



## Diabetes in Ethnic Minorities in UK: The Role of Diet in Glucose Dysregulation and Prevalence of Diabetes

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### Abstract

The aims of this paper are to evaluate the prevalence of diabetes among ethnic minority groups living in UK including Africans, Afro-Caribbeans and people from South Asia and to discuss the role of diet in glucose dysregulation and the prevalence of diabetes.

People of African and Caribbean descent are two to four times likely to have diabetes than those of European ancestry. In addition, while the prevalence of diabetes is 3-10% among Europeans, it is 14-20% among Arab, migrant South Asian and Chinese populations.

The higher prevalence of obesity, lack of physical activity, tobacco use and unhealthy diet are some of the notable risk factors contributing to the development of diabetes. Ethnic minority groups who have experienced malnutrition in early life in their countries of origin and now exposed to Western lifestyle are at increased risk of glucose dysregulation and development of type 2 diabetes. Also, an inherited lower percentage of skeletal muscle fibre type 1 found in Black people of West African origin may explain the lower fat oxidation and lower resting energy expenditure found in Blacks compared to Whites and these can lead to obesity and type 2 diabetes.

The role of diet in the management of diabetes is very important. The correlations between Glycaemic Index (GI) or Glycaemic Load (GL) of foods and long term conditions are mixed. Therefore, more research is required in establishing the relationships between GI and GL of ethnic minority foods in the UK and diabetes. On the other hand, special diets such as Mediterranean diet, High Carbohydrate Low Fat (HCLF) diet and Low Carbohydrate High Protein (LCHP) diets can help in reducing weight and diabetes by increasing sensitivity of insulin. The practical ways of reducing energy intake and sugar in foods are outlined.

### Keywords

Diabetes; Diet; Glycaemic index; Glycaemic load; Ethnic minorities; Africans in diaspora; Glucose dysregulation; Special diets; Prevalence

### Introduction

The aims of this review paper are to examine the prevalence of diabetes in ethnic minority groups living in the UK and to outline the role of diet in glucose dysregulation and the management of diabetes. About 9% of the UK population representing about 4.5 million people in England is of ethnic minority groups. These communities which include people of South Asian, African-Caribbean, black African and Chinese descents are at greater risk of developing type 2 diabetes [1]. Based on 2001 census, the main ethnic/racial groups in UK general population are Whites (92%), Asians (4%) and Blacks (2%). The majority of Asians are from India, Pakistan and Bangladesh [2]. The net migration which is the difference between long term migration into and out of UK represented about 48% of the UK growth. Net international migration was 230,000 in the year to mid-2010, 54,000 more than the previous year and 87,000 more than in the year of mid-2002 [3].

Although the total cost of type 2 diabetes to the UK economy is unknown, estimates of 7-12% of the total National Health Service (NHS) budget, suggesting a £2.8 billion associated cost for the UK in 2007 has been reported [4].

The prevalence of diabetes is on the increase around the world and variations exist between populations due to differences in genetic susceptibility and the influence of the environment [5,6]. People from developing countries, disadvantaged groups and minority groups who live in Europe and America are at increased risk of developing type 2 diabetes and identifying them will enable strategies to be put in place to alleviate the condition [5]. The increasing prevalence of diabetes in the UK has been linked to the higher prevalence of obesity, lack of physical activity, unhealthy diet and the increased longevity of those diagnosed due to improvement in technology and development of knowledge [4,7]. Diabetes prevalence increased from 2.8% in 1996 to 4.3% in 2005 in UK [8].

The increasing population of older adults amongst African and Caribbean people contributes to this situation [9]. For example, twenty to twenty five years after the mass migration of many Africans especially Nigerians to the UK with better economic variables, the effects of these factors on Africans living there have become evident. Most of these Nigerians who were in their twenties and thirties when they emigrated in the late 1980s and 1990s are now in their forties and fifties [10]. The effect of aging on health status is well documented. The pattern of work and the environmental conditions especially during winter create minimal room for individuals to engage in outdoor physical activities.

Language barrier, length of time in the country of residence and immigration status amongst Ethnic Minority Groups living in UK are some of the factors limiting accessibility to diabetes healthcare services although the availability of the NHS strives to bridge the gap of inequitable access to diabetes health service [9].

According to Alberti and Zimmet [11], Diabetes mellitus is a metabolic disorder of multiple etiology characterized by chronic

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hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both.

Although the main types of diabetes are type 1, type 2 and gestational diabetes, about 85-90% of all diabetes are type 2 [4]. It is now clear that the development of hyperglycaemia in diabetes results from the failure of the  $\beta$ -cells of the pancreas to produce insulin (type 1 diabetes) or sufficient insulin (type 2 diabetes) [6,12]. There is evidence that hyperglycaemia can also result from the failure of insulin to exert its biological influence at the level of the liver and the muscle in order to facilitate the diffusion of glucose into the cells to be used for energy, stored as glycogen or fat. Thus, a combination of lack of insulin or poor insulin secretion resulting from  $\beta$ -cell dysfunction and/or insulin resistance can lead to glucose dysregulation and hyperglycaemia [10]. The actions of the counter regulatory hormones such as adrenaline, cortisol and glucagon in counteracting the action of insulin in diabetes have been the subject of intense studies [13]. For example, during stress the body releases stress hormones such as catecholamines which are counter regulatory hormones to the action of insulin. The role of stress-response resulting from the socio-economic status of ethnic minority groups and its relationship to the development of type 2 diabetes has been reported [14].

Perhaps, it will also be useful to understand the pathophysiology of prediabetes defined by the presence of impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) as this will be helpful in developing interventions to prevent its progression to type 2 diabetes, although not all prediabetes develop to type 2 diabetes. While IFG has fasting plasma glucose  $>5.5$  mmol/L to  $<7.0$  mmol/L, IGT on the other hand is in the range of  $>7.8$  mmol/L to  $<11.1$  mmol/L following a 2 hour oral glucose tolerance test and both define the extent of glucose dysregulation between the range of normoglycaemia and type 2 diabetes [15].

In particular, IFG relates mostly to deficits in first-phase insulin response, normal muscle insulin sensitivity and hepatic insulin resistance. However, OGT results primarily from deficits in early and late phase insulin secretion, smaller increase in hepatic insulin resistance, but larger muscle insulin resistance [15].

The clinical features of diabetes include chronic hyperglycaemia, weight loss, blurred vision and polyuria (excessive urination), polydipsia (thirst) and polyphagia (craving for food) while the risk of developing long term complications such as retinopathy, nephropathy, stroke and neuropathy is often higher among ethnic minority groups compared to Europeans [6,9,13].

## Literature Search

A range of search terms including diabetes, glycaemic index, and glycaemic load were combined with others words to identify relevant studies. Thus, combinations such as diabetes and ethnicity, diabetes prevalence in the UK, diabetes and Africans in diaspora, ethnic minorities and diabetes in the UK, diet and diabetes, glycaemic index of food, glycaemic load of food, glucose dysregulation were used to search for useful studies. A number of databases such as EBSCOhost Research databases, PubMed, Health Research databases covering Academic Search Premier, Medline, Psychology and Behavioural Science Collection and CINAHL Plus, and SwetsWise databases were

used to identify relevant literature. Only studies published in English and after 2000 were considered for inclusion except a few research studies which were published earlier and included because these were critical to the review paper.

## Risk Factors for Diabetes in Ethnic Minorities in the UK

Factors such as unhealthy dietary regime, tobacco use, harmful alcohol, lack of physical activity, harmful lifestyle and poor physiological adaptation due to climatic variation are some of the notable risk factors contributing to the development of diabetes among ethnic minority groups [10,16]. However, the best predictors of diabetes include obesity, body mass index (BMI), random blood sugar test, sibling with diabetes and presence of diagnosed hypertension or ischaemic heart disease. In addition, those at the lower end of socio-economic ladder are also at increased risk of developing Type 2 diabetes [5].

Various hypotheses have been put forward in an attempt to explain the higher prevalence of diabetes among some ethnic minority group in UK. The "Barker hypothesis" relating to the fetal origin of long term conditions including diabetes may apply to ethnic minority groups living in UK- especially with respect to early childhood malnutrition leading to permanent changes in the way the body functions. The changes in glucose – insulin metabolism has been reported to reduce insulin secretion and increase insulin resistance and in combination with age and other lifestyle factors can increase the risk of type 2 diabetes among ethnic minority groups. Ethnic minority groups who are likely to have experienced nutritional deficits in early life in their countries of origin and now have access to Western lifestyle are at increased risk of developing type 2 diabetes leading to glucose derangement [14].

The intake of traditional diets amongst ethnic minority groups in the UK may change due to acculturation which could increase the risk of chronic diseases including diabetes. This condition can be exacerbated due to a rapid gain in fatness (catch-up growth) especially in early life. This is often evident in countries undergoing rapid economic and nutritional transition or when people migrate from less developed countries to developed ones, where early nutritional deficit is compensated for by nutritional abundance in later life [17].

It is possible that second generation offspring of former migrants may adopt poor dietary patterns and less physical activity than their parents which could increase the risk of diabetes [17].

The findings of Mckeigue et al. [18] suggest that the etiology of type 2 diabetes may be different in Afro-Caribbeans compared with South Asians. High waist-hip girth ratios, high trunk skinfolds and central obesity are major risk factors contributing to high prevalence of diabetes in South Asians. According to NICE [19], South Asians appear to have a higher percentage of body fat at a given BMI and a greater risk of developing type 2 diabetes than Europeans. This has led WHO to suggest that  $23-27.4$  kg/m<sup>2</sup> and  $27.5-32.4$  kg/m<sup>2</sup> should be used to identify people within different Asian populations who may be at risk of health conditions due to their weight.

In a study conducted by Chege [20] in Kenya, childhood starvation were found to predispose individuals to type 2 diabetes. In addition, family history of diabetes in first degree relative presents a risk that more than double in this population. These findings seem

to be in line with the 1000 days campaign aimed at improving the nutrition of mothers and children in developing countries including Africa and the Caribbean [21]. Hanson et al. [21] concluded that the long term consequences of poor start to life involves greater risk of non communicable diseases including diabetes.

According to Luke et al. [22], evidence appear to show an increase in the percentage of energy derived from fat and also significant increase in the consumption of refined foods and meat products as one moves from West Africa, to the Caribbean, to the USA and the UK. These food patterns are known to increase the risk of developing type 2 diabetes. This may explain the differences in the prevalence of diabetes between Africans on the continent and those in the UK and diaspora. The differences may also be accounted for by poor treatment of patients with diabetes living in Africa and the resulting high mortality.

Lean Blacks from West Africa who are physically inactive have been reported to have a lower percentage of skeletal muscle fibre type I and a higher percentage of type IIA fibres compared to White Canadians. In addition, an inherited lower percentage of skeletal muscle fibre type I in Black people of West African origin explains the lower oxidative enzyme activity as well as lower resting metabolic rate, resting energy expenditure found in Blacks compared to Whites and these can lead to obesity and type 2 diabetes [12].

Obesity is a major risk factor for the development of coronary heart disease and diabetes [23]. Obesity especially large abdominal fat, genetic constitution of the individual, ethnicity and age are some of the factors contributing to insulin resistance in type 2 diabetes [4]. Therefore, Africans in diaspora who are over forty years of age, who are overweight and obese, eat unhealthy diets and do not engage in physical activities are at an increased risk of developing chronic hyperglycemia leading to type 2 diabetes [10,16].

Other factors such as waist circumference, family history and previous history of gestational diabetes have been outlined as being the risk factors for the development of type 2 diabetes [24]. For example, men are at high risk if they have a waist circumference of 94-102 cm (37-40 inches) while women are at high risk if they have a waist circumference of 80-88 cm (31.5-35 inches) [24].

### Prevalence of Diabetes amongst Ethnic Minority Groups in UK

The prevalence of diabetes and other non-communicable diseases is on the increase worldwide. According to the Secretary General of United Nations, 36 million people died from non-communicable diseases, representing 63% of the 57 million global deaths in 2008. It is projected that up to 52 million people will die from non-communicable diseases in 2030 [16]. It is estimated that diabetes prevalence will increase from 171 million in 2000 to 366 million in 2030 [15].

At the 66<sup>th</sup> session of the United Nations General Assembly in 2011, the Prevention and Control of Non-communicable diseases, namely; cardiovascular diseases, diabetes, cancers and chronic respiratory diseases came up for discussion. The Secretary General's account based on the World Health Organisation Global status Report on Non-communicable disease 2010 noted the increase in non-communicable diseases worldwide and revealed that these were responsible for more deaths than all other causes combined [10,16].

The prevalence of diabetes in people of African and Caribbean descent is two to four times higher than those of European ancestry [9,25]. In addition, while the prevalence of diabetes among Europeans range from 3-10%, it is 14-20% among Arab, migrant South Asian, Chinese and Hispanic American populations [5]. Among South Asians, the prevalence of diabetes is high in their country of origin and in UK (11-20%) with a higher risk of complications compared to White Europeans [5].

With respect to gestational diabetes, this is more common in ethnic minority groups especially those from the Indian subcontinent with risk of this developing to type 2 diabetes. It is estimated that about 70% of women with gestational diabetes may develop type 2 diabetes within 5-10 years of the pregnancy and the children are at increased risk of developing diabetes [14].

The prevalence of diabetes in the UK general population for people aged 17+ based on the Quality and Outcomes Framework (QOF) data is outlined in table 1 [26].

These figures differ significantly from earlier data on the prevalence of diabetes in ethnic minority groups in the UK based on the work by McKeigue et al. [18] (Table 2) and the prevalence of doctor -diagnosed diabetes (Table 3) [4]. Table 4 outlines the

**Table 1:** Diabetes prevalence (2012) in the UK general population [26].

Country	Prevalence %	Number of people
England	5.8	2,566,436
Northern Ireland	4.0	75,837
Scotland	4.4	234,871
Wales	5.3	167,537

UK average=4.6%

**Note:** The UK prevalence reported here has been calculated using the total sum of list sizes for all practices, including all ages, as a denominator.

**Table 2:** Diabetes prevalence and anthropometric parameters (40-69 years) [18]

	Men			Women	
	European	South Asian	Afro-Caribbean	European	South Asian
Diabetes Prevalence%	4.8	19.6	14.6	2.3	16.1
Body Mass Index (kg/m <sup>2</sup> )	25.9	25.7	26.3	25.2	27.0
Waist-Hip Circumference Ratio	0.94	0.98	0.94	0.76	0.85

**Table 3:** The prevalence of doctor-diagnosed diabetes [4].

	Men (≥ 55 years)	Women (≥ 55 years)
General Population %	4.3	3.4
Black Caribbean	10.0	8.4
Black Africa	5.0	2.1
Indian	10.1	5.9
Pakistani	7.3	8.6
Bangladeshi	8.2	5.2
Chinese	3.8	3.3
Irish	3.6	2.3

**Table 4:** Regional estimates for diabetes (20-79 years), 2011 and 2030 [27].

	2011	2011	2011	2030	2030	2030
	Population millions	No of people with diabetes millions	Comparative diabetes prevalence%	Population millions	No of people with diabetes millions	Comparative diabetes prevalence%
Africa	387	14.7	4.5	658	28.0	4.9
Europe	653	52.8	6.7	673	64.2	6.9
Middle East and North Africa	356	32.6	11.0	539	59.7	11.3
North America and Caribbean	322	37.7	10.7	386	51.2	11.2
South and Central America	289	25.1	9.2	376	39.9	9.4
South East Asia	856	71.4	9.2	1,188	120.9	10.0
Western Pacific	1,544	131.9	8.3	1,766	187.9	8.5
<b>World</b>	<b>4,407</b>	<b>366.2</b>	<b>8.5</b>	<b>5,586</b>	<b>551.8</b>	<b>8.9</b>

prevalence of diabetes in these ethnic minority groups in their countries of origin based on the International Diabetes Federation (IDF) Diabetes Atlas [27]. Hanif et al. [5] reported prevalence values of between 11 and 20% in diabetes prevalence amongst South Asians living in the UK. Differences observed between the McKeigue et al. [18] study (Table 2) and the IDF data (Table 4) may be due to variations in method of calculating prevalence, year of study and/or the effects of acculturation following migration to an economically advanced country.

### The Possible Role of Diet in Glucose Dysregulation and Development of Diabetes among Ethnic Minority Groups Living in UK

The effect of diet in the development of diabetes and other long term conditions have been the subject of intense research [28,29]. With reference to ethnic minority groups living in UK, the impact of diet in glucose dysregulation and on the occurrence of diabetes can be looked at from the following perspectives;

- Glycaemic Index and Glycaemic Load
- Conventional diets
- Special diets

#### Glycaemic index (GI) and Glycaemic load (GL)

The GI relates to the physiological effects of carbohydrates in foods and it is an indicator of how much carbohydrate can assist in the prevention of lifestyle related diseases such as diabetes [30]. The GI of a food is a measure of how soon glucose reaches the bloodstream following the intake of food [31]. In other words, it is a measure of glycaemic response after carbohydrate is ingested and groups food based on its acute glycaemic effect [30,32]. The approach to calculating the glycaemic index of mixed meals or diets has been outlined [33].

Glycaemic Index (GI) is a measure of the average quality of carbohydrates consumed in terms of glycaemic response [34]. On the other hand, the Glycaemic Load (GL) shows the overall glycaemic effect of a specific amount of food item. It is calculated by multiplying the GI of a food with its carbohydrates amount (in grams) divided by 100 [34,35]. The GL is a measure of both the quality and quantity

of carbohydrate [34]. According to Hare-Bruun et al. [35], the associations between GI or GL and long term conditions including diabetes are mixed. However, high dietary GL or GI have been shown to be associated with high risk of diabetes especially after excluding energy misreporting [34].

Foods with low GI such as porridge, beans and lentils are digested slowly and therefore the glucose does not enter the bloodstream quickly compared with high GI foods such as Hovis bread, Instant mashed potato and Kelloggs' cornflakes which break down quickly during digestion [32,36]. The digestibility of the carbohydrate in low GI foods is less than that of high GI foods, and low GI foods increase the amount of carbohydrate entering the colon with increased fermentation and production of short chain fatty acid [33].

Widanagamage et al. [32] noted that long term use of foods with high GI place a higher metabolic demand in terms of higher insulin requirement on the body with a potential to lead to insulin resistance and type 2 diabetes, obesity and cardiovascular diseases. GI values of foods vary from one country to the other due to local factors such as variety, cooking and processing. Although reference foods for GI include glucose and white bread, the various carbohydrate rich foods can be grouped based on their GI [37].

- High GI foods have GI value  $\geq 70$
- Medium GI values are from 55 to 70
- Low GI foods have GI value  $\leq 55$

Although the FAO/WHO [33] suggested that specific local foods should be included in such lists where information is available (e.g. green bananas in the Caribbean and specific rice varieties in Southeast Asia), evidence from literature has shown that not much has been done in this area with respect to ethnic minority groups living in UK. Another issue that arises from the above is whether ethnic minority groups are aware of the GI and GL of the staple foods they eat and the GI categories of their foods. As stated previously, language barrier, length of time in the country of residence and immigration status limit their access to information in UK [9,14].

There are some macronutritional factors that significantly reduce the GI of foods including dietary fibre, protein and fat. The GI of foods also depend on: botanical source of the carbohydrate, nature of carbohydrate (i.e. monosaccharide, disaccharide or polysaccharide);

physical and chemical structure of starch (amylose and amylopectin); processing method; particle size of the food; acidity (i.e. lactic acid); antinutrients (i.e. phytic acid, polyphenols, lectins and tannins); polyols (i.e. sorbitol, mannitol, xylitol and maltitol) and resistant starch content of foods [32]. The GI values of foods are influenced by body composition amongst Asians and Caucasian subjects [38].

The physiologic and therapeutic effects of low GI foods include a reduction in both postprandial blood glucose and insulin responses. In addition, some studies have shown low GI diet is associated with reduced risk of developing type 2 diabetes. Similarly, clinical trials in normal, diabetic and hyperlipidemic subjects reveal that low GI diets reduce mean blood glucose concentrations, reduce insulin secretion and reduce serum triglycerides in individuals with hypertriglyceridemia [33]. In a study by Ayodele and Godwin [39], processed plantain meal which is a common staple food among Africans in diaspora caused low postprandial rise of blood glucose and was recommended for use in the diets of diabetics although roasted plantain provided the lowest GI and the value was significantly lower than other test diets.

### Conventional diets

There is evidence from literature that diabetes is preventable through lifestyle change [29]. The over reliance on fast foods which are not healthy diets by ethnic minority groups in UK has its effect on weight gain. These unhealthy foods are often much cheaper than the healthy foods such as fruits and vegetables although savings from eating cheaper unhealthy foods will no doubt increase the amount of remittance to their countries of origin. However, most of these unhealthy foods are rich in saturated fatty acids and low in mono-unsaturated and poly-unsaturated fatty acids. Even for most Africans who eat the traditional foods such as pounded yam (local staple food) have to consider the significance of the foods in terms of their nutritional value and the size of portions served. Large portion sizes of pounded yam are not necessarily helpful when striving to reduce the risk of diabetes. Thus, a combination of unhealthy dietary intake and lack of physical activity can lead to excessive weight gain and obesity in ethnic minority groups living in the UK [10].

Diet can play a significant role in the management of obesity and associated problems such as diabetes and hypertension. Some of the traditional African-Caribbean foods include hard dough, plantain, yam, breadfruit, cassava, sweet potato and salted fish [40]. Amongst Black Caribbean, UK-born generation consume less traditional foods, fruits and vegetables and more saturated fats than the Caribbean born subjects [25]. The practical ways of reducing energy intake include reducing the portion size of starchy foods such as yam, plantain, gari (processed cassava), and pounded yam. In addition, the following strategies may be useful [40];

- Boil plantain instead of frying it.
- Use semi-skimmed milk in place of whole milk.
- Fry fish with very little oil. Less of palm oil and more of the use olive oil.
- Use low fat spreads
- Practical ways to reduce sugar in food include;
- Reducing sugar added to tea and/or cereal.

- Reducing the amount of condensed milk.
- Cutting down on nourishment/nutrient

The UN [16] observed that the government and non-governmental organisations can assist in reducing the risk factors for diabetes and other non-communicable diseases through strategies and interventions that can improve diet. New methods of processing food can be developed to ensure reduction in salt, trans fat and saturated fat content of these foods. In addition, a review of trade, taxation and subsidy policy can enhance the availability and accessibility of healthy lifestyle options including availability of fruits, vegetables and unsaturated fats. Interventions such as the Diabetes Prevention Programme (DPP) and the Finnish Diabetes Study have shown significant reductions in the progression of the disease to type 2 diabetes in patients with IGT [5].

Wyness [31] offered some dietary recommendations aimed at reducing the risk of diabetes including, reduction in fat intake by ensuring that total fat intake is less than 35%, and for individuals who are overweight, total fat intake should be less than 30% of energy. In addition, saturated fat intake should be less than 10% of energy intake [31]. Decreased use of butter, removal of the skin from chicken or fatback in cooked vegetables may significantly decrease BMI and reduce diabetes risk. Healthy dietary lessons should include how to remove the skin of chicken before and after cooking [41].

In terms of non starch polysaccharides, this should be increased to more than 40 g per day, about half of which should be soluble fibre. It is thought that a reduced fat intake (particularly saturated fat) may lower the risk of diabetes by promoting weight loss and improving insulin sensitivity. Also, foods rich in vegetable oils, including non-hydrogenated margarines, nuts and seeds should replace foods rich in saturated fats from foods such as fatty meats, cream and butter [31].

### Special diets in diabetes

Special diets such as Mediterranean diet, High Carbohydrate Low Fat (HCLF) and Low Carbohydrate High Protein (LCHP) diets can help in reducing weight and diabetes by increasing sensitivity of insulin. Mediterranean diets have high proportion of monounsaturated fat, are rich in vegetables and whole grains, include fish and dairy components in small amounts, wine is taken in moderation with meals while red meat and poultry are consumed occasionally [28,29]. The major fat in the Mediterranean diet is olive oil which is rich in monounsaturated acid and beneficial phenolic compounds [29].

Esposito et al. [28] compared low-carbohydrate, Mediterranean-style diet with a low-fat diet (rich in whole grains and restricted additional fats, sweets, and high-fat snacks) in people with newly diagnosed type 2 diabetes and found that the Mediterranean diet delayed the need for antihyperglycemic drug therapy. The researchers also found Mediterranean-style diet seems to be preferable to a low-fat diet for glycemic control in patients with newly diagnosed type 2 diabetes.

HCLF diets are related to low diabetes-related mortality and low prevalence of diabetes [29]. According to Walker et al. [29] carbohydrate foods for HCLF diets should include mainly whole grain cereal foods and other sources of fibre-rich complex carbohydrates, particularly those of low glycaemic index. The use of refined carbohydrates should be avoided due to the fact that foods

high in fructose or sucrose can increase liver and serum triglyceride concentrations and may promote visceral obesity and insulin resistance.

On the other hand, LCHP diet has been shown to promote weight loss than HCLF diet over a 6 month period. The effect of LCHP diet may be due to the satiating nature of dietary protein or relate to the increased thermogenesis and energy expenditure associated with protein consumption. However, the concern on the use of LCHP diets may be the possibility of increasing the dietary intake of saturated fat due to the level of consumption of animal protein [29].

“Bubi” diets which include higher consumption of fish, fruits, vegetables, legumes, dairy products, mono-unsaturated fat and bread have been shown to be protective. However, the drawback in the diet is with respect to sugar, cholesterol, omega-3 fatty acids and fibre [42].

## Conclusion

The prevalence of diabetes among ethnic minority groups living in UK including Africans, Afro-Caribbeans and people from South Asia is significantly higher than those of European ancestry. Genetic predisposition, obesity especially abdominal obesity, lack of physical activity and unhealthy dietary choices are some of the risk factors leading to this development. In addition, the lack of equitable access to diabetes health information due to immigration status and communication difficulties including language barrier also contribute to disparity in the prevalence of diabetes.

The role of diet is particularly significant in the management of diabetes. While the relationships between GI or GL of foods and long term conditions including diabetes are mixed, some evidence show that long term use of foods with high GI can increase insulin requirement and this can lead to type 2 diabetes. However, more research is needed in order to unravel the correlations between GI and GL of foods of ethnic minority groups in the UK and diabetes. In addition, Mediterranean diet, High Carbohydrate Low Fat (HCLF) and Low Carbohydrate High Protein (LCHP) diets can help weight reduction and enhance sensitivity of insulin.

Ensuring intake of healthy and balanced diet, increased physical activity and eliminating harmful tobacco and alcohol use are some of the approaches to enabling good nutritional and health status.

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