful than traditional dietary advice in decreasing fat and increasing fiber content in the diet (14).

Little has been done in the African context to produce glycemic index values for locally accessible foods. The use of glycemic index values in diabetic patient nutrition care continues to be a difficulty in African hospitals, with many caregivers resorting to alternative standards set in Western nations to offer nutrition care in these patients' treatment. Even if GI data were provided, patients would struggle to understand and use them owing to illiteracy. There has been little documentation and publication of studies on the use of GI values in diabetic dietary control across the country. My investigation will focus on how existing GI values from the International Tables of Glycemic Index are employed in diabetic dietary therapy and management at Bungoma County Referral Hospital.

According to study findings, the ultimate objective of nutrition treatment is to enhance glycemic control. As a result, GI values are at the center of dietary discussions and prescriptions, and they should influence the recommendations given to patients by caregivers. They also educate patients on how to make informed dietary choices (15). However, the usage of GI values in Kenya is not well documented. Data on health care personnel's awareness of glycemic index values of commonly consumed meals is insufficient for delivering nutrition treatment to people living with diabetes. The use of glycemic index values by patients with diabetes to make informed dietary decisions to control their blood sugar levels is also little understood. The general objective of this study is to investigate if healthcare providers use the glycemic index values of commonly consumed food items when providing nutrition care or therapy and treating diabetes among patients at using Bungoma County Referral Hospital as a case study, and if the diabetes patients use the information, they learn to make informed dietary decisions. Specific objectives are (i) to investigate how effectively health-care practitioners comprehend and implement the glycemic index values of commonly eaten foods in the management of diabetes. (ii) To find out if patients with diabetes at Bungoma County Referral Hospital use glycemic index data to make informed dietary decisions to keep their blood sugar levels under control.

This study is significant because it will contribute to the country's understanding of GI utilization by highlighting healthcare workers' knowledge of glycemic index values of commonly consumed foods and common practices during patient care, as well as patients' attitudes and practices towards using the acquired information and glycemic index values to make informed dietary choices in managing their blood sugar levels. The study's suggestions will be included in policy creation at the county and national levels, supporting hospitals in enhancing service provision. The findings of this study will advocate for the introduction of evidence-based diabetic dietary management. It will also help our caregivers in identifying the most tailored diabetes treatment by widening their scope of practice and investigating the possibilities accessible for utilizing GI values. The project's purpose is to help patients with diabetes at Bungoma County Referral Hospital make better, more educated dietary choices based on GI values to control disease progression and enhance their quality of life.

2 Materials and Methods

A descriptive cross-sectional study design was used for collecting and analyzing data. The design was effective at meeting the study's objectives. We utilized questionnaires to collect data on nutritionists' or dieticians' understanding

of glycemic index values, which was then used to provide nutrition treatment to diabetes patients. We shared excerpts from international tables containing the glycemic index values of commonly accessible foods.

2.1 Study area

The study was conducted at Bungoma County Referral Hospital. This is a level 5 hospital, and patients from the Kanduyi, Bumula, Sirisia, and Kabuchai constituencies are referred here for specialized treatment. The hospital offers a diabetic section that treats patients with all forms of diabetes and will thus be useful in the study. Bungoma County has a population of 1.8 million people, with 883475 men and 925835 females. It is the third most populated county in Kenya, after Nairobi and Kakamega. It borders Kakamega to the south, Trans-Nzoia to the north, and Busia to the west, as well as an international border with Uganda. The study focused on nutritionists or dieticians who provide specialist nutrition treatment and diabetes management to patients with diabetes who visit Bungoma County Referral Hospital on a regular basis. The nutritionists or dieticians in the group will be useful in providing knowledge on how to use glycemic index data in diabetic nutrition care and management. The impact or influence of patients with diabetes food choices and quality of life were also investigated. This aided in the acceptance and usage of global glycemic index tables in diabetes care. The diabetes clinic at Bungoma County Referral Hospital serves 120 regular patients. It is served by a team of ten nutritionists and dieticians. A sample of 10 nutritionists or dieticians and 30 diabetes patients who visit the hospital on a regular basis were chosen using purposive sampling. This results in a sample size of 40 people representing a pool of diabetes patients who visit the hospital.

The sample size at Bungoma County Referral Hospital is indicative of the target population. These individuals took part in the study and responded to questionnaires. We used a researcher-assisted questionnaire to collect data. The form included both open-ended and closed-ended questions. The questionnaire was divided into three sections to capture patient information divided into subsections as follows; Section 1: Personal information; this section contained information such as name, gender, marital status, occupation, education level, place of residence, etc. The patient's medical history was also included because of its relevance to the study. It also contained information such as the duration of diabetes; diseases suffered other than diabetes, complications associated with diabetes, and management of these conditions. in addition, the section contained information such as the type of food consumed and frequency, locally available foods consumed by patients, dietary patterns, and factors influencing the choice of food. A 24-hour food recall was also used to collect data on foods consumed before the study and it covers breakfast, lunch, and supper and the time lapse between consecutive meals. Also, glycemic index information was captured under the dietary history of the patients. Data on the knowledge of glycemic index values, their utilization and uptake in the management and nutrition care of diabetics, and how they influence the choices of diabetic patients as well as their uptake impact on the quality of life was assessed. Section 2: This section captured nutritionists' or dieticians' information. It contained information such as caregivers' profiles and practice as well as knowledge on glycemic index and utilization of international tables of glycemic index values information in the management of diabetes. Section 3: This part contained the researcher's comments and evaluations of the completed questionnaire by both nutritionists and diabetic patients.

2.2 Study procedure

The researcher-assisted questionnaires were administered to nutritionists to give responses according to the questionnaire specifications on

their own. An extract of the international table of glycemic index values of locally and commonly consumed foods was made available to the nutritionist to determine their familiarity and further ascertain their knowledge and use in their day-to-day nutrition care and management of diabetes. The questionnaire was read to patients with diabetes and answers were marked according to the questionnaire's specifications. Data collected from caregivers and patients was summarized in section 3 of the questionnaire which was then used in the analysis.

2.3 Data analysis and presentation

Respondents completed questionnaire data were cleaned, edited and entered into an Excel spreadsheet and analyzed using descriptive statistics. Both SPSS and Excel spreadsheets were used. This data was presented in descriptive statistics such as frequencies and mean and in inferential statistics including tables, graphs, and pie charts.

2.4 Ethical consideration

Respondent's consent was sought, and none were forcibly involved in this study's questionnaires. Participants were made to understand the significance of the study and why it is important that they take part. Their privacy was guaranteed, and all the information given was confidential.

3 Results

Results showed that 17.5% of patients with diabetes are below 25 years of age, 47.5% are between the ages of 26-40 years, 20% are between the age of 41 to 55 years, and those between 56 to 70 years and 71 to 85 years were 7.5% each. The mean age of the sampled patients at Bungoma County referral hospital was 39 years. The table below illustrates further (Table 1).

From the results shown in the table above more females than males were diagnosed with diabetes mellitus. Females accounted for 65% of the sampled gender whereas men were 35% (Table 2). Generally, in Bungoma County, males provide physical labor at home. They engage in activities such as land tillage, weeding, plowing, construction works, and fetching water from distant water points in carts, bicycles, motorbikes, and herding cattle among other activities. These activities utilize a lot of calories and consequently a balanced calorie intake and output. Women are not much into these calories consuming physical activities. Consequently, they retain more calories from meals than they expend. These excess calories result in weight gain and consequently overweight and obesity among women which is a risk factor for diabetes type II (16).

On marital status, the results showed that 70% of the sample population was married, 27% were single and 3% were widows and none was widowed as shown in the pie chart below (Fig 1). Since diabetes mellitus type 2 specifically manifests at an advanced age that is above 40 years of age (17), it is expected that people this age are married to a higher percentage of the married population.

Based on education level, the results showed that 42.5% of the sample population had attained the tertiary level academic status, 27% had attained secondary education was only 30% had attained primary level education (Fig 2). Most of the patients in the tertiary level of education had a certificate, diploma, degree, or master's degree in the respective fields of study. Patience in the tertiary education level category was also employed with good earnings which translated to good purchasing power of consumer goods. Lack of education poses a big challenge in training patients about principles, particularly nutrition and this puts nutrition education uptake in jeopardy.

Pan Africa Science Journal
ISSN 2709-1473 | Open Access

Table 1. Diabetes prevalence in the study hospital

Age (Years)	Number of patients	Percentage (%)
<25	7	17.5
26 - 40	19	47.5
41 - 55	8	20
55 - 70	3	7.5
71 - 85	3	7.5

Table 2. Age and diabetes prevalence

Age (years)	No. of patients (*f*)	Midpoint (*x*)	*fx*
11-25	7	18	126
26-40	19	33	627
41-55	8	48	384
56-70	3	63	189
71-85	3	78	234
Total	40	240	1560

For employment status, the results in the table below show that 35% of the sampled diabetes patients are in the formal employment sector, 45% were self-employed and 20% were unemployed (Fig 3). The formal employment sector included teachers, nurses, nutritionists, accountants, human resource officers, and the secretary whereas masons, hairdressers, carpenters, businessmen and women, and farmers constituted the self-employed population.

Evidently, diabetes not only affects the rich who presumably feed more refined foods and assume a sedentary lifestyle but also the poor depending on dietary patterns, food choices, and the hereditary or genetic makeup of individuals. Good income commands higher purchasing power for food products as low income reduces this capacity.

As established by ADA (18), nutrition constitutes the primary care and management of diabetes and the following campuses a challenge in the management of diabetes aspirations have reduced capacity to acquire basic nutritious foods to make a balanced diet.

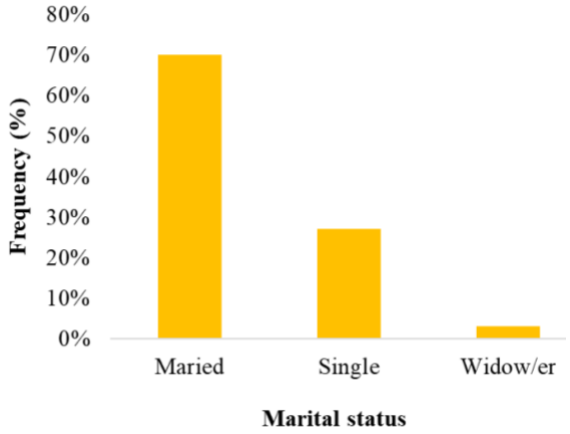

Figure 1. Bar plots showing diabetes prevalence based on marital status.

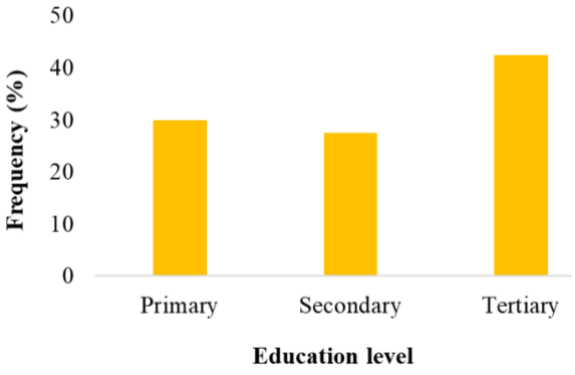

Figure 2. Bar plots show diabetes prevalence based on the education level.

Figure 3. Bar plots showing diabetes prevalence based on employment status.

3.1 Dietary patterns and food intake frequencies for starchy processed grains

The dietary patterns present the frequency of food items taken within a span of one week prior to the study in frequencies of daily, twice, thrice, and four times. Special interest was given to carbohydrates and starchy food items. The table below presents food items consumed, their glycemic index, frequencies of INTECH and several individuals consuming them for the past week prior to the study.

Table 3. Dietary patterns and food intake frequencies for starchy processed grains

Food item	Glycemic index	Frequency of intake	No. of patients
Wheat bread	75	Daily	13
		Twice	1
		Thrice	0
		Four times	3
White rice	73	Daily	9
		Twice	8
		Thrice	7
		Four times	5
White ugali	51-100	Daily	25
		Twice	2
		Thrice	8
		Four times	2
Chapatti	52	Daily	1
		Twice	4
		Thrice	5
		Four times	3

During the study, the frequency of consumption of select food items was assessed for the past week prior to the study. The results were analyzed and calculated based on the food item, its glycemic index frequency of consumption, and the number of people consuming the food items as in the table above. The glycemic index value of foods obtained from international tables of glycemic index. Individual food items are discussed below. Maize meal is consumed by the highest number of the diabetic sample population i.e., 92.5%. Daily consumption accounted for 67.6% of diabetes patients consuming the meal daily, 5.4% consuming it twice a week, and 21.6% and 5.4% consuming it twice and four times a week respectively. With its high glycemic index and a high number of consumers, maize meal poses a challenge to glucose control in diabetics. Rice was the second most consumed food item with 72.5% of the sample population consuming it. Rice accounted for 31% of daily consumers, 28% of diabetes patients who consumed it twice a week, and 24% and 17% of those who consumed it thrice and four times a week respectively. The glycemic index of white rice or 73 and was classified as a high GI food

item. As is the consumption of maize meal, excessive uncontrolled consumption of white rice poses a challenge in achieving glycemic control among diabetes patients. Bread accounted for 42.5% of consumers from our sample population with 76.5 of these consumers eating daily. Bread has a glycemic index of 75 and is thus classified as a high glycemic index food item. High glycemic index foods are known to raise blood glucose drastically to high levels and therefore are not ideal for daily consumption when you must control your blood sugar. Chapati is one of many products consumed by residents of Bungoma. The glycemic index of whole wheat before processing stands at 30. Processing of wheat raises its glycemic index to 70. The process of wheat is used to prepare Chapati. Chapati weather falls under the category of a high glycemic index food item and accounts for 32.5% of consumers from the sampled population at Bungoma County referral hospital (Table 3).

3.2 Dietary patterns and food intake frequencies from tubers

For tubers (Table 4) Irish potatoes accounted for 20% of consumers from the sample population with 37.5%, 50%, and 12.5% consuming it twice, thrice, and four times a week respectively. With a glycemic index of 78, Irish potatoes are classified as high glycemic index food items. High glycemic index foods are known to voice the postprandial blood glucose shortly after intake and therefore not suitable for the management of diabetes. The result shows that only 32.5% consumed arrowroots will be in a week prior to the study and a large population of this sample that is 67.5% did not consume arrowroots within that specified period. However, 15.4%, 38.5%, 30.7%, and 15.4% reported having consumed the food item daily, twice, thrice, and four times respectively a week prior to the study. Arrowroots have a glycemic index of 63 and fall under the category of foods with medium glycemic index and thus do not pose a serious challenge in the control of blood sugars among diabetics.

Table 4. Dietary patterns and food intake frequencies for tubers

Tuber	Glycemic index	Frequency of intake	No. of patients
Irish potatoes	78	Daily	0
		Twice	3
		Thrice	4
		Four times	1
Sweet potato	49	Daily	1
		Twice	2
		Thrice	0
		Four times	0
Cassava	46	Daily	0
		Twice	2
		Thrice	1
		Four times	0
Arrow roots	63	Daily	2
		Twice	5
		Thrice	4
		Four times	2

3.3 Factors influencing dietary choices of diabetics.

The results presented in the table above show that 65% of diabetes patients sometimes made dietary choices based on nutritionist advice. On the other hand, 15% of the sample population always made choices based on the nutritionist's advice, and 20% never based their dietary choices on the nutritionist’s advice. The results also showed that

57.5% of the sample population reported sometimes making dietary choices based on their personal initiative to manage diabetes as 15% always made dietary choices to help manage diabetes and 27.5% never made dietary choices based on such basis. Although many factors could be chosen, only two factors for selected purposefully. These factors were derived from the question, "What influences your dietary choices?" Two answers (factors) who presented with a scale shown in the table below (Table 5).

Table 5. Factors influencing dietary choices of diabetics.

Influences of diet choice	Number of patients			Percentage (%)		
	Always	Sometimes	Never	Always	Sometimes	Never
Nutritionist's advice	6	26	8	15	65	20
Personal initiative in management of diabetes	6	23	11	15	57.5	27.5

3.4 Knowledge and utilization of the glycemic index concept

The study findings revealed that about 90% of the sampled Nutritionists had knowledge of glycemic index and only 80% reported to utilizing the GI concept in counseling sessions with their patients to help them make informed dietary choices in managing diabetes. On the other hand, only 10% of the sample nutritionists reported having no understanding of the glycemic index.

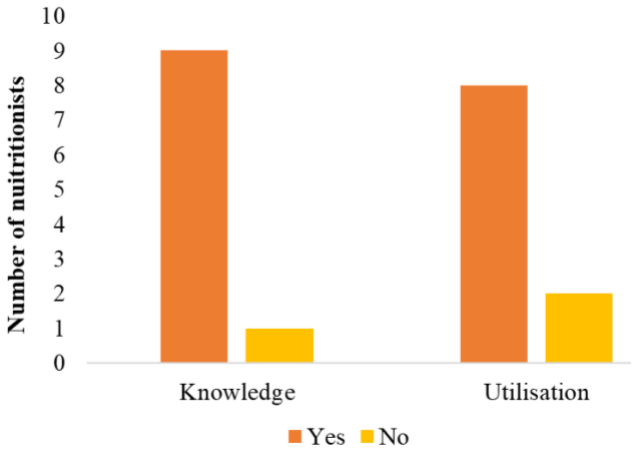

Figure 4. Knowledge and utilization of the glycemic index concept

Although 90% of nutritionists reported understanding the concept, 20% of them didn't utilize the concept in counseling patients on the management of diabetic conditions and preferred using traditional methods such as food portioning. The table below shows the findings (Fig 4).

3.5 Perceived barriers to utilization of the GI concept

The study findings showed that most nutritionists agreed on the following as challenges known to hinder the ability and applicability of the glycemic concept in the management of diabetes in primary care and clinical settings, (a) Ignorance and patient's unfamiliarity with the glycemic index concept. Limited time was assigned to nutrition education at the medical outpatient clinic (b) Lack of proper follow-up, evaluation, and monitoring at the community level to assess adherence to the concepts taught. (c) Feasibility of applying the concept in the community. Lack of commitment from both parties' inadequate information delivered to patients. (d) Uncooperative patients and or clients. (e) Limited knowledge and foods with low glycemic index.

4 Discussion

Jenkins et al. first proposed the glycemic index concept in 1981. It has already been demonstrated to be a crucial and novel concept in the field of nutritional research. Many further investigations aimed at identifying the GI values of various foods and testing the clinical relevance of the GI

concept were influenced by Jenkins' work. Since the GI concept was introduced, GI values have been published for over 2000 different foods. Various international diabetic associations, such as Diabetes Canada, the Canadian Cardiovascular Society (CCS), the American Diabetes Association, Diabetes Canada, Diabetes Australia, Diabetes UK, the European Association for the Study of Diabetes, the European Society of Cardiology, or the European Society of Cardiology, have lent their support to their adoption and use in the management of diabetes and cardiovascular diseases. Many countries, notably Australia (the leader), New Zealand, the United Kingdom, and South Africa, have successfully implemented GI values on food labels (19). The approach is also employed in diabetes patient education at various education centers, and it has proven to be more effective than normal dietary recommendations in terms of lowering fat and boosting fiber content in the diet (20).

Controlling and maintaining postprandial blood glucose levels is critical in the treatment of diabetes mellitus. Nutritionists and other caregivers face a difficult burden in discovering techniques to properly manage glycemia as the prevalence of diabetes mellitus rises year after year. Many researchers now believe that if lowering postprandial glycemia is a part of the approach for preventing, controlling, and managing diabetes and cardiovascular disease, the GI concept is just as important as carbohydrate amount (21). Foods with a low glycemic index are linked to lower insulin demand, better blood glucose management, lower lipid concentrations, and lower body weight, making them crucial in the prevention of diabetic-related cardiovascular events, according to Wang (22) conducted a systematic evaluation of nine publications to determine the impact of dietary GI on glycemia in type 2 diabetes patients. They discovered that in patients with type 2 diabetes, a low GI diet was more successful in managing glycated hemoglobin and fasting blood glucose than a high GI diet. According to Thomas and Elliot (23), a low GI diet reduces the percentage of glycated hemoglobin levels by 0-4 percent when compared to a control diet. When compared to the reductions achieved by drugs for newly diagnosed type 2 diabetes patients, this drop was determined to be clinically meaningful. Yosuf, et al (24) observed that the low GI diet was linked with a higher reduction in fructosamine and fasting plasma glucose than the conventional diet in individuals with type 2 diabetes in an Asian population. Eldakhakhny et al (25) found that there was an apparent difference in GI reaction between men and women in a study that investigated whether gender differences affect GI response in healthy young adult men and women with a normal BMI.

The uncertainty about the accuracy and applicability of international GI tables has hampered the adoption of GI on a worldwide basis. The reason behind this is that the tables were created by people in Western countries, whereas very little was created by people in Africa. Because the GI idea is based on single foods, it creates a big challenge because many societies rarely consume single foods, preferring to consume mixes or different combinations of food. The GI concept fails to anticipate the glycemic index of mixed meals (26), posing a nutritional problem for diabetes patients. In type 2 diabetes patients, a low GI diet is linked to a short-term improvement in glycemic control. While the GI values of rural African and Caucasian persons were similar for various test foods (27), there was no difference in the GI values of Vietnamese foods examined in Asians and Caucasians (28). Although there are obvious flaws and difficulties surrounding the GI concept, as there are with any other scientific approach, proponents of the GI concept give compelling data in support of its implementation in medical nutrition management and diabetes care. In comparison to a high glycemic index diet, a low GI diet lowers postprandial glycemia, lowers insulin demands, improves blood glucose control,

and successfully controls glycated hemoglobin and fasting blood glucose. It is thus worthwhile to use the GI concept in the Kenyan setting.

In this study, a larger percentage of the diabetes patients who responded to the questionnaire were in advanced age with a mean age of 39. This confirms there is a paradigm shift from old age onset of diabetes to slightly past youthful age. Most of them had good sources of livelihood from both formal employment and self-employment which informs of their better purchasing power of nutritious food items. Most of these diabetes patients are married and have a good education achievement. Most of these patients consumed food products that were high in glycemic index values and therefore put to question their food choices and preferences in managing their condition. Most diabetes patients had attained tertiary education, but this did not translate into two useful uptakes of concepts taught on nutrition management of diabetes. A larger percentage of them reported sometimes either following nutritionist's advice or being guided by their initiative in the management of diabetes. This poses a challenge to how effectively these patients utilize the taught concepts while at home. Although most nutritionists reported understanding the glycemic index concept and its application, most of them stumbled upon a basic definition of the concept and its utilization claims and, therefore, proved questionable. Most of the nutritionists pointed out ignorance, infrequent nutrition education, and glycemic index concept, lack of commitment from both nutritionists and diabetics towards the glycemic index concept, and the feasibility of applying the concept in the community, among others as the perceived barriers to suitability and applicability of the glycemic index concept in the management of diabetes.

Today's medical approaches to the management of various conditions call for evidence-based approaches to management. Nutrition alongside other lifestyle modifications provides a long-term management plan to diabetes patients and helps improve their quality of life. Traditional methods such as the use of a diabetic plate among other food portioning techniques have been used in planning diabetic diets. Nutrition counseling and education have been one major nutrition support offered in many health facilities within the country. If glycemic values of commonly consumed food items within our local environment are incorporated into the national food composition tables, it will prove to be a resourceful evidence-based approach to help manage diabetes.

5 Conclusion and recommendations

The glycemic index, which is commonly reported as a percentage of the GR of a reference item, such as glucose or white bread (29), is a measure of how well a food, responds to glucose; GI = (AUC test food/ AUC reference food) × 100 The GI system classifies carbohydrate-containing foods into categories based on their glycemic response. As a result, the slower the rate of carbohydrate absorption, the lower the blood glucose rise and the lower the GI rating (30). Food's GI values are divided into three categories: high (GI value > 70), medium (GI value 56-69), and low (GI value 55) (31). According to these findings, we can manually place score the foods based on GI on the Jenkins chart which is very important in addressing diet and diabetes (Fig 5).

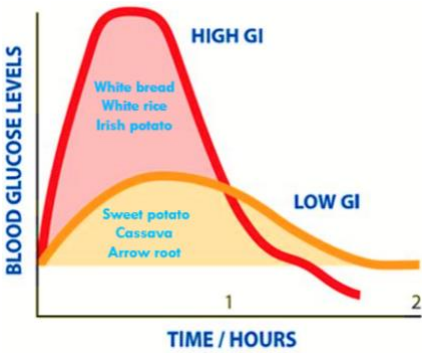

Figure 5. Glycemic index chart with the foods studied.

The following recommendations will be useful in the utilization of the glycemic index concept in the management of diabetes; Nutritionists offering continuous medical management care and support to diabetic patients should be better equipped and acquainted with the glycemic index concept knowledge to facilitate patient uptake of the concept. Incorporation of glycemic index values of locally available food items in food composition tables. Studies on glycemic index concept uptake with a larger sample size in an urban setting in comparison to a rural setting. Studies on how the glycemic index and glycemic load of whole and fine food products compare (wheat and maize). Studies on the impact of hybridization of food items on their glycemic index. Further research with a larger sample size to be able to have precision in results.

References

1. Petersmann, A., Müller-Wieland, D., Müller, U. A., Landgraf, R., Nauck, M., Freckmann, G., & Schleicher, E. Definition, classification, and diagnosis of diabetes mellitus. *Expt Clinical Endocrinology Diabetes*, **2019**, 127, S1-S7. doi: 10.1055/a-1018-9078
2. Punthakee, Z., Goldenberg, R., & Katz, P. Definition, classification and diagnosis of diabetes, prediabetes, and metabolic syndrome. *Canad J Diabetes*, **2018**, 42, S10-S15. 10.1016/j.jcjd.2017.10.003
3. Good, C.B, Kolb NR, Meyer M. World Health Organization Guidelines on Medicines for Diabetes Treatment Intensification. *Ann Intern Med.* **2019,** 16;170:583. doi: 10.7326/L19-0068
4. Gregg, E.W, Buckley J, Ali MK, Davies J, Flood D, Mehta R, Griffiths B, Lim LL, Manne-Goehler J, Pearson-Stuttard J, Tandon N, Roglic G, Slama S, Shaw JE; Global Health and Population Project on Access to Care for Cardiometabolic Diseases. Improving health outcomes of people with diabetes: target setting for the WHO Global Diabetes Compact. Lancet. **2023**, 401(10384):1302-1312. doi: 10.1016/S0140-6736(23)00001-6
5. Zilbermint, Mihail. "Diabetes and climate change." *J Community Hospital Internal Medicine Perspectives*, 10,5 409-412. 3 2020, doi:10.1080/20009666.2020.1791027
6. Saeedi, P., Petersohn, I., Salpea, P., Malanda, B., Karuranga, S., Unwin, N., Colagiuri, S., Guariguata, L., Motala, A. A., Ogurtsova, K., Shaw, J. E., Bright, D., Williams, R., & IDF Diabetes Atlas Committee (2019). Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. Diabetes research and clinical practice, 157, 107843. https://doi.org/10.1016/j.diabres.2019.107843
7. Sami W, Ansari T, Butt NS, Hamid MRA. Effect of diet on type 2 diabetes mellitus: A review. *Int J Health Sci* (Qassim). 2017;11(2):65-71.
8. Franz, M. J., Boucher, J. L., & Evert, A. B. (2014). Evidence-based diabetes nutrition therapy recommendations are effective: the key is individualization. Diabetes, metabolic syndrome, and obesity: targets and therapy, 7, 65–72. https://doi.org/10.2147/DMSO.S45140
9. Ojo O, Ojo OO, Adebowale F, Wang XH. The Effect of Dietary Glycaemic Index on Glycaemia in Patients with Type 2 Diabetes: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. Nutrients. 2018 Mar 19;10(3):373. doi: 10.3390/nu10030373.
10. Chiu, C. J., & Taylor, A. (2011). Dietary hyperglycemia, glycemic index, and metabolic retinal diseases. Progress in retinal and eye research, 30(1), 18-53.
11. Chang, K. T., Lampe, J. W., Schwarz, Y., Breymeyer, K. L., Noar, K. A., Song, X., & Neuhouser, M. L. (2012). Low glycaemic load experimental diet more satiating than high glycaemic load diet.
12. Vinoy S, Goletzke J, Rakhshandehroo M, Schweitzer L, Flourakis M, Körner A, Alexy U, van Schothorst EM, Ceriello A, Zakrzewski-Fruer JK, Buyken A. Health relevance of lowering postprandial glycaemia in the pediatric population through diet': results from a multistakeholder workshop. Eur J Nutr. 2023 Apr;62(3):1093-1107. doi: 10.1007/s00394-022-03047-y. Epub 2022 Dec 19. PMID: 36534178; PMCID: PMC10030539.
13. Jenkins, D. J., Wolever, T. M., Taylor, R. H., Barker, H., Fielden, H., Baldwin, J. M., … & Goff, D. V. (1981). Glycaemic index of foods: a physiological basis for carbohydrate exchange. The American journal of clinical nutrition, 34(3), 362-366.
14. Foster-Powell, Atkinson, F. S., K., & Brand-Miller, J. C. (2008). International tables of glycaemic index and glycaemic load values: 2008. Diabetes care, 31(12), 2281-2283.

15. J. H. (2021). The Glycaemic Index of Food-Should It Be Gender Specific? Current Research in Nutrition and Food Science Journal, 9(1).
16. Leitner, Deborah R et al. "Obesity and Type 2 Diabetes: Two Diseases with a Need for Combined Treatment Strategies - EASO Can Lead the Way." Obesity facts vol. 10,5 (2017): 483-492. doi:10.1159/000480525
17. Veit, Meike et al. "The role of dietary sugars, overweight, and obesity in type 2 diabetes mellitus: a narrative review." European journal of clinical nutrition vol. 76,11 (2022): 1497-1501. doi:10.1038/s41430-022-01114-5
18. Marrero, D.G et al. "Nutrition management of type 2 diabetes by primary care physicians: reported use and barriers." Journal of General Internal Medicine vol. 15,11 (2000): 818-21. doi:10.1046/j.1525-1497. 2000.t01-1-90907.x
19. Viguiliouk, E., Nishi, S. K., Wolever, T. M., & Sievenpiper, J. L. (2018). Point: Glycaemic Index—An important but oft misunderstood marker of carbohydrate quality. Cereal Foods World, 63(4), 158-164.
20. Brand-Miller, J., Hayne, S., Petocz, P., & Colagiuri, S. (2003). Low–glycaemic index diets in the management of diabetes: a meta-analysis of randomized controlled trials. Diabetes care, 26(8), 22612267.
21. Henry, C. J. K., & Thondre, P. S. (2011). The glycaemic index: concept, recent developments and its impact on diabetes and obesity. Smith Gordon, 15(2), 154-75.
22. Lambadiari V, Korakas E, Tsimihodimos V. The Impact of Dietary Glycemic Index and Glycemic Load on Postprandial Lipid Kinetics, Dyslipidemia and Cardiovascular Risk. Nutrients. 2020; 12(8):2204. https://doi.org/10.3390/nu12082204
23. Thomas, D. E., & Elliott, E. J. (2010). The use of low-glycaemic index diets in diabetes control. British journal of nutrition, 104(6), 797-802.
24. Yusof, B. N. M., Talib, R. A., Kamaruddin, N. A., Karim, N. A., Chinna, K., & Gilbertson, H. (2009). A low-GI diet is associated with a short-term improvement of glycaemic control in Asian patients with type 2 diabetes. Diabetes, Obesity and Metabolism, 11(4), 387-396.
25. Eldakhakhny, B. M., Alamoudi, A. A., Binmahfooz, S. K., Alamoudi, S. A., Akshawi, M. E., & Linjawi,
26. Gulliford, M. C., Bicknell, E. J., & Scarpello, J. H. (1989). Differential effect of protein and fat ingestion on blood glucose responses to high-and low-glycaemic-index carbohydrates in
27. Wolever, T.M.S et al. "Effect of ethnicity on glycaemic index: a systematic review and meta-analysis." Nutrition & diabetes vol. 5,7 e170. 13 Jul. 2015, doi:10.1038/nutd.2015.21
28. Chan, H. M. S., Brand-Miller, J. C., Holt, S. H. A., Wilson, D., Rozman, M., & Petocz, P. (2001). The glycaemic index values of Vietnamese foods. European journal of clinical nutrition, 55(12), 1076- 1083.
29. Salmeron, J., Manson, J. E., Stampfer, M. J., Colditz, G. A., Wing, A. L., & Willett, W. C. (1997). Dietary fibre, glycaemic load, and risk of none—insulin-dependent diabetes mellitus in women. Jama, 277(6), 472-477.
30. Mann, J.I., De Leeuw I, Hermansen K, Karamanos B, Karlström B, Katsilambros N, Riccardi G, Rivellese AA, Rizkalla S, Slama G, Toeller M, Uusitupa M, Vessby B; Diabetes and Nutrition Study Group (DNSG) of the European Association. Evidence-based nutritional approaches to the treatment and prevention of diabetes mellitus. *Nutr Metab Cardiovasc Dis*. **2004**, 14(6):373-94. doi: 10.1016/s0939-4753(04)80028-0. PMID: 15853122.

© 2023 by the authors. Submitted for possible open-access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).