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*Full Length Research Paper*

# Assessment of nutritional status and food consumption in Makepe Missoke, Douala, Cameroon

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Abstract

**In Cameroon, malnutrition is associated with the emergence of some chronic diseases. However, there is no information on diet and nutritional status of population in some localities. The purpose of this study was to assess the nutritional status and food consumption of population in Maképè Missokè (Douala). During this study, 89 men and 163 women aged between 18 and 70 years were recruited. Anthropometric measures comprising height or size, weight, waist and arm circumferences were measured respectively using a stadiometer, an ordinary scale and a measuring tape. The body mass index was calculated and the values were used to evaluate nutritional status. Dietary habits and frequency of usual consumption of foods were determined after estimated foods records using local material. The responses were all reported on questionnaire. The determination of serum albumin was performed by spectrophotometry using bromocresol green. The mean body mass index ranged between 27.4 and 29.1 kg/m$^2$ in women and between 23.7 and 27.6 kg/m$^2$ in men. The means waist circumference ranged between 86.4 and 93.5 cm in women, and between 80.9 and 94.8 cm in men. The arm circumference measures ranged between 28 and 31 cm in both sex. In the study population, 10.7 % of men and 29 % of women were overweight, 2.8 % of men and 17 % of women were obese. Consumption of fruits and vegetables was low. The foods eaten were rich in fat and carbohydrates, but low in protein. Nearly 8 % of men and 42 % of women were reached from hypoalbuminemia. The coverage of protein and energy needs with local foods could not meet the recommended nutritional needs and was responsible of major health problems in Maképè Missokè (Douala).**

**Keywords:** Food consumption, Nutritional status, Serum albumin, Douala.

## INTRODUCTION

Nutrition plays an important role in the health and development of an individual (UNICEF, 2011). The adequate nutritional needs of an individual ensure tissue renewal, maintaining a good physical and mental health, but also reduce the risk of non communicable diseases related to food (C.D.U, 2009). Dietary intakes not meeting the needs of the body are the cause of malnutrition. Malnutrition is a health problem caused by excessive food intake (overnutrition), inadequate or imbalanced diet does not contain all the nutrients needed for good nutritional status (undernutrition) (FAO, 2003). Overnutrition or obesity is associated with increased blood pressure and hyperinsulinemia, which are considered risk factors for developing chronic diseases such as diabetes mellitus type 2 and cardiavascular diseases (Spolidoro *et al*, 2012). However, marasmus and kwashiorkor resulting from energy or protein undernutrition (C.D.U, 2009). Malnutrition in women and men can result in reduced productivity, slow recovery from illnesses, increased susceptibility to infections, and a heightened risk of adverse pregnancy outcomes. Women with poor nutritional status has a greater risk of obstructed labor having a baby with a low birth weight, having adverse pregnancy outcomes, producing lower quality breast milk, and illness for herself and her baby (Sumana *et al*, 2011). Improving nutrition contributes to productivity, economic development, and poverty reduction by improving physical work capacity, cognitive development, school performance, and health by reducing diseases and mortality (Hunt, 2005).

Worldwide, at least one billion people are undernouris-

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hed and lack key vitamins and minerals, while at the same time; 1.5 billion people are overweight or obese (WHO, 2011). The estimated diabetes prevalence for 2011 has risen to 366 million, representing 8.5 % of the world's adult population (Radzevicienè and Ostrauskas, 2012).

Although Cameroon has a diversity of food resources sufficient to feed its population, it is not immune to nutritional problems (PAM, 2007). Research work carried by Sobngwi *et al*. (2002), Kamadjeu *et al*. (2006) and Kana Sop *et al*. (2010) in some cities of Cameroon (Yaoundé, Douala, Bamenda, Garoua) showed that, the prevalence of malnutrition was high in population aged 15 to 65 years in these cities. However, there is no information on diet and nutritional status of population in many districts of these cities. A study was therefore conducted to Maképè Missokè (Douala) in order to assess the nutritional status and food consumption of population of this district.

## MATERIALS AND METHODS

### Site and study Population

The study was conducted in Maképè Missokè, a locality in the city of Douala in Cameroon. The area was unhealthy and almost ignored by the health community, leading its residents or inhabitant to many diseases. During this study, 252 peoples aged between 18 to 70 years, showing no apparent pathology and able to give information on their diets were recruited. They were enrolled after reading and signing the informed consent. The protocol was approved by the National Ethic comity of Cameroon.

### The food survey

The dietary survey was conducted among the population. Through the questionnaire designed for this purpose, the methods of 24-hour recall and dietary history were used to determine dietary habits, the type of food and the usual frequency of consumption of food. The repeated (trice) 24-hour recall helped to collect information on foods eaten daily and to estimate nutrients intakes.

### Anthropometry

The anthropometric parameters measured during the period of the study were the size, weight, waist and arm circumferences of population recruited involved in the study. Weight measurement was performed using an ordinary balance (Soehnle-Waagen, Murrhardt, Germany) with the range 25 to 150 kg and 500 mg accuracy. Subject size was measured using a stadiometer. The size and weight were used to determine the body mass index (BMI) according to the formula, weight (Kg) divided by the square of height ($m^2$) ($Kg/m^2$). BMI categories were selected in accordance with WHO recommendations.

### Cut-off-points

Once an anthropometric indicator and a reference population have been selected, it is necessary to determine the limits of "normality". The definition for overweight was taken as BMI ≥ 25 and < 30 $kg/m^2$, and obesity as BMI ≥ 30 $kg/m^2$. The WC ≥ 80 cm for women and WC ≥ 94 cm for men are considered having a high risk of obesity (android or gymnoid). The critical threshold of arm circumference was 230 mm in men and 220 mm in women.

### Blood sample collection

Blood samples were collected in dry tubes. Blood tubes were labeled and were placed in a cooler containing ice packs "TempGuard" (-10 to 6 °C), and transported to the laboratory of Biochemistry of the University of Douala.

### Centrifugation of samples

The centrifugation of blood was carried out using a centrifuge (Sigma, Laborzentrifugen, Germany) at a speed of 3600 rev / min for 20 min. The serum (supernatant) was extracted using a micropipette "eppendorf" (1000 µl) and introduced into cryotubes (1.2 ml). The serum obtained was used for determination of serum albumin.

### Determination of serum albumin

The method of Doumas *et al*., (1972) was used to determine participants the serum albumin levels. Indeed, the preparation of different solutions used for serum albumin (white, standard and sample) was performed as described in the following table 1.

The set of solutions of each tube was mixed and incubated for two minutes at 37 ° C and the spectrophotometer (Shimadzu UV-110-02) was used to read the absorbance. The system parameters were: temperature 37 ° C, wavelength 628 nm. The serum albumin was obtained using the following formula:

$$\textbf{Serum Albumin} = \frac{\text{Sample absorbance}}{\text{Standard absorbance}} \times [\text{standard}]$$

**Table 1.** Preparation of solutions for the serum albumin determination.

| | White tube | Standard Tube | Sample tube |
|---|---|---|---|
| Reactive | 2000 µl | 2000 µl | 2000 µl |
| Sample (serum) | - | - | 10 µl |
| Standard | - | 10 µl | - |

**Table 2.** Correlations between anthropometric parameters in both sexes

| Anthropometric parameters | | BMI | | Arm circumference | |
|---|---|---|---|---|---|
| | | M | F | M | F |
| Waist circumference | Correlation coefficient | 0.868 | 0.699 | 0.582 | 0.517 |
| | Significance | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| | Nomber | 89 | 163 | 89 | 163 |
| Arm circumference | Correlation coefficient | 0.722 | 0.598 | - | - |
| | Significance | 0.0001 | 0.0001 | - | - |
| | Nomber | 89 | 163 | 89 | 163 |

M = male, F = female

### Statistical analyzes

Statistical analyzes were performed by SPSS version 16. Student's t test and Pearson correlation were used to compare values of different anthropometric parameters. The test of khi 2 was used to verify the differences in prevalence of overweight by gender. The results were given as mean and differences were considered significant from $p < 0.05$.

## RESULTS

The population aged 18 to 70 years participating in the study was distributed to 25% of men and 75% women for a total of 252.

### Body mass index

Measured weight and height were used to determine BMI. The mean values of BMI ranged from 23.7 ± 0.35 to 27.6 ± 1.12 in men and 27.4 ± 0.39 to 28.4 ± 1.35 in women. In all age groups, the mean BMI was higher in women than in men and higher than normal. The higher BMI was found in the age group 35 to 49 years for both sexes, while the lowest was found in the age group 18 to 35 and 50 to 70 years respectively in men and women. The BMI varied by age and sex.

### Waist and arm circumference of participants

The waist circumferences (WC) ranged from 80.9 ± 0.84 to 94.8 ± 2.97 in men and 86.4 ± 1.07 to 93.5 ± 1.26 in women. The measurements of WC were above the normal range in all age groups in women and only in the group aged 35 to 49 years in men. The values of WC were higher in the groups aged 35 to 49 in both men and women. Some men and women had android or gymnoid distribution of fat that may influence their health differently. The arm circumferences ranged from 28 ± 1.03 to 31 ± 0.80 in men and women.

### Correlation between the measured anthropometric parameters

Correlation coefficients (close to 1) in measured anthropometric parameters are reported in Table 2. It showed that, there were positive correlations between body mass index, waist circumference and arm circumference in both sex.

### Nutritional status based on BMI

The BMI values were used to assess the nutritional status of the population recruited. The following table showed that 21.4 % of men and 19.1 % of women had a normal nutritional status, 10.7 % of men and 29 % of women were overweight. Obesity was observed in 2.8 % of men and 17 % of women. Overweight and obesity were problems related to food that appeared in both men and women. The difference was significant in the prevalence of overweight and obesity ($\chi^2$=14.146; p=0.0001; $\chi^2$=21.178; p<0.0001) in women and men. (Table 3)

**Table 3.** Distribution of participants by sex and nutritional status

| Slice of age (years) | [18-35] | | [35-50] | | [50 -70] | |
|---|---|---|---|---|---|---|
| **Sex** | M (N(%)) | F (N(%)) | M (N(%)) | F (N(%)) | M (N(%)) | F (N(%)) |
| **Normal State** | 42 (16.6) | 41 (16.3) | 05 (2) | 07 (2.8) | 07 (2.8) | 00 (0) |
| **Overweight** | 19 (7.5) | 54 (21.4) | 07 (2.8) | 13 (5.2) | 01 (0.4) | 06 (2.4) |
| **Obesity** | 02 (0.8) | 28 (11) | 05 (2) | 13 (5.2) | 00 (0) | 02 (0.8) |

M = male, F = female; Values expressed are means ± standard error; N (%) = Numbers (Percentages)

**Table 4.** List of foods consumed in family Maképè Missokè

| Carbohydrate foods | | Frequency of consumption (%) |
|---|---|---|
| Tubers | Banana | 80 |
| | Yam | 18 |
| | Potato | 15 |
| | Cocoyam | 23 |
| | Cassava | 14 |
| | Plantain | 10 |
| | Potato | 10 |
| | Taro | 02 |
| Cereals | Rice | 98 |
| | Wheat flour | 63 |
| | Spaghetti | 20 |
| | Corn | 08 |
| **Fat foods** | | |
| Palm oil | | 95 |
| Refined oil | | 06 |
| **Protein foods** | | |
| Meat | | 4,5 |
| Fishes | | 15 |
| Legumes | | 12 |
| Vegetables | | 17 |
| Fruits | | 01 |

**The assessment of food intakes and frequency**

The achievement of the dietary survey of population in Maképè Missokè, has determined the frequency of food consumption in this locality. After counting of the survey forms, the different foods eaten and their frequency were presented in Table 4.

The results in Table 4 show that the most widely consumed foods were foods contents high carbohydrates and lipids. But the consumption of fruit, vegetables and protein foods were low.

**Serum albumin levels**

It is clear from table 5 that 8 % of men and 42 % of women had low serum albumin levels (less than 35 g/l). However, 4 % of men and 8 % of women had a higher rate of albumin (greater than 55 g/l), while 20 % men and 18 % women had a normal serum albumin (35 to 55 g/l). Men have a higher serum albumin than women in all age groups. This table also shows that the average men serum albumin was in the standards (35-55 g/l) in all age groups while that of women was below the norm.

**Determination of Significance**

Table 6 presents the different significances that were obtained by Student's test. This table shows that the mean BMI was significantly higher ($p < 0.05$) in women than in men for age 18 to 35 and 50 to 70 years. The average waist circumference was also significantly higher in women than in men for age 18 to 35 years. While the differences in the average arm circumference in women and men were not significant ($p > 0.05$) in all age groups.

**Table 5**. Variation of serum albumin depending on age and sex

| Age | Men | Women |
|---|---|---|
| [18 35[ | 42.55 (n=8) | 31.07 (n=42) |
| [35 50[ | 40.83 (n=20) | 33.54 (n=18) |
| [50 70] | 39.38 (n=4) | 15.31 (n=8) |

n=Percentage

**Tableau 6.** Influence of gender on the anthropometric parameters.

| Slice of age (years) | [18 -35[ | | [35-50[ | | [50-70] | |
|---|---|---|---|---|---|---|
| Sex | M | F | M | F | M | F |
| Nombres | 63 | 117 | 18 | 38 | 08 | 08 |
| BMI (kg/m$^2$) | *24.2 ± 0.35 | 27.4 ± 0.39 | 27.6 ± 1.12 | 29.1 ± 0.66 | *23.7 ± 1.18 | 28.4 ± 1,35 |
| Significance (P value) | 0.0001 | | 0.225 | | 0,019 | |
| Waist circumference (cm) | *80.9 ± 0.84 | 86.4 ± 1.07 | 94.8 ± 2.97 | 93.47 ± 1.26 | 85.50 ± 0.73 | 90.1 ± 4.98 |
| Significance (P value) | 0.001 | | 0.623 | | 0.380 | |
| Arm circumference (cm) | 29 ± 0.36 | 29 ± 0.28 | 31 ± 0.80 | 31 ± 0.45 | 28 ± 1.06 | 28 ± 1.03 |
| Significance (P value) | 0.818 | | 0.485 | | 0.791 | |

M = male, F = female, BMI = body mass index; Values expressed are the mean ± standard error. ; * The difference is significant (P <0.05)

## DISCUSSION

We determined BMI, waist and arm circumferences in population aged 18 to 70 years living Maképè Missokè. Women and men in the study would categorized as being "at risk" using the proposed cut-off-points for one or other index: BMI ≥ 25 kg/m$^2$ or WC ≥ 80 cm for women and WC ≥ 94 cm for men. The Table 3 revealed that 10.7 % of men and 29 % of women were overweight (25 <BMI <29.9), while 2.8 % of men and 17 % of women were obese (BMI ≥ 30). The result correlate those of studies carried on population aged 15 to 65 living in some cities of Cameroon (Yaoundé, Douala, Garoua and Bamenda) which reported that 5.4 % and 17.1 % of men were respectively overweight and obese (Sobngwi *et al*., 2002), 21 % of women were overweight and men were normal (18.4<BMI <25) (Kana Sop *et al*., 2010). Other studies reported by Kamadjeu *et al*., (2006), in population living in Douala showed that 12.5 % of men and 25 % of women were overweight, 6.5 % of men and 19.5 % of women were obese. As in those cities in Cameroon, the population of Maképè Missokè is suffering from overweight and obesity. In the same locality, overweight and obesity were higher in women than men; this is in agreement with the results of the OMS (2003) on the epidemiology of obesity. BMI lower or greater than the normal influence negatively the health and the economic productivity of community and individuals. In a study carried out by Spolidoro *et al*, (2012), overnutrition or obesity is associated with increased blood pressure and hyperinsulinemia, which are considered risk factors for developing chronic diseases such as diabetes mellitus type 2 and cardiovascular diseases. Malnutrition in women and men can result in reduced productivity, slow recovery from illnesses, increased susceptibility to infections, and a heightened risk of adverse pregnancy outcomes. Women with poor nutritional status has a greater risk of obstructed labor having a baby with a low birth weight, having adverse pregnancy outcomes, producing lower quality breast milk, and illness for herself and her baby (Sumana *et al*, 2011).The waist circumference (WC) expresses strong correlation with visceral fat (VAT) and with subcutaneous fat (SAT) (Spolidoro *et al*, 2012). It is recognized that, VAT more than SAT, exerts a greater influence on the hepatic release of free fatty acids which, in turn has a greater

effect in raising blood pressure than the brain (Després and Lemieux, 2006). The brain may increase blood pressure through vagal afferent signals increasing adrenal sympathetic activity (Després and Lemieux, 2006; Katagiri *et al*, 2007). The correlation of WC with the fat deposits was stronger in females (Spolidoro *et al*, 2012). This study showed that the WC means of population enrolled varied from 86.4 to 93.5 cm for women and from 80.9 to 94.8 cm for men. These data support possible relationship between the WC and abdominal fat distribution. An excess body fat especially abdominal fat is directly related to changes in lipids profile (Spolidoro *et al*, 2012).

A dietary approach made from a food survey presented foods commonly consumed by population recruited indicated very monotonous eating habit combined with imbalanced diets. The frequency of consumption of the identified foods showed that carbohydrate foods and fat were the most abundant and frequently consumed. While consumption of fruits, vegetable and protein foods were low. The same observations were obtained by Kana Sop *et al,* (2010) in Cameroonians students of University of Douala; this study has showed the relationship between food intakes and nutritional status. Food rich in lipids (fats and oils) could result in excess calories fat in the body, which is a key factor in food risk of obesity and cardiovascular disease (Karger, 2008). While a diet rich in carbohydrates cause excess carbohydrate calories in the body, which could have adverse metabolic effects. This excess carbohydrate calories cause physiological dysfunctions that are causing obesity, diabetes, insulin resistance, cardiovascular disease (Karger, 2008). The consumption of imbalanced diet high in carbohydrates and lipids may be the cause of the high percentage of overweight and obesity in the population of Makèpé Missokè. However other factors like genes are reported to predispose to obesity and may not be overlooked in the development of overweight and obesity (C.E.N.D, 2001), which could justify the presence of these food-related problems in some people recruited from the same family in this locality. The low consumption of protein foods in this locality was linked or correlate to hypoalbuminemia. The same observations were made by Alexandre, (2003), and in some cases could result marasmus (C.D.U, 2009). The low consumption of fruits and vegetables has also been observed in this population. Fruits and vegetables contain several types of vitamins (Karger, 2008) and minerals essential to the body. Hence lack of vitamins and minerals is the cause of many health problems (AFSSA, 2005). In this population, 8 % of men and 42 % of women had hypoalbuminemia. Indeed, in Makèpé Missokè, the frequency of consumption of protein foods was low. This consumption of low protein foods in this population could result hypoalbuminemia (Bach *et al*., 2004). Several other factors may also induce hypoalbuminemia. The pre-treatment (cooking in most cases) that can affect foods nutritional value, digestibility and bioavailability of proteins may justify the low concentrations of albumin in the blood as reported in previous works (Jacotot *et al*., 2003). Intestinal malabsorption could also be the cause of hypoalbuminemia (Alexandre, 2003). This study also showed that men had serum albumin level greater than those of women in all age groups. This was comparable to the results of work carried out by Hamza (2008) who showed that serum albumin levels in men were 5 % higher than those of women.

## CONCLUSION

Upon completion of this work which was designed to evaluate the nutritional status and food consumption among population in Maképè Missokè (Douala-Cameroon), it was noted that the foods most consumed by population were generally high in fat and carbohydrates. The frequency of consumption of fruits, vegetables and protein rich foods was low. Over 50 % of the study population suffered from hypoalbuminemia, which was the source of protein malnutrition. Overweight and obesity found in this study population, expose them to cardiovascular disease, diabetes and hypertension. The low coverage of protein and energy needs exposed the affected patients to multiple health problems.

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