



## Review Article

# Role of Paleolithic Diet in Prevention of Diabetes and Related Chronic Diseases Consequences

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### ABSTRACT

Archeological clues don't prove existence of chronic diseases (cardiovascular diseases & Diabetes) in prehistoric time. Accumulating evidences depicts Asian countries under chronic diseases burden as compared to western population. Genetic vulnerability of Asian countries to Type 2 Diabetes is more in comparison with other nation in the globe. The question of concern is why Asian genome does not cope with the adaptation as compared to western population; in addition to other risk factors like essential nutrients deficiency, obesity, insulin resistance and malnutrition which are considered to be the predisposing factors for Type 2 diabetes. Togetherly, these major stressors contributes well in aggravation of diabetes in the region. Currently available treatments are based on lifestyle changes and drug therapy. The emphasis should be placed on correcting diet nutrients according to the age of individuals.

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### INTRODUCTION

Among chronic illness, diabetes became one of the leading problems in the world. It affects all ages' groups and people. Recent statistics (US) shows 25.6 million young people age 20 or older having diagnosed or undiagnosed diabetes. In older people (age 65 years) or more were estimated to be 10.9 million (CDC, 2011). Globally, type 2 diabetes exists in majority of societies. Statistical data showed about 285 million people (aged= 20-79 years) across the globe with diabetes in the year 2010. However, the number will further increase to 439 million by the year 2030 (Shaw et al., 2010). Numerous factors are considered to be responsible for developing diabetes. These include lifestyles, diet, socioeconomic status and genetic variation. About 26% of Pakistani men aged over 55 years have type 2 diabetes. The prevalence of type 2 diabetes is similar in Pakistani men (aged over 55 year) living in England. On contrast, about 7% of men (European) with same age have type 2 diabetes (Tuomilehto, 1997).

Type 2 diabetes enormously rises in Asian countries. In India, currently 19 million people are diabetic which will be rise to about 57 million up to 2025 (King et al., 1998). Similarly, in China five folds increase in diabetes prevalence occurred in recent years and expectedly there will be 38 million type 2 diabetic people in 2025 (King et al., 1998). However, in economically poor countries like Africa, the incidence of type 2 diabetes is quite low. This indicates that apart from susceptibility of our genome to type 2 diabetes, lifestyles, socio-economic status and dietary patterns are crucial factors that may plays important role in pathophysiology of diabetes.

### Old diet the Remedy

Prehistoric foods which are also known as Paleolithic age food (2.5–0.01 million years BP) were able to treat and prevent chronic illness like type 2 diabetes, heart diseases and insulin resistance (Lindeberg et al., 2003). The old ages included were rich in lean meat, fish, fruits, shellfish, vegetables, roots, eggs and nuts (Jonsson et al., 2009). In a recent study, type 2 diabetic patients (n=13) were given Paleolithic diet and another diet, used for diabetic patients. The result showed that Paleolithic diet have improved glycemic control, cardiovascular outcomes as compared to diet used for type 2 diabetic patients (Jonsson et al., 2009). Similarly, in a cross sectional study carried out on populace resides at Rawalpindi, Pakistan included a total of 1091 subjects, divided into male (n=293) and female (n=798) showed that 15.41% of the males and 12.31% of the females were suffered from diabetes mellitus with a diseases burden of 13.14%. The study further traced out key stressor like

**Table 1:** Some demographic feature of the subjects under investigation

Variable	Characteristic	Percent	Total	
Age group	≥25years	31.48	1,077	
Blood glucose mg/dl	Below 101	81.25	1088	Zafar et al., 2011
Body mass index	≤20	26.29	909	
Waist circumference in inches	≤30	24.13	1069	

Obesity; hypertension, age and family history (Zafar et al., 2011) were related to diabetes. Although the study make association of unhealthy food and lack of exercise with prevalence of diabetes (Table. 1) but however, the study fails to show exact dietary pattern of the population. Lifestyles changes towards diet and exercise have tremendous effect on glycemic control. Therefore, there is a dire need of awareness regarding the disease and the habits that either revoke or provoke diabetes (Khan, 2012).

Based on scientific data, dietary intervention plays important role in ablating diabetes burden. According to world health organization, the recommended nutrients in diabetic patients should contain nutrients in the range given in Table 2. Recently (Khan and Safdar, 2003) showed that high simple carbohydrates and fat diet results in development of type 2 diabetes. The authors further claimed beneficial effects of cinnamon, cloves, bay leaves, tumeric and jamon on type 2 diabetes mellitus. It is worth to mention that cinnamon and chromium potentiate insulin activity. Further improvements may be achieved with diet having 60% carbohydrates, 20-25% fat and protein in the range 15-20% for diabetic patients (Khan and Safdar, 2003).

**Table 2: Dietary nutrients for diabetic patients**

Nutrients	Percentage (%)
Carbohydrates	15
Total fat	35
Mono unsaturated Fatty Acids	20
Poly unsaturated Fatty Acids	Less than 8
Saturated & Trans Fatty acids	Less than 7
Proteins	15-20
Cholesterol	Less than 15mg/day
WHO, 2006	

#### Vitamin D and Diabetes

On the basis of accumulating evidences, vitamin D deficiency increases risk of Type 2 diabetes mellitus. This vitamin deficiency increases inflammation, pancreatic  $\beta$ -cell dysfunction and insulin resistance. These serious pathophysiological conditions may participate in Type 2 diabetes development (Xuan et al., 2013). In addition to vitamin D deficiency association with Type 2 Diabetes, it also increases risk of obesity. In a cross-sectional study (n=200), Type 2 Diabetics (n=100) and 100 healthy controls were assessed for 25(OH) D, calcium, phosphorous, parathyroid hormone (PTH), fasting blood glucose, HbA1c, serum insulin and BMI. The findings revealed that 85% type 2 diabetics and 79 % healthy subjects were found vitamin D deficient. The level of vitamin D in the serum was 22.08±15.20 ng/ml, calcium 8.94±0.59 mg/dl. Both of vitamin D and calcium were found to be statistically significant with BMI in type 2 diabetic patients. However, there was non-significant association of parathyroid level with BMI in patients or healthy individuals (Taheri et al., 2012). However, another study showed vitamin D association with body fat mass. In a recent study, vitamin D3 supplementation significantly decreased body fat mass in the subjects who were given vitamin D supplements and neither vitamin D supplements nor placebo (Lactose) significantly change body weight and waist circumference (Salehpour et al., 2012). Contradictory results are also found regarding vitamin D and diabetes. A study on non-diabetic (n=83,779), non-cardiovascular or cancer were conducted. The study subjects were given vitamin D and calcium supplements and were follow-up for 20 years. During 20 years of follow-up, 4843 subject's cases were Type 2 diabetic. This study indicated no association between total vitamin D intake and Type 2 diabetes.

However, this study further claimed that a total of more than 1,200 mg calcium and more than 800 IU vitamin D is link with 33% lower risk of Type 2 Diabetes (Pittas et al., 2006). Other studies also showed beneficial effects of vitamin D and calcium level on Type 2 Diabetes mellitus especially when both supplements are given in combination in a population at high risk of glucose intolerance (Pittas et al., 2007).

#### Dietary fibers and diabetes

Anti-hyperglycemic medications such as diet used for low-glycemic index improves glycemic control and cardiovascular risk factors in subjects with type 2 diabetes. This conclusion base on a randomized, parallel study involved subjects (n=210) with type 2 diabetes given anti-hyperglycemic medications for 6 months diet intervention. This study used high-cereal fiber and low-glycemic index dietary advice which resulted in moderately lower glycosylated hemoglobin HbA(1c) levels on low-glycemic index diet in comparison to high-cereal fiber diet (Jenkins et al., 2008). In a randomized trial conducted on known type 2 diabetes mellitus subjects were given dietary fiber which resulted in reduction of fasting blood glucose of 0.85mmol/L as compared to placebo groups. In addition, dietary fiber also showed effect on HbA1c 0.26% over placebo. Thus, this study indicated positive impacts in patients with type 2 diabetes mellitus as the dietary intervention reduced fasting blood glucose and HbA1c (Robert et al., 2012). It is also acknowledged that viscous and gel-forming attributes of soluble dietary fiber prevents macronutrient absorption. It also reduces postprandial glucose response and some of the blood lipids. Soluble fiber present in food may also provide colonic fermentation opportunity. However, some prospective cohort studies showed that especially insoluble cereal dietary fiber and whole grains are linked to reduced diabetes risk (Weickert and Pfeiffer, 2008). A prospective study (n=3,428) on non-diabetic men (age 60-79 years) followed up for 7 years showed 162 incident cases of type 2 diabetes and lowest dietary fiber (20 g/day) intake was linked with increased risk of diabetes. Therefore, this further indicated the role of fiber in the diet for diabetes prevention. However, quantities lower than optimal fiber intake may not beneficial because dietary fiber is inversely related to inflammatory markers (CRP&interleukin-6) and with tissue plasminogen activator and gamma-glutamyl transferase enzymes (Wannamethee et al., 2009).

#### Diabetes and Chromium

Recently, chromium is evaluated as an interesting nutrient in metabolism of glucose and insulin. This nutrient is needed for normal insulin effect and blood sugar level (Hemmati et al., 2011). A quantity lower than optimal or suboptimal of this very nutrient increase risk factors allied with diabetes and cardiovascular diseases. In subjects with glucose intolerance, Type 1, Type 2, gestational and steroid induced diabetes were improved with chromium supplementation. Similarly, a case study (patient) with neuropathy and glucose intolerance has reversed by additional chromium supplementation. The nutrient is important in binding of insulin with cells. Furthermore, it not only increases number of insulin receptor but also activates insulin receptor kinase enzyme thereby, enhanced insulin sensitivity (Anderson, 2000).

In a randomized controlled trials conducted on subjects (n=10) receiving chromium for more than three weeks revealed improved glycosylated hemoglobin levels by -0.6% in patients with Type 2 diabetes and fasting glucose by -1.0 mmol/l. However, this study showed no effects on lipids level. Interestingly, chromium supplementation benefit in individuals with diabetes but not normal subjects (Balk et al., 2007). In a comparative study carried out on patients with Type 2 diabetes and control non-diabetic subjects showed significant differences (mean serum chromium level) of diabetic patients

(4.58µl) and control group (7.92µl). In diabetic patient's chromium level were lower as compared to normal subjects (Hemmati et al., 2011). Type 2 diabetes mellitus (n=257) patients and non-diabetic control subjects (n=166) having 45-75 of age of both genders were analyzed for micro nutrients level. The findings showed significantly reduced level (Mean values of Zn, Mn, and Cr) in blood and scalp-hair of diabetic subjects in comparisons to control subjects (p<0.001) (Kazi et al., 2008). However, meta-analyses results showed minor benefit from chromium in individuals with or without diabetes. Importantly, the two meta-analyses findings concluded no effects of chromium on glucose metabolism or insulin level in non-diabetic subjects (Althuis et al., 2002; Pittler et al., 2003).

#### Malnutrition and Diabetes

A prospective study on diabetic subjects (n=146) with mean BMI 29.6±7.1 kg/m<sup>2</sup> and HbA<sub>1c</sub> 6.9±1.2% showed prevalence of malnutrition in obese subjects (Vischer et al., 2010) with a peak incidence of malnutrition in elderly patients. Special attention is therefore, needed in case of patients with cystic fibrosis because such patients are unable to achieve desirable growth due to malabsorption, anorexia and maldigestion. These major illnesses always lead to losses of essential nutrients. Therefore, cystic fibrosis related diabetes predispose individuals to pulmonary disease, nutritional decay and even death. Protein energy malnutrition (PEM) decreases survival diabetic kidney disease (DKD) patients. The risk of mortality is higher in diabetic patients as compared to non-diabetic subjects. Dietary intervention plays important role DKD patients (Prasad and Sinha, 2012).

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