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# Managing Diabetes and its Complications Through Traditional African Dietary Intervention

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**ABSTRACT**

Diabetes mellitus was a rare disease in Africa. However, Africa is now emerging as one of the most rapid epidemiological transitions of non-communicable diseases and especially diabetes, overwhelming to Africa's health care systems. A decade back, the prevalence of diabetes Mellitus in Rural Sub-Saharan Africa was 0-2.2% and that of for Urban Sub Saharan Africa, 2.2-6.7%. Insulin and other hypoglycemic drugs are expensive. The improvement of many African economies into middle-income status is associated with an increasingly sedentary lifestyle and increased prevalence of diabetes. Many of the traditional dietary preparation known to ameliorate diabetes and other chronic diseases have been abandoned for westernized foods. Reverting to original/traditional diets may be an answer to addressing the diabetes pandemics. Free fatty acids have been reported to impair insulin action, Dietary fat composition has been implicated in the development of insulin resistance as well as fasting hyperglycaemia and type 2 diabetes mellitus. This study has shown the benefits of consuming vegetable oils on the management of diabetes in diabetic mice. Diet fortified with non-refined red palm oil, (*Elaeis guineensis*), groundnut oil (*Arachis hypogaea*) and coconut oil (*Cocos nucifera*) have been shown to have a hypoglycemic effect. Insulin and other hypoglycaemic drugs are expensive. A paradigm shift, back to traditional diets using these vegetables and vegetable oils in appropriate proportions and good calorific value would help to reduce the requirement of insulin and other hypoglycemic drugs.

**KEYWORDS**

Hypoglycemia, hyperglycemia, cholesterol, vegetable oil, dietary, lipid profile, diabetes mellitus

## INTRODUCTION

Diabetes is a metabolic disorder characterized by chronic hyperglycemia and alterations in carbohydrate, protein and lipid metabolism with absolute or relative deficiencies in insulin sensitivity, secretion and/or insulin production[1].

Diabetes was once a rare disease in Africa. But now Africa is emerging as one of the most rapid epidemiological transitions in non-communicable diseases and especially diabetes, overwhelming to Africa's health care systems. The sudden epidemiological increase in non-communicable diseases is not equated by resources. A decade ago, the prevalence of diabetes mellitus in Rural Sub-Saharan Africa was put at 0-2.2% and that of Urban Sub-Saharan Africa, at 2.2-6.7%[2]. There is no national data on diabetes prevalence in Ghana. Amoah *et al.*[3], put a crude prevalence at 6%.

In most African countries, conventional drugs for treating diabetes are very expensive. The large populace normally found in the rural areas cannot afford these antidiabetic medications and therefore depend on herbal medicines[4]. Complications of poorly managed diabetes lead to a loss in quality of life due to associated conditions of mobility, mortality obesity, retinopathy, nephropathy and cardiovascular diseases[5]. There is an associated loss in economic growth as a result of the loss of the labor of both the patients and the caretaker[6].

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The sudden rise in the prevalence of diabetes is associated with lifestyle changes. Ghana is now recorded as a middle-income country as a result of the improvement in the national economy, improved transportation and therefore, increased sedentary lifestyle and or lack of exercise[7]. There is also a paradigm shift from the consumption of traditional foods to westernized energy-rich fast foods resulting in an increased calorific intake, a recipe for overweight and obesity. For example, many 'educated' and affluent people patronize processed and fast foods as a symbol of middle-class status at the expense of traditional food. Also, the working class finds it time-saving and convenient to consume processed and semi-processed foods whose preparation takes a shorter time and lesser energy than traditional foods.

Most traditional African foods prepared from plant barks, fruits and vegetables shunned by many city dwellers and the 'educated' seem to provide answers for the control of diabetes epidemic[8-10]. Ngala *et al.*[11] have shown that 10% composition by weight of vegetable oils (red palm oil, coconut oil and groundnut oil) in food consumption in diabetic mice had a hypoglycemic effect and an improved lipid profile. The incidence of diabetes can therefore be reduced by changes in our dietary lifestyle.

The article is aimed at educating Sub-Saharan Africans with diabetes, on how to manage diabetes at a minimal cost, requiring very little or none of the conventional prohibitive antidiabetic drugs by making use of nutritional intervention of locally/traditional available foods. Attempts are also made to give the scientific explanation/mechanisms by which these foods may induce a hypoglycemic effect.

### Vegetable oils

The commonest vegetable oils consumed in Ghana and most Sub-Saharan African countries include, red palm oil (*Elaeis guineensis*), coconut oil (extracted from the kennel of *Cocos nucifera*) and groundnut oil (extracted from the nuts of (*Arachis hypogaea*). Red palm oil induces its antidiabetic effect through the antioxidant effect of carotenoids, phosphatides, sterols, tocopherols vitamin E, ascorbic and trace metals constituent of the oil and these are effective against oxidative stress in *in vitro* and *in vivo* studies and also possess anti-inflammatory effect[12]. Red palm oil also induces hyperinsulinemia and therefore has a glucose-lowering effect[13]. A reduction in plasma glucose by the consumption of groundnut oil has been reported[14]. It is thought to be mediated through the monounsaturated fatty acids (MUFA) effect. The mechanism by which coconut oil induces hypoglycemia is not well understood, however Ngala *et al.* have shown that the hypoglycemic effect of coconut oil is additive to the effect of glibenclamide, it may therefore have an insulin secretory effect.

### Green vegetables

Green leafy vegetables are extremely nutritious. They have very low calorific value, low in digestible carbohydrates and therefore lower blood sugar levels. Greens vegetables are good sources of antioxidants because of the constituent carotenoids, flavonoids, phosphatides, sterols, tocopherols[10,15], lutein and zeaxanthin minerals, including vitamin C[16]. These antioxidants have muscular degeneration protective effect and lower diabetes complications[17,18]. Studies have shown that vitamin C intake down-regulates inflammatory markers and lower fasting blood sugar levels in people with type 2 diabetes and also lowers blood pressure[19]. The most common vegetables consumed in Africa containing these antioxidants include: 'Kontomere' (Tora leaves: *Xanthosoma mafafa*) green okra, 'Alefu' (Amaranth leaves: *Amaranthus viridis*) 'Ayoyo' (Jute leaves: *Corchorus (Olitorius aestuans*), Bitter leaves (*Vernonia amygdalina*), Cassava leaves, Bean leaves, Moringa Leaves (*Moringa oleifera*), lettuce, cabbage, etc. These vegetables can be prepared into stews, soups or at times cooked and eaten as a meal.

### Proteins

### Egg proteins

There have been controversies on the effect of egg consumption and hypercholesterolemia. Even though an egg contains a high amount of cholesterol, it is usually of the 'good cholesterol' (HDL cholesterol). In most cases, the 'bad cholesterol' (LDL) associated with egg consumption is presumably from the mode of preparation. Fried eggs or eggs mixed with beef tallow may contain bad cholesterol from the oils used in the preparation[17]. Recent research has shown that eggs decrease inflammation, improve insulin sensitivity, increase HDL cholesterol levels and also modify the size and shape of LDL cholesterol into larger, less dense and less atherogenic cholesterol[20]. In one study, people with type 2 diabetes who consumed 2 eggs daily as part of a high-protein diet had improved lipid profile and blood sugar levels[21]. Lutein and zeaxanthin, antioxidants that protect the eyes from the disease are also known to be benefits derived from eating eggs[22].

### Fish

In studies, in an elderly population, the regular consumption of a small amount of fish was found to protect against the development of impaired glucose tolerance and diabetes mellitus[23].

The mechanism by which the intake of fish delays or impairs the development of type 2 diabetes may be attributed to its high content of dietary n-3 polyunsaturated fatty acids, specifically eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Higher EPA and DHA quantities in the phospholipid cell membranes have been shown to increase insulin sensitivity[24]. Indeed EPA and DHA dietary supplementation increased insulin sensitivity in animal models and some human studies[25].

### *Cocoa*

Cocoa is widely grown in Ghana and most of the West African sub-region. It is a major source of export earning for Ghana, Ivory Coast, Nigeria, Cameroon and many other countries. Cocoa is processed into several foods and as food additives including chocolate bars, chocolate drinks, chocolate biscuits, etc. These are usually consumed for recreational and nutritional purposes. Many people hardly consume cocoa products for medicinal benefits.

Polyphenols are secondary metabolites found ubiquitously in coca and other plants. Significant levels of flavanols are found in a variety of dietary plants including tea, apples, grapes, cocoa, berries, plums, apricots and nuts[26,27]. Cocoa contains the most concentrated dietary source of flavanols and polyphenol that have the strongest antioxidant potential[28,29]. Many of the health benefits associated with cocoa consumption are likely due to its high flavanol content. Cocoa has anti-diabetic effects by lowering blood glucose levels. The mechanism by which cocoa lowers blood glucose is not well understood. However, studies in Male ZDF rats fed on feed supplemented with cocoa (10%), showed decreased body weight gain, improved glucose and insulin levels, improved glucose tolerance and insulin resistance[30]. The Cocoa-rich-diet improved insulin resistance, probably by increasing tyrosine-phosphorylated-insulin receptor levels and inhibiting the inactivation of glycogen synthase kinase-3/glycogen synthase pathway (GSK-3/GS). The glucose-lowering effect of cocoa appears to be mediated through the lowering of the glucogenic proteins, phosphoenolpyruvate-carboxykinase (PEPCK), glucose-6-phosphatase (G-6-Pase), sodium-glucose-co-transporter-2 (SGLT-2) and glucose-transporter-2 (GLUT-2) levels in ZDF rat renal cortex of rats fed on cocoa[31]. The consumption of cocoa has also been linked to an improved lipid profile. The lipid-lowering effect is mediated through decreased fatty acid synthesis and increased fatty-acid oxidation[32] leading to improved insulin sensitivity.

### *Nuts*

Nuts are a good source of nutrients of high medical benefits, they contain high levels of unsaturated fatty acids and other bioactive compounds: high-quality vegetable protein, fiber, minerals, tocopherols, phytosterols and phenolic compounds and antioxidants[33]. The monounsaturated and polyunsaturated fatty acids in cashews nuts are probably responsible for the decreased LDL cholesterol and triglyceride levels after the nut consumption. This has the effect of reducing the risk of cardiovascular disease, stroke and heart attack[34].

The consumption of 30 g/day walnuts or more or 15 g/day of oil prevents and control plasma glucose in type 2 diabetes with no side effects on body weight or blood pressure changes[35,36].

Peanuts and peanut butter have a low glycemic index, which implies they don't raise blood sugar levels. Scientific evidence shows that eating 15 g/day of nuts, including peanuts can, lower plasma glucose and may also reduce the risk of heart disease because of the monounsaturated fatty acids and low cholesterol levels[34].

### *Legumes*

Legumes contain a high amount of plant proteins, unsaturated fatty acids and have a low glycaemic index. Legumes consist of plants such as alfalfa, clover, peas, black eye pea, peanuts, soybeans, chickpeas, lentils and various types of beans. Legumes contain phytochemicals-bioactive compounds that further improve the body's metabolism and are thought to protect against heart disease and diabetes[37].

## CONCLUSION

Diabetics who consume large amounts of foods particularly traditional foods prepared using these vegetable oils, vegetables, nuts and legumes may experience improved glycaemic control, reduces the incidence of complications and above all a cut down in the need for and cost of conventional antidiabetic drugs.

## SIGNIFICANCE STATEMENT

This article is aimed at educating Africans with diabetes, to take advantage of locally available foods to live a full healthy life despite the disease condition, simply by using appropriate diet intervention of the locally produced/ prepared foods. Some of these foods ameliorate diabetes and therefore it will put less demand on conventional antidiabetic drugs that are priced beyond the capabilities of many patients.

## CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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## DISCLAIMERS

The opinions expressed in this article are the authors' personal views and do not represent that of their affiliated organizations, employers or associations.

## DATA AVAILABILITY STATEMENT

Not Applicable.

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