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Sources of Change and Factors Associated with Obesity Among Women in Cameroon

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ABSTRACT: Obesity is a condition caused by excessive weight gain. Obesity is measured by the body mass index (BMI), which is calculated based on an individual's weight and body size; thus, an individual with BMI of 30 kg/m2 or higher is considered obese. In Cameroon, the rapid increase in the proportion of obese women of childbearing age (7.8% in 2004, 10.3% in 2011, and 10.3% in 2018) is a source of national health concern. In fact, this condition is now part of the public health problem in Cameroon (MINSANTE, 2017). The country now faces the double burden of malnutrition. It mostly affects vulnerable groups such as children under five and breastfeeding or pregnant women. According to the results of the fifth Cameroon Demographic and Health Survey (CDHS), almost three out of ten children under five (29% in 2018) suffer from stunted growth, 11% have underweight, and 11% are overweight; an increase in the proportion of obese women was observed between 2004 and 2018, that is 8.2% in 2004, 10.8% in 2011, and 14.0% in 2018. This study focuses on women aged 15 to 49. It aims to provide an initial assessment of obesity among women of childbearing age in Cameroon. To this end, the study examined the causes of the increase in obesity at the national level and the factors associated with the risk of obesity among these women. The results of the decomposition showed that the increase in obesity among women aged 15 to 49 is mainly due to changes in their feeding habits. The analytical model highlights the explanatory factors of the obesity status of women of childbearing age in Cameroon, including the region of residence, women's status in the household, household income level, women's occupation, and their age. Therefore, it is essential to raise awareness among these women about the importance of a healthy diet and physical exercise. This awareness should be led by health and sports professionals, with the support of government authorities.

Keywords: Obesity, women of childbearing age, Cameroon

I. INTRODUCTION

In 2003, the World Health Organization (WHO) sounded the alarm about the dangers of obesity worldwide, describing it as one of the most important issues in public health overall. In recent years, obesity has reached epidemic proportions. Today, the obesity pandemic is constantly growing and affecting all layers of the population, but women of childbearing age are among the most vulnerable to this condition that is becoming increasingly prevalent. The way it affects women of childbearing age is particularly worrisome. According to

Mr. António Guterres, on the occasion of World Digestive Health Day, celebrated on May 29, 2021, "*over four million people die worldwide each year due to obesity"*.

According to the WHO, approximately 13% of the global adult population (i.e. 11% men and 15% women) were obese in 2016 and one out of four women of childbearing age (27%) suffer from obesity, totalling about 146 million women of childbearing age (WHO, 2016). Additionally, the risk of death increases 2 to 3 times among obese individuals. The same trend is observed in Cameroon, where the prevalence of obesity among women of childbearing age is estimated at 14% according to the fifth CDHS. The speed at which this proportion has increased since 2004 is alarming: the proportion of Cameroonian women of childbearing age who are obese (with a Body Mass Index BMI of 30 or higher) has increased from 8.2% in 2004 to 10.8% in 2011 and to 14% in 2018. Thus, assessing the nutritional status of women of childbearing age is particularly useful in identifying high-risk pregnancies and non-communicable diseases (NIS and ICF International, 2018). The nutritional status of women aged 15 to 49 is also one of the determinants of maternal mortality as it has a significant influence on the course and outcome of pregnancies.

The Cameroon health system is mainly characterized by low funding, and the increasing rate of obesity is leading to increased needs and pressures on subsequent financial resources that are not always available, especially in a health system exposed to the double burden of malnutrition (undernutrition and overnutrition). From a political perspective, health authorities are concerned about the growing trend of this condition. Obesity has consequences on the quality of life, psychological state, and social well-being. The accumulation of excess calories in the form of fat in adipose tissues significantly reduces the quality of life. It is also associated with increased mortality and morbidity from cardiovascular and respiratory diseases, hypertension, diabetes, musculoskeletal disorders, and certain cancers. According to Sellam et al., (2016), obesity increases the risk of death from diabetes by four times and significantly increases the risks of death from cirrhosis, stroke, and coronary heart disease. Overall, obesity worsens atherosclerosis in women of childbearing age, leading to complications during pregnancy, that in turn increases perinatal mortality. The effect of obesity on mental health is significant among some women, as they are often subject to popular mockery.

In Cameroon, the constant increase in this condition is due to inappropriate dietary practices and particularly the consumption of foods providing an excessive caloric intake. This caloric intake is accompanied by an increased frequency of metabolic syndrome. In a context of increasing sedentary lifestyles, particularly due to urbanization, and a low prevalence of physical activity among women of childbearing age (only 3.2% of Cameroonian women engage in physical activity), the rate of obesity continues to rise. Given the current data and considering the indirect costs associated with obesity among women of childbearing age in an already fragile Cameroonian health system, it is necessary to propose tailored solutions and prevention measures to government and medical authorities for this target population. Therefore, it is useful to understand the phenomenon of obesity.

This study seeks to identify the sources of change contributing to the rise in obesity among women of childbearing age in Cameroon in a context characterized by the double burden of malnutrition, with both undernutrition and obesity present simultaneously. Specifically, we aim to test and determine the potential explanatory factors behind the increase in the proportion of women suffering from obesity in Cameroon from 2004 to 2011 and from 2011 to 2018, as well as to identify the factors associated with obesity among women of childbearing age in 2018.

II. Context, Data and Methods

Context

Cameroon is a country in Central Africa with a surface area of 475,650 km2, including 9,600 km2 of maritime surface contained in river mouths, creeks and lakes. It is characterized by geographical diversity, with a wide variety of climates, vegetation and hydrographic potential. Its natural environment is relatively diverse,

with three main types of natural regions that contribute to this diversity, resulting in an uneven distribution of the prevalence of obesity, risks and inequalities among women of childbearing age across these regions.

Years of drought (2009 and 2011) and flooding (2010 and 2012) have significantly affected cereal stocks, creating situations of food insecurity. The northern part of the country is affected by poor production conditions and generally insufficient rainfall for agricultural production (FEWS NET, 2020). This region faces risks of famine and drought due to the gradual drying out of Lake Chad and a climate not conducive to agriculture. This could lead to a low prevalence of obesity among women of childbearing age residing there.

In Cameroon, seasonal variations determine nutrient availability, especially in areas highly exposed to climatic hazards. In fact, local climate fluctuations that influence soil quality can also lead to variations in agricultural production. The latter is likely to have an unequal impact on the nutritional status of populations, particularly women and children, as each climate has its own particular type of vegetation and plant and animal resources. As a result, individuals eat differently depending on the food resources available in the regions where they live, leading to differentiation in terms of quality and type of nutrients, and consequently to obesity in some regions as opposed to others.

In the 2005 Population and Housing Census, the population of women of childbearing age was estimated at 4,248,727, and in 2015, it was around 5,506,148. The proportion of women of childbearing age in the total population increased from 24.3% in 2005 to 25.0% in 2020. Such demographic growth in the female population of childbearing age means a high dependency ratio (approximately 95.0%) which in turn puts high pressure on basic social infrastructure and services such as education, health, access to energy and clean water, food security, and land security. As a result, differences in obesity prevalence.

In Cameroon, fertility remains high despite a clear downward trend from 5.8 children per woman in 1991 to 4.8 children per woman in 2018 (NIS and ICF International, 2020). This decline is greater in urban than in rural areas. Indeed, between 1991 and 2018, the Total Fertility Rate (TFR) fell from 5.2 to 3.8 children per woman in urban areas, compared with 6.3 to 6.0 children per woman in rural areas over the same period (NIS and ICF International, 2020). Fertility is therefore higher in rural than in urban areas, due to socio-cultural constraints relating to health, literacy and contraceptive practices.

Moreover, fertility remains high at young ages (15 to 19), then increases very rapidly to reach its peak in the 25 to 29 age group, and then declines steadily with age (NIS and ICF International, 2020). As a result, the still high fertility rate can lead to obesity risks, as repeated pregnancies can lead to a significant increase in body mass for some women.

The pregnancy-related mortality ratio is estimated at 467 deaths per 100,000 live births over the period 2011 to 2018. Applying the WHO definition, which restricts the calculation to deaths of women during pregnancy or childbirth, or within 42 days following childbirth or the end of pregnancy, the maternal mortality ratio is then estimated at 406 deaths per 100,000 live births (NIS and ICF International, 2020). However, this level has risen sharply since 1998, and is far from the target set by SDG 3 target 3.1, which is to reduce the global maternal mortality ratio to 70 per 100,000 live births (NIS and ICF International, 2020). Obesity could have a significant influence on this high level of maternal mortality by contributing to a sizeable proportion of maternal deaths. Excessive pre-pregnancy weight gain increases the risk of adverse outcomes such as gestational hypertension, pre-eclampsia, gestational diabetes and caesarean delivery. Other adverse outcomes include retention of excess weight after delivery, macrosomia, high birth weight and premature delivery. These adverse pregnancy outcomes have significant repercussions on both mother and child. An obese woman is therefore more likely to die from pregnancy-related causes than a woman of normal weight (WHO, 2017).

Since 2008, Cameroon has been experiencing the effects of the global economic and financial crisis, which resulted in a deteriorating of the terms of trade by 18.1% in 2009, following a 22% appreciation the previous year. This effect, combined with a decline in oil production and inadequate energy supply, had a

negative impact on economic activity in Cameroon. As a result, between 2008 and 2009, real GDP growth slowed from 2.9% to 1.9%, and real GDP per capita fell by 0.2%. Consequently, the population faced an increase in the cost of living. Inflation, which had hitherto been contained at an annual average of 2.3% between 2001 and 2007, rose to 5.3% in 2008 as a result of soaring world prices for consumer food products with a high import content into Cameroon, notably rice, wheat, wheat flour and frozen fish.

In Cameroon, the incidence of poverty is higher in male-headed households compared to female-headed households (33% versus 39% among men (NIS, 2015). Although women on average have lower human capital and concomitantly lower incomes, it should be noted that the households they head generally have a higher standard of living. This is due to the fact that female-headed households are generally smaller in size. Furthermore, the report specifies that female-headed households most often receive transfers. Similarly, 24% of the population in general and 21% of the poor live in female-headed households. The precariousness of households headed by people working in the informal agricultural sector is all the more worrying given that these people generally have very little capital and resources to ensure good productivity, income or savings. Since 2001, the poverty profile has shown that these households face a number of difficulties, including weak productive capital and difficult access to markets. This situation slightly changed between 2007 and 2014 (NIS, 2015). It is therefore possible that the economic characteristics of the household in which the woman lives could influence her nutritional status, potentially creating variation in obesity rates depending on the type of household.

Cameroon is made up of various sociological segments, with its own cultural and religious practices that make it possible to identify ethnic and religious groups. The current spatial distribution of the population must be understood in the context of migratory movements that have marked the Central African Sub-region in recent centuries (BUCREP, 2011). The population consists of over 250 ethnic groups divided into six major human groups: the Sudanese, Hamites, and Semites who live in the Adamaoua, North, and Far North regions; the Bantus, Semi-Bantus and Pygmies who live in other regions. The religious landscape is characterized by Christianity (Catholicism, Protestantism including new evangelical churches), Islam, and animism.

Regarding Cameroon's population by ethnic group, we have the Sudanese, Hamites, Semites, Forest Bantus, Coastal Bantus, and Semi-Bantus. These major groups often migrate from one region to another, bringing their dietary habits with them. This cultural diversity in Cameroon is likely to bring about variations in nutrition and health behaviours. In fact, these diverse behaviours, generally resulting from prohibitions or taboos, can influence the nutritional and health status of women, which can lead to variations in obesity rates among them.

III. Source of data and sample

The data used in this study are from the 2004 Cameroon Demographic and Health Surveys (EDSC-III), 2011 (EDSC-MICS), and 2018 (EDSC-V). The rationale for the choice of these data sources is linked, on one hand, to the availability of anthropometric data on women of childbearing age during the three surveys and on the other hand, due to the possibility of carrying out an evolutionary study of the phenomenon over the period. The study focuses on women of childbearing age who are not pregnant and have not given birth in the two months preceding the survey. There were 361 women aged between 15 and 49 in 2004, 727 in 2011 and 793 in 2018 for whom the body mass index (BMI) was calculated, distributed throughout the country.

The sample was selected on the basis of a three-stage sampling method: in the first stage, the enumeration areas (EAs) were drawn from a 2005 (3rd General Population and Housing Census) census random list. In each selected EA, households were drawn in the second stage and in the third stage one household out of two was selected for anthropometric measurements. All women aged 15-49 in the selected households were eligible for height and weight measurements. The anthropometric measurements (weight and height) of women were used to calculate their Body Mass Index (BMI=weight/height2), which is the explanatory variable of this study.

IV. Method of Analysis

Two methods of analysis were used: the Decomposition method and the binomial logistic regression in a multilevel approach. The decomposition method consists in finding the 'sources' of the change in the prevalence of obesity among women of childbearing age in Cameroon. The decomposition method, within the framework of this study, seeks to identify the origin of the change in the obesity rate among women of childbearing age over the period 2004 to 2011 and between 2011 and 2018 by considering certain classification variables. We distinguish two types of decomposition: the simple decomposition and the advanced decomposition. The simple decomposition considers two sources of change (composition and behaviour). Its formula is obtained by expressing the national performance as a weighted average of the performances of the groups.

The composition effect indicates the proportion of the change that results from a change in the statistical representation of women of childbearing age. The performance effect indicates the proportion of social change attributable to the average variation in obesity status across the different social categories. The mathematical formulation of the simple decomposition is obtained by expressing the national average as the performance of social groups.

$$Y_t = \sum w_{jt} * y_{jt}$$

Where Y represents obesity among women of childbearing age at the national level, y is the proportion of obese women for group j in year t, and W_{jt} is the proportion of women in group j at time t.

In this formula, the national change in obesity among women of reproductive age can be expressed as follows: $\Delta Y = \sum \bar{y}_j * \Delta w_j + \sum \bar{w}_j * \Delta y_j$

Composition effect Performance effect

As for the advanced decomposition method, it disaggregates the performance effect into three sub-components: the contribution of the basic nutrition system in Cameroon (basic performance); the contribution related to the differentiation of obesity according to the categories of different classification variables (differentiation effect); and the contribution associated with the classification variables not taken into account in the decomposition (residual effect).

$$\Delta Y = \left[\sum \bar{y}_j * \Delta w_j\right] + \left[\sum w_j + \Delta\alpha\right] + \left[\sum w_j + x\Delta\beta\right] + \left[\sum w_j + \Delta\mu_j\right]$$

Base **Differentiation** **Residual**

Composition Effect **Performance Effect**

Regarding the multilevel binomial logistic regression method, it enables us to identify the factors associated with obesity among women of childbearing age in Cameroon in 2018. This multilevel analysis will be conducted at three levels: individual, household and community. We will use four models to analyze the causal effects of obesity among women aged 15 to 49 in Cameroon.

Multilevel models are a statistical solution for handling information that is nested at several levels of observation or analysis entities. They allow us to see how individual characteristics and aggregated characteristics (households and communities) play differently on the behaviours of individuals living in a given entity (Courgeau et al., 1997; Nganawara, 2016).

In fact, in this study, we use data from the 2018 Cameroon DHSC-V, which has a hierarchical structure, i.e. the units of observation are nested. Specifically, regarding women, it can be seen that they are grouped within households, and these households are grouped in communities (measured here by enumeration areas).

The fact that women of childbearing age share a common environment can affect the behaviour we wish to study. The existence of shared characteristics (which are not all observable) among all women in a group means that the observations will have a particular structure, and that conventional statistical inference may provide biased results.

The use of multilevel models helps to address these limitations of single-level (conventional) analyses. In fact, a single-level analysis of a social phenomenon such as obesity among women of childbearing age, which depends on contextual aspects, involves certain errors (biases), namely:

- **The ecological fallacy or aggregation bias** if we try to detect individual behaviours from aggregated data (Courgeau, 2004). This involves interpreting individual behaviour from aggregated data.
- **The atomistic error** if we ignore the context in which human behaviours occur. This context can be defined as the family environment in which the woman lives or more generally as a surrounding area, or less extended around her: her region of residence, her municipality, etc. One may think that this context can influence individual behaviours, and it seems fallacious to isolate the woman from the constraints imposed by society and the environment in which she lives (Courgeau, 2004).
- **The independence of residuals**: Conventional logistic regression models using ordinary least square (OLS) assume that residuals are independent. In other words, there is no relationship between the errors observed in two distinct individuals (Petrucci et al., 2015). This hypothesis is very restrictive in the sense that it excludes the possibility of a group effect. It excludes the fact that individuals living in the same group, the same environment, are more likely to resemble each other in their behaviours compared to those living in different environments.

Given the non-independence of the observations in our specific context, the fundamental assumption of ordinary least squares regression, which assumes that the dependent variable observations are not related and do not influence each other, is violated. Strictly speaking, conventional regression methods cannot be applied. The multilevel model addresses this limitation by measuring a component of the heterogeneity specific to each level.

- **The homoscedasticity of residuals**, which in simple logistics regression assumes that the error variance is identical for all individuals (Petrucci et al. 2015). This appears restrictive in the sense that the possible differential effects of the environment in which the obese woman finds herself are not taken into account.

It is important to note that multilevel models simultaneously model the *fixed effects* (*averages*: identical value for all statistical units at the aggregation level) and the *random effects* (variances: varying value from one statistical unit to another at a given aggregation level) of independent variables on the study variable (Petrucci et al. 2015).

Multilevel models therefore refer to a structuring of the data, and hence of the behaviour studied, according to different levels of observation and analysis. The structuring into groups is marked in multilevel models by introducing randomness in these groups. The variance between individuals is decomposed into two (or more) variances, one between individuals in defined groups and the other between groups. These models no longer take the event under study, where the individual is surveyed, out of context. The quantitative analysis carried out

in this sense is in line with the general paradigm of social sciences, which interpret the behaviour of individuals as the product of their own history and the history of the social groups and territories through which these groups have passed, in line with the more qualitative disciplines (Bringe et al. 2017).

In this study, five (5) models were used to measure the contribution of each of the three levels of aggregation in explaining obesity among women of childbearing age in Cameroon and to assess the (net and random) effects of variables selected at the individual, household, and community levels in the explanation of this phenomenon.

The unconditional or empty model included only the dependent variable and the constant. Its use was essential in the multilevel approach because the relevance of its results serves as a reference for interpreting the results of the other models. In fact, it made it possible to evaluate the influence of contextual and individual characteristics on obesity among women of childbearing age attributable to context effects; by highlighting the variability of the phenomenon within communities on one hand, and between communities on the other hand. It is called an empty model because it did not include any explanatory variables and corresponds to a simple decomposition of the total variance of the phenomenon into intergroup and intragroup variance. It highlighted the effect of context on the phenomenon studied.

This proportion was determined by the value of the intra-class correlation (ICC), which corresponds to the portion of the variance explained by the group effect, and justifies the usefulness of using multilevel modelling. If the intra-class correlation is close to zero, this means that multilevel modelling does not offer much more than a traditional linear model. Conversely, when the intra-class correlation is close to 1, it means that the units within the same group are very close and very different from those in other groups.

Consider the following global equation: $Y_{ijk} = a_{0jk} + e_{ijk}$ obtained from the empty model where the coefficients a_{0jk} and e_{ijk} respectively designate the coefficient of variation at the individual level and the random term explaining the variation of obesity in woman i of household j in community k. Recall here that we are in a three-level nested model. In other words, the higher level influences the lower level. Therefore, at level two, the coefficient of variation a_{0jk} consists of a fixed term β_{00k} for the community and a random term μ_{0jk} for households in a given community.

We then obtain the following regression equation: $a_{0jk} = \beta_{00k} + u_{0jk}$ which allows us to determine the random term independently of the level one term. Note that level three influences the first two levels; in fact, the fixed term obtained at level two is broken down into a fixed term γ_{000} for all the individuals observed and a random term v_{00k}, resulting in the following regression equation: $\beta_{00k} = \gamma_{000} + v_{00k}$. In the end, we obtain the equation below:

$$\text{Logit}(Y_{ijk}) = Ln\left[\frac{P(Y_{ijk}=1)}{1-P(Y_{ijk}=1)}\right] = \gamma_{000} + \left[v_{00k} + u_{0jk} + e_{ijk}\right] \qquad (1)$$

Where $\left[v_{00k} + u_{0jk} + e_{ijk}\right]$ in equation (1) is the random or residual term, while the other part is the fixed part. The quantity e_{ijk} is the random residual of woman i within household j located in community k; u_{0jk} is that of household j within community k and v_{00k} is that of the community with $\boldsymbol{v_{00k} \sim N(0, \sigma_v^2)}$, $\boldsymbol{u_{0jk} \sim N(0, \sigma_u^2)}$, and $\boldsymbol{e_{ijk} \sim N(0, 1)}$. It is worth noting that the last error term will not be explicitly included in the models because we are conducting a logistic regression. The preceding error terms are assumed to be uncorrelated pairwise.

In the case of a logit regression, the intergroup variance at the individual level is $\frac{\pi^2}{3}$ and the unit in the case of a probit regression (Bressoux, 2004). Note that σ_v^2 is the intergroup variance at the community level and σ_u^2 is the intergroup variance at the household level. The variance of the random terms at each level is a parameter to estimate and the significance of the variability at each level gives meaning to the hierarchical scheme.

Overall, the multilevel logit model does not take into account the level-one error term. This is because it is the randomness of this error that is taken into account as we model the probability of an event occurring rather than the variable itself. Furthermore, the multilevel random constant models used in this study are characterized by the fact that, in addition to the individual variance, only one random term is placed on the intercept, with a variance significantly different from 0, reflecting a heterogeneous average level depending on the contexts (Bringe et al, 2017). From the above, it is relevant to evaluate the contribution of each level of analysis in explaining the fluctuations related to obesity among women of childbearing age in Cameroon.

Therefore, we calculated the intergroup correlation coefficient, which represents the total variability due to a group. The Intragroup Correlation Coefficient (ICC) which represents the degree of similarity between two women from the same community will also be calculated. It is a measure of the homogeneity that exists in a community; that is, the degree of similarity in behaviours among women living in approximately the same contexts. The formula for calculating the ICC is as follows in the case of logit regression (i.e., the sample distribution does not follow a standard normal distribution):

$$ICC = \frac{\sigma_{v0}^2}{\sigma_{v0}^2+\sigma_{u0}^2+\frac{\pi^2}{3}}$$ for the community level

$$ICC = \frac{\sigma_{u0}^2+\sigma_{v0}^2}{\sigma_{u0}^2+\sigma_{v0}^2+\frac{\pi^2}{3}}$$ for the household level

- **Individual model (M1)**

In this model, only the individual-level X_{ijk} explanatory variables were introduced, in order to measure their own influence on the variations in obesity among women of childbearing age. The aim in this model, as in subsequent models, was to reduce the residual variances of the empty model. This involves determining whether the variance at the level of each group is due to its composition or not. Its equation is given as:

$$Y_{ijk} = \gamma_{000} + \sum_{q=1}^{Q} a_q X_{qijk} + \left[v_{00k} + u_{0jk} + e_{ijk}\right] \quad (2)$$

- **Household model (M2)**

The second model consisted in introducing household characteristics into the empty model. This made it possible to identify the fixed effect of each household variable on obesity among women of childbearing age.

It was materialised as follows:

$$Y_{ijk} = \gamma_{000} + \sum_{n=1}^{N} \beta_n Y_{njk} + \left[v_{00k} + u_{0jk} + e_{ijk}\right] \quad (3)$$

- **Community model (M3)**

The third model consisted in introducing community characteristics into the empty model. This made it possible to identify the fixed effect of each community variable on obesity among women of childbearing age.

It was obtained using the following formula:

$$Y_{ijk} = Y_{000} + \sum_{r=1}^{R} \gamma_r Z_{rk} + \left[v_{00k} + u_{0jk} + e_{ijk}\right] \quad (4)$$

- **Final Model (M4)**

The final model took into account all the independent variables related to individual, household, and community levels. In this model, the explanatory variables were introduced step by step. In some cases, the contextual variance could be significantly reduced even though only one variable was introduced into the model, simply due to structural effects. This was, for example, the case when an individual variable was highly correlated with an important contextual variable. This model thus allowed us to identify the individual and contextual factors associated with obesity among women of childbearing age in Cameroon.

The equation of the final model is as follows:

(5)

$$\text{Logit}(Y_{ijk}) = Ln\left[\frac{P(Y_{ijk}=1)}{1-P(Y_{ijk}=1)}\right] = Y_{000} + \sum_{q=1}^{Q} a_q X_{qijk} + \sum_{n=1}^{N} \beta_n Y_{njk} + \sum_{r=1}^{R} \gamma_r Z_{rk} + \left[v_{00k} + u_{0jk} + e_{ijk}\right]$$

Where: i is level 1 observation, j level 2 observations and k level 3 observations.

Y_{ijk} is the overall obesity score for a woman i living in a household j in community k.

It was necessary to check certain application criteria before carrying out the logistic regression. Generally, statistical problems arise when there is a significant linear relationship between two or more regressors. If an exact linear relationship exists between two or more regressors, the equation of a linear regression does not yield any result. In this case, the researcher is advised to retain only one of the explanatory variables among those that are perfectly correlated for analysis. In this specific case, Bourmont (2012) notes that this approach poses no particular issue, provided that the variables involved represent a single “reality”. It is noteworthy that more subtle statistical problems can arise when there is a significant linear relationship between two or more regressors. Unlike in the previous case, it is not obvious that these variables represent the same "reality," despite being correlated. In such instances, two techniques are commonly used to address multicollinearity issues: correlation matrix and calculation of VIFs (Variance Inflation Factors). In this study, we opted for VIF calculation, as it enables each explanatory variable to be regressed on the others, enabling the researcher to determine the portion of variance of an explanatory variable that is independent of the other explanatory variables.

An important multicollinearity issue is identified in a regression when the value of VIF is greater than 10 or when the average of all VIFs is greater than or equal to 2 (Bouba Djourdebbe, 2015). Therefore, if neither of these values is reached, according to this author, the impact of multicollinearity is fearless, and all explanatory variables can be retained for analysis. The analysis reveals that there are multicollinearity problems between the variables selected in this study, with the average VIFs being equal to 2.31. To address this issue, the marital status variable will be removed from the model, as it reflects the same reality as the household expenditure decision-making variable. After correction, the average VIFs stand at 1.90 (Results not presented in this document).

Regarding the adequacy of data for multilevel models, the Wald chi-square test was used. This statistic provides information on the validity of the results provided by the logit regression using a multilevel approach. It is significant if at least one of the explanatory variables introduced in the model significantly influences the phenomenon at a specific level of significance. In this study, the level of significance was set at 5%. If the

probability associated with the chi-square statistic exceeds the set level of significance, it was concluded that the independent variables used in the model significantly explain the variance of the study variable, indicating that the explanatory variables can predict model values. It is worth mentioning that the empty model did not provide this statistic, as it contained no explanatory variables.

V. Study Variables

The dependent variable in this study is the nutritional status of women. During the 2018 DHS survey, anthropometric data (height and weight) of women aged 15 to 49 were collected. These measurements enabled the calculation of the Body Mass Index (BMI) or Quetelet index, which is used to assess their nutritional status. Invented in the 1840s, the BMI in this study indicates whether a woman's weight is ideal, i.e., whether it is appropriate for her height.

This indicator is commonly used by doctors to evaluate nutritional status. It can be used to determine malnutrition, overweight, or obesity. BMI calculation, validated by the WHO, involves a simple mathematical formula: dividing weight in kilograms by the square of height in meters; It is expressed in kg/m2. The resulting number estimates body size and potentially indicates overweight or obesity in adults, particularly women. A woman who is too thin for her height has a BMI of 18.5 kg/m2; this condition is normal when the BMI is between 18.5 and 25 kg/m2. Above 25 kg/m2 its overweight and as from 30 kg/m2, we talk of obesity.

Thus, a BMI $\leq$ 30 indicates a woman is not obese, while a BMI > 30 suggests obesity. This variable was categorized into two in the study: "0" for non-obese women and "1" for obese women. Ultimately, the study's dependent variable was of a qualitative dichotomous nature, with 14% of women aged 15 to 49 classified as obese in Cameroon in 2018.

The independent variables were tested in the analysis model to identify individual and contextual factors associated with obesity among women of childbearing age in Cameroon. Some variables were constructed while others were grouped according to our objectives. The independent variables were categorized into three groups: contextual variables, those related to household characteristics, those related to gender, and those related to the individual characteristics of women.

Variables related to the area of residence

In this study, the region of residence has been grouped into 6 categories in relation to the agroecological zones and the low proportions of certain categories. The categories are as follows: Far North/North/Adamaoua, Centre/South/East, Littoral/Southwest, West/Northwest, Douala, Yaoundé. The type of place of residence is a differentiation variable. This variable distinguishes women living in urban areas from their counterparts living in rural areas.

The type of place of residence refers to the location where the household habitually lives. It plays an important role in influencing individuals' behaviours. This variable helps to understand the influence of urbanization on individuals' behaviours, perceptions, attitudes, and hence on the organization of what can be called a "social system". The type of place of residence is a differentiation variable. As infrastructures are generally more developed in cities than in rural areas, women living in urban areas have easier access to a diet rich in sugar and calories than those living in rural areas. This variable is used in this study because it refers to the process of acquiring norms, values, and practices and plays an important role in influencing women's behaviours. Thus, it helps to understand the factors associated with obesity according to the context of residence. For this variable, we consider 2 categories: urban (major cities, with at least 50,000 inhabitants) and rural (small agglomeration of less than 10,000 inhabitants).

The proportion of educated women in the community is an endogenous variable that reflects the average level of education of women living in a community (EA). It was constructed based on the woman's level of educational variable. Firstly, this variable was grouped into two categories (educated and not educated).

We then obtained the proportion of educated women in each community. The use of this variable in this study is justified by the fact that it provides information on the human capital of women in a community. Given that the level of education is positively correlated with obesity, this variable is likely to provide insights into the degree of influence of this social category on women who are not educated or less educated. The proportion of women in the community was grouped into 2 categories: low and high. This proportion is low when it is less than 50% and high when it is more than 50%.

Variables related to household characteristics

An indicator of the standard of living was constructed based on the household's possession of goods and the comfort of the habitat. The categories used to construct the standard of living variable were weighted on an increasing scale according to their economic value. A principal component analysis was then performed on the weighted variables. The first component (which explains most of the variance) was finally selected as the standard of living indicator. It was categorised into three: low, medium, and high.

Gender-related variable

The woman's status in the household refers to her position in relation to the management of the household in which she lives; it is her ability to act as head of the household or not. In this study, this variable was grouped into 3 categories: head, spouse, and other.

Variables related to individual characteristics of the woman

The woman's level of education is captured by the last class attended. This variable was categorised into: No education, Primary, Secondary, and Higher. However, given the small sample observed in the "higher" category, we decided to group this variable into three categories: no education, primary, and secondary or higher. This recoding of the categories takes into account the size of the sample.

The level of media exposure was constructed by combining these three variables, namely: exposure to television, radio, and newspapers, and then recoded into three categories: low for those who never follow or follow less than once the three media, medium for those who follow at least once the three media, and high for those who frequently follow the three media.

The age of the woman was grouped into three categories: young (15-24 years), adults (25-34 years), and elderly (35 years and over). Marital status was grouped into the following categories: in a relationship (married and in union) and not in a relationship (single, widowed, divorced/separated). Parity achieved was grouped into three categories: No children, 1-3 children and 4 or more children. The woman's occupation was grouped into three categories: Without occupation/household/domestic work, traders/services, and farmers.

VI. RESULTS

The results interpreted here mainly concern those related to the source of changes and the factors associated with obesity in Cameroon.

Analysis of the source of changes in obesity among women of childbearing age

Here, we examine the evolution of obesity among women of childbearing age in Cameroon between 2004 and 2011 and between 2011 and 2018 according to the variables of classification selected for the analysis. These variables include household standard of living, the level of education of the woman, and their age group.

Household Standard of living between 2004 and 2011

In the various DHS databases used, the household standard of living variable is measured by "wealth quintiles." Three categories are distinguished in "household standard of living." The "low" category includes the

poor and very poor classes, the "medium" category corresponds to the middle class, and the "high" category corresponds to the rich and very rich classes of the wealth quintile.

The results of the simple decomposition describing the increase in the proportion of obese women (table 1) reveal a significant contribution of the performance effect (76.71%). It is therefore the differential change in women's nutritional behaviour by standard of living that mainly explains the increase in the proportion of obese women in Cameroon between 2004 and 2011. Women living in households with a high standard of living contributed 73.49% of this increase.

Extending the performance effect (table 1) reveals that it is the differentiation effect (76.71%) and the base effect (9.31%) that contributes to the performance effect. In other words, the increase in the proportion of obese women can be explained on the one hand by the overall change in the basic nutritional system in Cameroon (base effect) and on the other hand by the difference (differentiation effect) in their behaviour according to the household's standard of living.

Table 1: Simple and advanced decomposition of the increase in the proportion of obese women by household standard of living between 2004 and 2011

Standard of living	DHS 2004		DHS 2011		Simple Decomposition (%)			Advanced Decomposition (%)		
	% women	Obesity rate	% women	Obesity rate	composition effect	performance effect	Contribution per level	Base	Differentiation	Error
Low	34,73	2,00	32,48	3,20	-0,06	0,40	13,75%	0,08	0,30	0,02
Medium	19,34	6,20	18,76	8,10	-0,04	0,36	12,76%	0,04	0,34	-0,03
High	45,93	13,40	48,76	16,40	0,42	1,42	**73,49%**	0,11	1,28	0,03
Total					0,32	2,19	100,00%	0,23	1,92	0,03
Contribution per effect					12,84%	**87,16%**		**9,31%**	**76,71%**	1,14%

Source: *Authors*

Household standard of living between 2011 and 2018

Between 2011 and 2018, the results obtained from the simple decomposition reveal that the increase in the proportion of obese women is mainly due to a change in their behaviour in relation to their standard of living. In fact, the performance effect is (113.23%). The change in the behaviour of women of medium standard of living on one hand, and those of high standard of living on the other hand, contributes 45.32% and 48.72% respectively to the increase in the proportion of obese women in Cameroon between 2011 and 2018.

Extending the performance effect (table 2) reveals a predominance of the differentiation effect (145.92%) and, to a lesser extent, the base effect (16.04%). Thus, although the increase in the proportion of obese women is mainly explained by the change in the differential behaviour of women from households with a high standard of living, the change in the basic nutritional system also contributes to this increase (16.04%).

Table 2: Simple and advanced decomposition of the increase in the proportion of obese women by household standard of living between 2011 and 2018

Standard of living	DHS 2011		DHS 2018		Simple Decomposition (%)			Advanced Decomposition (%)		
	% women	Obesity rate	% women	Obesity rate	Composition effect	Performance effect	Contribution per level	Base	Differentiation	Error
Low	32,48	3,20	33,94	3,50	0,05	0,10	5,96%	-0,13	0,56	-0,33
Medium	18,76	8,10	20,23	13,10	0,16	0,97	45,32%	-0,08	0,66	0,39
High	48,76	16,40	45,83	20,10	-0,53	1,75	48,72%	-0,19	2,41	-0,47
Total					-0,33	2,82	100,00%	-0,40	3,64	-0,42
Contribution per effect					-13,23%	**113,23%**		-16,04%	**145,92%**	-16,65%

Source: *Authors*

Women's level of education between 2004 and 2011

A woman's level of education refers to her level of school attendance at the time of the survey. This variable has three categories: 'No education', 'Primary' and 'Secondary or more'.

The results of the simple decomposition of the increase in the proportion of obese women (table 3) show the predominance of the performance effect (88.47%) in explaining the increase in the proportion of obese women between 2004 and 2011. The change in the nutritional behaviour of women with secondary education or more accounts for 77.63% of this increase. Extending the performance effect (Table 3) reveals a subsequent contribution of the differentiation effect (92.10%) to the observed change in behaviour and, to a lesser extent, the base effect (5.48%) in explaining the increase in the proportion of obese women of childbearing age.

Table 3: Simple and advanced decomposition of the increase in the proportion of obese women by level of education between 2004 and 2011

Level of education	DHS 2004		DHS 2011		Simple Decomposition (%)			Advanced Decomposition (%)		
	% women	Obesity rate	% women	Obesity rate	Composition effect	Performance effect	Contribution per level	Base	Differentiation	Error
No education	21,00	3,30	18,23	3,70	-0,10	0,08	-0,75%	-0,03	0,20	-0,09
Primary	38,86	8,50	34,21	11,30	-0,46	1,02	23,12%	-0,05	0,73	0,34
Secondary or more	40,14	10,10	47,56	12,50	0,84	1,05	77,63%	-0,06	1,32	-0,20
Total					0,28	2,15	100,00%	-0,13	2,24	0,04
Contribution per effect					11,53%	**88,47%**		-5,48%	**92,10%**	1,84%

Source: *Auteurs*

Women's level of education between 2011 and 2018

Between 2011 and 2018, the simple decomposition of the increase in obesity among women of childbearing age according to their level of education highlights the performance effect (100.40%) in explaining the increase in obesity among these women. Women with "secondary education or more" were found to contribute about 96.54%. Extending the performance effect (table 4) shows that it is the differentiation effect that best explains the influence of the performance effect on the increase in the proportion of obese women aged 15 to 49 in Cameroon.

Table 4: Simple and advanced decomposition of the increase in the proportion of obese women by level of education between 2011 and 2018

Level of education	DHS 2011		DHS 2018		Simple Decomposition (%)			Advanced Decomposition (%)		
	% women	Obesity rate	% women	Obesity rate	Composition effect	Performance effect	Contribution per level	Base	Differentiation	Error
No education	18,23	3,70	19,45	4,60	0,05	0,17	8,66%	-0,02	0,22	-0,03
Primary	34,21	11,30	27,06	13,80	-0,90	0,77	-5,20%	-0,03	0,70	0,09
Secondary or more	47,56	12,50	53,49	15,70	0,84	1,62	96,54%	-0,05	1,74	-0,08
Total					-0,01	2,55	100,00%	-0,10	2,66	-0,01
Contribution per effect					-0,40%	**100,40%**		-3,93%	**104,81%**	-0,48%

Source: *Authors*

Women's age between 2004 and 2011

In this analysis, the age of the woman was categorised into three groups: 15-24 years, 25-34 years and 35 years and above. The results of the simple decomposition show the predominance of the performance effect in explaining the increase in the proportion of obese women in Cameroon between 2004 and 2011. Women aged 35 and above account for 88.41% of this increase.

Extending the performance effect (table 5) reveals that the main source of change is the differentiation effect (363.17%). In other words, the increase in the proportion of obese women of childbearing age is mainly due to the change in nutritional behaviour of those aged 35 and above.

Table 5: Simple and advanced decomposition of the increase in the proportion of obese women by age group between 2004 and 2011

Age group	DHS 2011		DHS 2018		Simple Decomposition (%)			Advanced Decomposition (%)		
	% women	Obesity rate	% women	Obesity rate	Composition effect	Performance effect	Contribution per level	Base	Differentiation	Error
15-24years	46,07	3,70	44,28	2,90	-0,06	-0,36	-17,38%	-3,04	2,19	0,49
25-34 years	28,06	11,30	28,80	12,10	0,09	0,23	12,97%	-1,91	2,76	-0,62
35 years and above	25,86	12,50	26,91	21,40	0,18	2,35	88,41%	-1,78	3,84	0,29
Total					0,21	2,21	100,00%	-6,73	8,79	0,16
Contribution per effect					8,49%	**91,51%**		-278,24%	**363,17%**	6,58%

Source: *Authors*

Women's age between 2011 and 2018

Over the period 2011 to 2018, we note that the increase in the proportion of obese women is mainly due to the performance effect (95.56%). However, unlike the period 2004 to 2011, women in different age groups contribute 51.57%, 26.26% and 22.17% to this performance effect for the 25-34, 15-24 and 35 and above age groups respectively.

Extending the performance effect (table 6) shows that it is the base effect that best explains the increase in the proportion of obese women in Cameroon between 2011 and 2018. In other words, the change observed is due to the alteration in the basic nutritional system in Cameroon between 2011 and 2018. There has been a preference for the consumption of foreign (imported) products over local products.

Table 6: Simple and advanced decomposition of the increase in the proportion of obese women by age group between 2011 and 2018

Age group	DHS 2011		DHS 2018		Simple Decomposition (%)			Advanced Decomposition (%)		
	% women	Obesity rate	% women	Obesity rate	Composition effect	Performance effect	Contribution per level	Base	Differentiation	Error
15-24years	44,28	2,90	42,17	4,60	-0,08	0,73	26,26%	0,78	0,13	-0,17
25-34 years	28,80	12,10	31,19	15,30	0,33	0,96	51,57%	0,54	0,18	0,24
35 years and above	26,91	21,40	26,64	23,70	-0,06	0,62	22,17%	0,48	0,24	-0,11
Total					0,19	2,31	100,00%	1,80	0,55	-0,04
Contribution per effect					7,44%	**92,56%**		72,11%	22,06%	-1,60%

Source: *Authors*

Analysis of the factors associated with obesity among women of childbearing age in Cameroon in 2018

The multilevel logistic model used for this study has as dependent variable the nutritional status of women which takes the value (1) if the woman has a BMI equal to or greater than 30kg/m² and Zero (0) if not. It is a three-level model, namely: individual, household, and community. At the individual level, the variables considered are as follows: the woman's age, the woman's level of education, media exposure, the number of children, and the woman's occupation. At the household level, the variables considered are the household's standard of living and the woman's status in the household, and at the community level, we have the region of residence, the type of place of residence, and the proportion of educated women in the community. The level of significance used was at 5% and the results interpreted as "every other thing being equal"; that is, the influence of a variable is analysed while keeping the effects of the other variables constant.

Model M1: Individual level variables

In Model (M1), which focuses on women's individual characteristics, they were all found to explain obesity among women of childbearing age in Cameroon. The results show that women aged between 25 and 34 years and women aged strictly over 35 years are respectively 4.545 and approximately 14 times more likely to be obese than those aged 15 to 24 years. Regarding the women's level of education, women with no education are 70.1% less likely to be obese than educated women (table 7). In fact, there is no significant difference in obesity status between women with primary education and those with secondary education and above at the 5% level of significance. The level of education could be one of the factors contributing to obesity among women of childbearing age in Cameroon.

The results of this model show that women with low and medium exposure to the media are 76.5% and 42.9% less likely to be obese than women with high exposure to the media. The analysis of the number of children shows that women without children are 52.1% less likely to be obese than their counterparts with at least one child. It was also found that women engaged in agricultural activities were 39.5% less likely to be obese than women with no occupation, and women engaged in commercial activities were 1.662 times more likely to be obese than women with no occupation. There was no significant difference in the level of obesity between women with no occupation and housewives. Thus, the absence of physical activity could be a factor that explains obesity among women of childbearing age.

Model M2: Household level variables

At household level, all the variables selected were found to be determinants of obesity among women of childbearing age in Cameroon. The results show that women living in households with a low and medium standard of living are 92.7% and 48.5% respectively less likely to be obese than their counterparts living in households with a high standard of living. As for the woman's status, the results show that female household heads and married women are 7.201 and 6.059 times more likely to be obese than those with another status in the household.

Model M3: Community level variables

At community level, only the woman's region of residence influences the occurrence of obesity. We found that women living in the Far North, North and Adamaoua regions were 61.6% less likely to be obese than those living in the Centre, South and East regions. On the other hand, women living in other regions of the country are more likely to be obese than those living in the Centre, South and East regions.

Final model: Individual, household, and community level variables

The final model takes into account all the variables introduced into the model. Overall, at the individual level, women aged 25 and over are more likely to be obese than those aged under 25years. As for the number of children, women without children are 47.5% less likely to be obese than those who have already given birth. Female traders were 1.549 times more likely to be obese compared to other women. However, the variables relating to the women's level of education and media exposure in the household no longer affect women's obesity. At household level, women living in low standard of living households were 75.0% less likely to be obese than those living in medium- and high standard of living households. This can be explained by the fact that the quantity of food consumed in low standard of living households is less than in medium- and high standard of living households. Similarly, female household heads and married women are respectively 1.518 and 1.734 times more likely to be obese than those of other status. At community level, we found that women from the Far North, North and Adamaoua regions were less likely to be obese than women from other regions.

Table 7: Net effects (odds ratios) of explanatory variables on obesity among women of childbearing age in Cameroon in 2018

Variables/Categories	M0	M1	M2	M3	M4
Individual characteristics of the woman					
Woman's age		***			***
15-24years		RC			RC
25-34 years		4,545***			3,486***
35 years and above		13,925***			8,079***
Woman's level of education		***			ns
No education		0,299***			0,714ns
Primary		0,975ns			1,143ns

Secondary or more		RC			RC
Exposure to media		***			*
Low		0,235***			0,659*
Medium		0,571***			0,809ns
High		RC			RC
Number of children		***			***
No children		0,479***			0,525***
1-4 children		RC			RC
5 children and more		1,181ns			1,400*
Women's occupation		***			***
No occupation		RC			RC
Housewife/domestiques work		1,351ns			1,339ns
Trader/Services		1,662***			1,549***
Farmer		0,605**			0,843ns
Household Characteristics					
Household standard of living			***		***
Low			0,073***		0,250***
Medium			0,515***		0,799ns
High			RC		RC
Women's status in the household			***		***
Head			7,201***		1,518**
Spouse			6,059***		1,734***
Other			RC		RC
Community characteristics					
Region of residence				***	***
Far North/North/Adamawa				0,384***	0,492**
Centre/South/East				RC	RC
Littoral/South-West				3,432***	3,857***
West/North-West				4,080***	5,094***
Douala				5,133***	5,113***
Yaounde				1,779**	1,555ns
Type of place of residence				***	ns
Urban				RC	RC
Rural				0,449***	0,756ns
Proportion of educated women in the community				ns	ns
Low				0,773ns	0,928ns
High				RC	RC
var(_cons[v001])	4,983***	2,227***	2,487***	1,185ns	1,168ns
var(_cons[v001>v002])	11,016***	48,641***	27,753***	11,558***	51,789***
Chi2 de wald		306,562	243,668	245,129	347,219

Source: *Authors*

VII. DISCUSSION AND CONCLUSION

The increasing prevalence of obesity among women of childbearing age in Cameroon between 2004 and 2011 and between 2011 and 2018 appears to be linked to changes in their nutritional behaviours. This

change in behaviour stems from the westernization of dietary habits, with a preference for cheap imported products that are rich in calories and animal fat, to the detriment of local foods. This increase in the prevalence of obesity is more noticeable among women aged over 24 years. Thus, as a woman's age increases, so does her risk of excessive weight gain. This relationship is further explained by the feeling of satiety, which disappears with age, leading to excessive weight gain. Giving birth often results in weight gain during pregnancy for women. Women who have had at least one child are at a higher risk of obesity compared to those without children. This is because repeated pregnancies, which result in women reaching parity, lead to increasingly excessive weight gain as their number of children increases. This excessive weight gain is more pronounced in women aged 30 and over. This result is justified by the socio-demographic approach, which suggests that the household income in which the woman lives is closely linked to her age, marital status, and employment status, all of which are associated with obesity risks (Dumas, 2011). The prevalence of obesity among women is also accentuated among those engaged in commercial activities. Sedentary lifestyles and increasing urbanisation, particularly with the resurgence of motorised vehicles, have considerably reduced the amount of walking that used to play an essential role in reducing women's weight. It should be noted that the practice of physical activities is not deeply rooted in the mentality of Cameroonian women as a whole.

Exposure to the media induces a sense of mimicry among Cameroonian women of childbearing age due to the portrayal of obesity as a symbol of wealth and social success. This perception is often tied to the household's standard of living where the woman resides. Results have shown that women from medium and higher living standards are more likely to be obese compared to those with lower standards of living. This trend can be partially explained by Popkin's nutrition transition approach (2012), which posits that increased income leads to the availability of easier-to-prepare goods and easier access to animal products, resulting in a significant dietary change. This transition, driven by economic development and globalization, tends to steer Cameroonian women away from local diets towards more diversified and calorific Western diets. In Cameroon, when the standard of living of a household in which a woman lives increases, it ultimately leads to an increase in her financial capacity, which in turn increases her purchasing power and her calorie-rich diet. As a result, escaping from poverty and food shortages promotes a culture of chubbiness perceived as a sign of social success. Media exposure also reflects cultural behaviours, as shown by Samba et al. (2014) in a study in Mali focusing on the rise of obesity. Culture is the imprint of norms related to women's body size, including traditions of forced feeding in the populations of northern Mali, particularly among the Moors, as well as the Tuaregs and Songhai.

These results can also be explained by the theory of gender, which suggests cultural differences manifested in social relationships linked to bodily differences. The status of head of household gives women greater purchasing power. It is therefore her ability to decide how much food to eat that affects her nutritional status. While men are seeking to reproduce the masculine ideals of breadwinner and head of household, the current political and economic context is putting them under increasing pressure, especially in the crisis areas of the North West and South West. The holding of economic power as an instrument of male domination is being undermined in these crisis regions. In this context, marked by the evolution of women's economic capacity, it is likely that

Increase in obesity is also noticeable among female household heads and married women. Female household heads have greater access to food in their homes and decide on their food consumption quantity. Once married, women generally gain weight as they usually have greater access to food in the household and are primarily responsible for cooking. In addition, married women intentionally gain weight as they are no longer seeking a life partner. These results can also be explained by the theory of gender, which suggests cultural differences manifested in social relationships linked to bodily differences. In fact, the household head status gives women greater purchasing power. Hence, their ability to decide on the quantity of food consumed influences their nutritional status. While men are seeking to reproduce the masculine ideals of breadwinner and head of household, the current political and economic context is putting them under increasing pressure, especially in the crisis regions, namely the Northwest and Southwest. The possession of economic power as an

instrument of male domination is being undermined in these crisis regions. In this context, marked by the evolution of women's economic capacity, it is likely that women can influence their own excessive weight gain.

The region of residence influences a woman's obesity level. Women living in the Southwest and Littoral regions (excluding Douala), those living in the West and Northwest regions, and those in the cities of Yaoundé (political capital) and Douala (economic capital) are more likely to be obese compared to those in other regions of the country. The difference in obesity rates is linked to the level of economic development and the degree of urbanization specific to these regions, as women from these areas have greater access to cheap food (imported products) and higher purchasing power compared to those in the Far North, North, and Adamaoua regions. Therefore, in Cameroon, food availability and household income are dependent on the level of socio-economic development of the country's regions, correlating with the rise in obesity among childbearing women. Cameroon is currently facing a double burden of malnutrition among women of childbearing age, because in addition to underweight, there is a rise in obesity, which remains a public health concern. This pathology is particularly worrisome given that the Cameroonian healthcare system is currently unable to deal with it.

This article aimed to understand the sources of increased obesity among women in 2004, 2011, and 2018 and identify the factors associated with increased obesity among women of childbearing age in Cameroon in 2018. At the end of the analyses, it is observed that the increase in the proportion of obese women in Cameroon between 2004, 2011, and 2018 primarily results from changes in their nutritional behaviours. Overall, this rise in obesity is more noticeable among women living in households with a high standard of living. The higher a woman's standard of living, the greater her risk of obesity. Similarly, after the age of 24, women run a greater risk of becoming obese, particularly if they have had one or more children. This situation is compounded by the perception that a larger body size is a sign of well-being and social success, while leanness is associated with poverty. Therefore, it is crucial to educate women on proper nutrition and the importance of physical activity. This awareness should be conducted by healthcare and sports professionals with the support of government authorities.

Excessive weight is a health risk and the cause of many diseases. Engaging in daily physical activity and eating healthily are some actions to adopt for overall well-being.

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