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# Dietary Control and Lipid Profiles of Type 2 Diabetes Mellitus Patients in Yaounde, Cameroon

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**Abstract:** This study was conducted to compare the dietary and blood lipids between type 2 diabetes subjects and non diabetes subjects living in Cameroon. Dietary intakes were significantly higher in non diabetic men compared to diabetic men but not significantly higher in diabetic women compared to diabetic women. Dietary fiber was significantly higher in diabetic men and women compared to non diabetic subjects. Type 2 diabetic patients of both sexes had a triglyceridemia level higher than non diabetic patients. However Type 2 diabetic men had a cholesterolemia level lower than non diabetic men and there was no difference between cholesterolemia of type 2 diabetic women and non diabetic women. It was concluded that type 2 diabetic subjects are consuming diets that are varied and nutritionally adequate for a healthy adult. To optimize nutrition therapy of type 2 diabetic subjects in Cameroon, recommendations should emphasize on traditional dishes which are mainly constitutes of tubers, fruits, cereals and green leaf vegetables.

**Key words:** Type 2 diabetes, nutrition therapy, blood lipids

## Introduction

Once considered as a disease limited to developed counties, the occurrence of diabetes mellitus is increasing throughout the world, both in industrialized and in developing countries (AFD, 2000), with the developing countries experiencing an accompanying epidemiological transition (Murray and Lopez, 1997). Although diabetes mellitus is not a leading cause of death in developing countries, its social and economic impact can however not be overlooked (Wild *et al*., 2004).

Medical nutrition therapy (MNT), physical activity, and medical therapy are the main components of diabetes management, with medical nutrition therapy being the cornerstone of type 2 diabetes management, especially in diabetes self management (Franz *et al*., 2002). The term "medical nutrition therapy" was introduced by the American Dietetic Association to better articulate the nutrition therapy process. It is defined as the use of specific nutrition services to treat an illness, injury, or condition. This involves two phases: the assessment of the nutritional status of the patient and the treatment, which includes nutrition therapy, counseling, and the use of specialized nutrition supplements (ADA, 1994). For effective nutrition therapy, consideration has to be made to lifestyle changes as well as cultural and ethnic preferences.

The use of MNT in type 2 diabetes mellitus does not address only glycemic control, but also other aspects of metabolic status including dyslipidemia and hypertension, which are major risk factors for macro-vascular complications and cardiovascular diseases. Initially thought to be of importance in diabetes management, present consensus recommendations do not support widespread use of the glycaemic index. Current recommendations are that monounsaturated fatty acids and carbohydrates combined should provide 60-70% of daily energy intake, with individual flexibility in the respective proportions, whereas intake of saturated fats is limited to < 10% of energy intake (Kelley, 2003). These recommendations have however been made for diabetic patients in Western countries, and have generally not taken into account the special characteristics, dietary patterns as well as socio-cultural differences of diabetics in Africa (Hoffmeister, 2002). This study investigates the Dietary control and lipid profiles of Type 2 and effectiveness of medical therapy in type 2 diabetic patients in Yaounde, Cameroon.

## Materials and Methods

**Patients:** A total of 81 with Type 2 diabetic subjects (25 women, aged 55.8 ± 9.3 years with disease duration of 5.6 ± 4.2 years and 56 men, aged 56.5 ± 8.8 with disease duration 7.0 ± 5.3 years) attending 3 different outpatient diabetic clinics in Yaoundé (Cameroon) took part in the study. Age and sex matched 81 non diabetic subjects (25 women, age 53.1 ± 11.0 years and 56 men, age 56.8 ± 8.8 years. The study was carried out from September 2002 to August 2003, to cater for the different planting and harvesting seasons, when the quantity and variety of foods differed. During the study period, consideration was also taken as to the exact period of the month, since Cameroonians tend to alter their intake

Table 1: Distribution of diabetic subjects according to prescribing practitioner of diet

| Prescriber of diet advice | Percentage |
|---|---|
| Medical doctor or nutritionist | 67.1 |
| Nurse | 11.84 |
| Others | 21.05 |

Table 2: Comparative data of triglyceridemia of type 2 diabetic patients and non diabetic subjects

| Sex | Level of triglycerides (mg/l) | | |
|---|---|---|---|
| | Diabetic | Non diabetic | P |
| Men | 170.75±48.84 | 142.98±71.79 | 0.02 |
| Women | 189.36±34.90 | 119.21±32.72 | 0.001 |

Table 3: Comparative data of cholesterolemia of type 2 diabetic patients and non diabetic subjects

| Sex | Level of cholesterol (mg/l) | | |
|---|---|---|---|
| | Diabetic | Non diabetic | P |
| Men | 176.13 ± 41.45 | 154.90 ± 44.45 | 0.032 |
| Women | 162.76 ± 45.92 | 156.43 ±56.41 | 0.607 |

based on the availability of funds (higher quality and quantity immediately after salaries are paid).

Inclusion criteria for type 2 diabetic patients were that they must have been diagnosed and have been on treatment for at least one year, and be willing to give their written consent for the study. The study was approved by the clinical board of the Yaoundé Central Hospital.

**Dietary assessment:** Subjects completed unweighed dietary intakes for 7 days. They were instructed to estimate portion sizes with standardized household measurements of all food and drinks consumed. A 60-min one-on-one interview was used to instruct subjects on how to keep individual food diaries, which was of a 9-page booklet. Written instructions and a sample food record were distributed and reviewed with each subject to ensure complete and accurate recording. They were told to write down what they normally and actually ate and drank and not what they thought they should be eating and drinking immediately after consumption.

The diary solicited information on the following items: date and time of consumption, type of food consumed, form of purchase, method of preparation if applicable and quantity consumed. The estimation of portion size was aided by the use of household measuring utensils and the estimation of dimensions.

The records were returned in person by the subjects after 7 days, and at this second 30-min individual interview, the diaries were checked to clarify vague descriptions and to validate the contents as well to convert household measures to weight according to a standardized list of portion sizes. All of these were done by the same dietetician.

Details of ingredients used in cooked dishes had to be collected to provide a nutritional composition of each dish. To obtain a representative nutritional composition of that dish, World Food Dietary Assessment System version 2.0 was used for the nutrient composition of food and energy intake. If energy intake estimated from a subject's dietary diary was less than the minimum (1.2 BMR) for age, sex and weight, that subject was excluded from the study. Nine subjects were excluded from the study because of their lower reported energy intake.

**Biological parameters:** Body weight, blood pressure and waist circumference were determined at the first visit by the same investigator and with the same material.

Fasting blood samples were taken from the antecubital vein after a 12-h fast. Blood samples were centrifuged (at 3500 rpm for 10 minutes) and plasma removed and analyzed immediately for glucose, total plasma cholesterol and triglycerides. Total cholesterol and triglycerides were measured by enzymatic methods (Sigma Diagnostics).

**Statistical analysis**: Statistical analysis was performed using SPSS.9.0 for Windows. The program was used to calculate means. Comparisons between dependent variables were determined using the Student t-test. Statistical significance was defined at $p \leq 0.05$.

## Results

We observed that 93.82% of the diabetic subjects followed some form of dietary advice. Dietary advice was prescribed mainly by a medical doctor or nutritionist (67.1%), while dietary advice for 11.84% of diabetics was by a nurse (Table 1).

Table 2 shows the Triglyceridemia level of diabetic and non diabetic subjects and Table 3 shows the total cholesterolemia level of diabetic and non diabetic subjects. Type 2 diabetes patients of both sexes have a triglyceridemia level higher than non diabetes patients. However Type 2 diabetes men have a cholesterolemia level higher than non diabetes men and there is no difference between cholesterolemia of type 2 diabetic women and non diabetic women. Table 4 and 5 show the mean daily intakes of energy and nutrients in both men and women and Fig. 1 and 2 show the nutrient density of diabetes and non diabetes subjects.

Total energy, lipid intake (kcal), saturated fatty acids (g), protein intake (kcal) were higher in non diabetes men subjects compare to diabetes men subjects; the fibre intake and the percentage of carbohydrate intake were higher in diabetes men subjects compare to non diabetes men subjects.

The nutrient density of dietary fibre was higher in diabetes men subjects ($P<0.001$) than in non diabetes men subjects; nutrient density of proteins ($P<0.05$), carbohydrates ($P<0.01$), and saturated fatty acids

Table 4: Mean daily intake of type 2 diabetic women and non diabetic women

| Subjects | Non diabetes | Diabetes | P |
|---|---|---|---|
| Total energy intake (kcal) | 2572.4 ± 702.2 | 2247.3 ± 554.6 | 0.078 |
| Lipids (kcal) | 772.0 ± 331.1 | 706,8 ± 304.5 | 0.477 |
| Lipids (%) | 29.7 ± 9.6 | 30.7 ± 7.5 | 0.697 |
| Saturated fatty acids (g) | 28.9 ± 14.9 | 23.7 ± 8.0 | 0.130 |
| Carbohydrates (kcal) | 1203.0 ± 399.5 | 1128.9 ± 317.6 | 0.475 |
| Carbohydrates (%) | 46.9 ± 9.1 | 50.7 ± 11.5 | 0.215 |
| Proteins (kcal) | 513.1 ± 197.9 | 403.5 ± 247.3 | 0.094 |
| Proteins (%) | 19.8 ± 5.0 | 18.0 ± 10.9 | 0.480 |
| Dietary fibre (g) | 24.1 ± 8.3 | 32.3 ± 15.5 | 0.002 |
| Alcohol (g) | 12.0 ± 10.3 | 1.1 ± 1.0 | 0.002 |

Table 5: Mean daily intake of type 2 diabetic men and non diabetic men

| Subjects | Non diabetes | Diabetes | P |
|---|---|---|---|
| Total energy intake (kcal) | 2892.7± 590.7 | 2477.2 ± 496.9 | < 0.001 |
| Lipids (kcal) | 960.5 ± 312.7 | 802.8 ± 229,0 | 0.003 |
| Lipids (%) | 32.8 ± 7 | 32.2 ± 5.8 | 0.602 |
| Saturated fatty acids (g) | 38.3 ± 15.2 | 26.8 ± 10.9 | < 0.001 |
| Carbohydrates (kcal) | 1256.3 ± 290.7 | 1244.7 ± 290.5 | 0.831 |
| Carbohydrates (%) | 43.8 ± 7.5 | 50.5 ± 8.3 | < 0.001 |
| Proteins (kcal) | 556.3 ± 175.3 | 398.2 ± 139.9 | < 0.001 |
| Proteins (%) | 19.2 ± 4.5 | 16 ± 4.3 | < 0.001 |
| Dietary fibre (g) | 26.9 ± 9.8 | 41 ± 12.8 | 0.001 |
| Alcohol (g) | 17 ± 13.3 | 4.4 ± 3.1 | < 0.001 |

(P<0.01) was higher in non diabetes men subjects compare to diabetes men subjects.

Dietary intake of fibre of women diabetes subjects was higher (P<0.01) than those of non diabetes subjects. Diabetes women consumed high amount of dietary fibre compare to non diabetes women. Nutrient density of dietary fibre was higher in diabetes women subjects (P<0.01) than in non diabetes women subjects and nutrient density of saturated fatty acids was lower in diabetes women subjects (P<0.01) compare to non diabetes women subjects.

## Discussion

Type 2 diabetes is associated with a cluster of interrelated plasma lipid and lipoprotein abnormalities, including reduced HDL cholesterol, a predominance of small dense LDL particles, and elevated triglycerides (ADA, 2003). These abnormalities occur in many patients despite normal LDL cholesterol levels. Triglyceride overproduction as well as inadequate clearance contributes to the hypertriglyceridemia.

We had observed that triglyceride values were comparatively higher in diabetic patients than in non diabetic patients of female sex (P<0.001) and male sex (P<0.02). Moreover the difference between total cholesterol value from diabetic patients and non diabetic patients of male sex was significant (P=0.032); while that from the diabetic and non diabetic patients of female sex was not statistically significant. These values were considerably lower than that observed by Sharma and Pavlik (2001) in US in African Americans. This difference might be due to the high fibre diet consumed by type 2 diabetic.

The mean dietary intake of fibre was respectively 36.3 g/day and 41g/day for type 2 diabetic female and male patients respectively. Chandellia (2000) showed that high fibre diet reduced total triglyceride and low density lipoprotein and can help to achieve the glycemia control. Dietary fibre enhances glycemia control, reduces hyperinsulinemia and enhances a good control of plasmatic lipids (Franz *et al.*, 2002). Fibre-rich foods such as vegetables, fruits, whole-grain cereals and legumes are rich sources of nutrients, phytochemicals and antioxidants which appear to decrease risk for cardiovascular diseases (Anderson and Hanna, 1999). Fibre intake is not only inversely associated with fasting insulin (Ludwig *et al.*, 1999), but insoluble and cereal fibre intakes significantly also reduce the risk of type 2 diabetes (Meyer *et al.*, 2000). The improved insulin sensitivity with high-fibre diets may occur because the gel-forming properties of soluble fibres delay the rate of carbohydrate absorption (Anderson *et al.*, 1994). Magnesium is another component in whole grains that may improve insulin sensitivity. Intracellular magnesium has also been linked to insulin sensitivity in metabolic studies (Resnick *et al.*, 1993), and clinical studies have shown that supplementation with magnesium improves insulin sensitivity (Paolisso *et al.*, 1992). Furthermore, an inverse association between dietary and serum

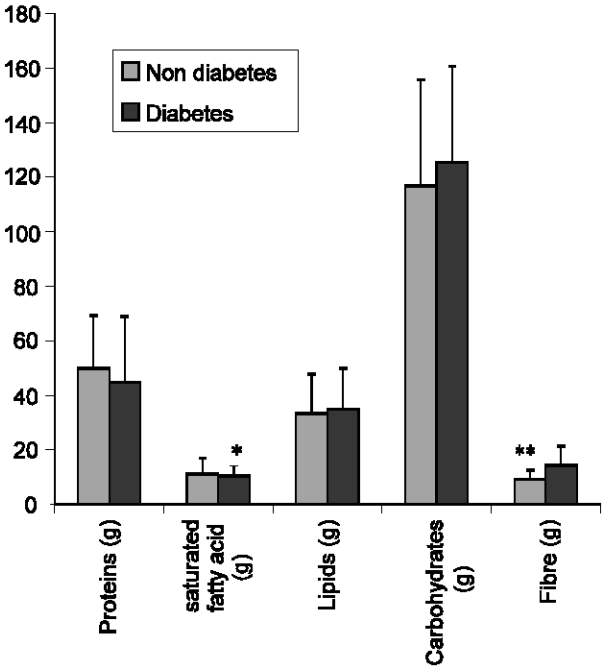


Fig. 1: Average nutrient density of diets of diabetes and non diabetes women subjects. *Significance difference P<0.05, **significance difference P<0,01.

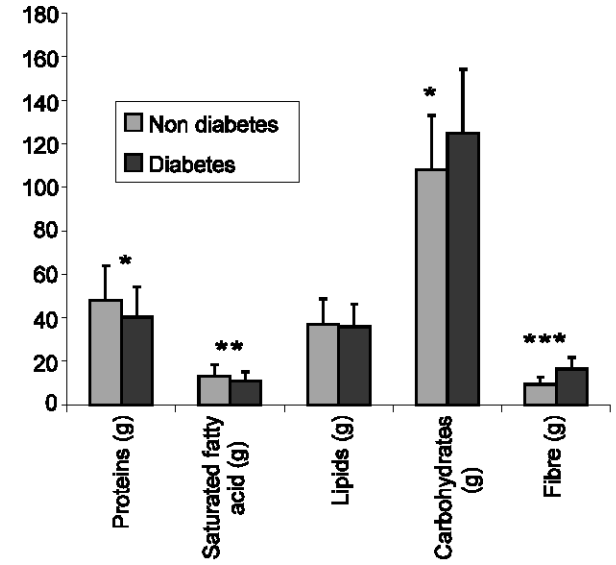


Fig. 2: Average nutrient density of diets of diabetes and non diabetes men subjects. *Significance difference P<0.05, **significance difference P<0.01, ***significance difference P<0.001

magnesium and incidence of type 2 diabetes is supported by some epidemiological data (Kao *et al.*, 1999).

Generous intake of whole grains provides protection from development of diabetes and obesity. Diets rich in wholegrain foods tend to decrease serum LDL-cholesterol and triacylglycerol levels as well as blood pressure while increasing serum HDL-cholesterol levels (Anderson, 2003).

Comparative study showed that type 2 diabetic men (P<0.001) and female patients (P<0.001) had a high fibre intake than non diabetic patients of both sex. Moreover carbohydrates intake was higher in non diabetic men than type 2 diabetic men; while that from type diabetes patient's women and non diabetes women was not different. Whereas saturated fatty acids (P<0.0001), alcohol (P<0.0001), and proteins intake (P<0.0001) were found to be lower in type 2 diabetic men than non diabetic men. There was lower intake but no significant difference in dietary intake of carbohydrates, lipids, proteins, energy intake of type 2 diabetic women compare to non diabetic women.

The diet of diabetes subjects contained more fibre than that of non diabetes subjects. Dietary intake of fibre was higher in diabetes men and women and the nutrient density of fibre was higher in diabetes men and women subjects compare to non diabetes subjects. Diabetes subjects have increased their consumption of cereals, fruits and legumes which rich food sources of dietary fibre.

The nutrient density of saturated fatty acids was lower in diabetes men and women subjects compare to non diabetes subjects suggesting that diet of diabetes subjects have adopted specific dietary patterns, perhaps because of their awareness of cardiovascular diseases risk factors. The reductions of dietary lipids and saturated fatty acids are the cornerstone of all national heart program.

It appears that type 2 diabetic male made more changes in their dietary pattern than women living with type 2 diabetes. Based on these preliminary findings, it appears that medical nutrition therapy (MNT) for individuals with diabetes in Cameroon is effective, however there is still need for a cohort study in order to assess the long term effects of medical nutrition therapy and the metabolic control of diabetic patients living in Cameroon.

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