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ASSESSING THE ECONOMIC COST (QALY AND ACUR) OF OBESITY IN THE BAMENDA MUNICIPALITY OF THE NORTH WEST REGION OF CAMEROON

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Abstract

Introduction: Five people die every minute, 75 people every 15minutes and 7.671 persons each day from obesity-related complications in the world (WHO, 2014). Overweight and obesity are the fifth leading risks for global deaths (WHO, 2014). In June 2013, the American Medical Association recognized obesity as a disease (WHO, 2014. In Cameroon, the obesity figures stood at 9.6% second in CEMAC after Gabon which was 15% in 2014 (WHO 2014). In addition, 44% of the diabetes burden, 23% of the hypertension burden and between 7% and 41% of certain cancer burdens and 60% of Cardiovascular Disease in Cameroon were attributable to overweight and obesity in that same year (WHO, 2014).
Purpose: This study purports to calculate the obesity QALY and ACUR and to scrutinize the effect of obesity on mobility index and age at death in the North West region of Cameroon.
Methodology: To calculate the QALY and ACUR, data was collected secondary source making up 149 individuals aged 50 and above who died in the Bamenda general hospital from obesity related illnesses between 2016 and 2018. To generate the mobility index, we issued and corrected the EQ-5D-5L questionnaire for testing quality of life to238 individuals in the Bamenda Municipality. To ensure the reliability of the instrument, Pre-tests were conducted. Descriptive and inferential statistics were used for the calculation of QALY.
Findings: The Average cost utility ratios' (ACURs) show that obesity treatment in the Bamenda Municipality will result in a 0.275 QALYs gained and monthly ACURs of $3,578.18/QALY. It also shows that obesity significantly and negatively influences mobility index and age at death. We thus conclude that obesity incurred major economic cost.
Unique contribution to theory, practice and policy: Policy wise, the "2M (Mentality and Motivation) concept" of obesity treatment is recommended as major contributions to theory, practice and policy. This will lead to a change in the perception and motivation toward treating obesity.

Key Words: *Obesity, Treatment, Cost, Mentality, Motivation.*

INTRODUCTION AND LITERATURE REVIEW

In the world today, thousands of men and women suffer from a medical condition referred to as obesity. While obesity has been existing, it was only in June 2013, that the American Medical Association (AMA) recognized obesity as an epidemic. This led to more attention being given to it worldwide. One year after the recognition by AMA, the World Health Organization (WHO) in 2014, wrote enormously on issues related to obesity facts and figures. Overweight and obesity becamethe fifth leading risks for global deaths. At least 2.8 million adults die each year as a result of being overweight or obese (WHO, 2014). In addition, 44% of the diabetes burden, 23% of the heart disease burden and between 7% and 41% of certain cancer burdens are attributable to overweight and obesity (WHO, 2014). Worldwide, obesity has nearly doubled since 1980. According to the WHO global report for 2012, more than 1.4 billion adults, (20 years and older), were overweight. Of these overweight adults, over 200 million men and nearly 300 million women were obese. Overall, more than 10% of the world's adult population was obese in 2008, (WHO, Facts and Figures of obesity and overweight, 2012).In the fast facts on Economic Costs of Obesity (2006), healthcare cost for obesity is one of the biggest causes of chronic diseases in the United States. It costs approximately $147 billion to $210 billion yearly, (Fast Facts of Obesity, 2006). According to this same study, Cameroon spends up to US$61 per person on health for obesity and other health problems, above the average for Sub-Saharan Africa excluding South Africa (US$ 51), and in line with countries such as Senegal and Nigeria. While public resources allocated to health in Cameroon have progressively increased over the past ten years, they however remain one of the lowest in Africa in terms of GDP at 1.5 percent of GDP, (Fast Facts of Obesity, 2006).

Several studies have dwelled on this topic, such as the study by (Wang, Yang, Lowry and wester, 2003) on the cost-effectiveness and cost-benefit of Planet Health, a school-based intervention designed to reduce obesity in youth of middle-school age children. Their results show that at an intervention cost of $33, 677 or $14 per student per year, the program would prevent an estimated 1.9% of the female students (5.8 of 310) from becoming overweight adults. As a result, an estimated 4.1 QALYs would be saved by the program, and society could expect to save an estimated $15, 887 in medical care costs and $25, 104 in loss of productivity costs. These findings translated to a cost of $4305 per QALY saved and a net saving of $7313 to society. Results remained cost-effective under all scenarios considered and remained cost-saving under most scenarios.

To add, Hampp, Hartzema PharmD, MSPH, FISPE and Kauf, (2008) estimated the incremental cost-utility ratio (ICUR) of rimonabant 20 mg/day in the treatment of obesity from a third-party payer's perspective. Their results showed incremental benefits (costs) were 0.0984 QALYs ($5209) compared to no treatment and 0.0581 QALYs ($4182) compared to placebo, producing ICURs of $52,936/QALY (95% confidence interval $39K–$69K) and $71,973/QALY ($51K–$98K), respectively. In another study, Chotai, Sielatycki, Parker, Sivaganesan. Key, Stonko, Wick, McGirt, Devin, (2016) determined cost-utility following anterior cervical discectomy and fusion (ACDF) in obese patients. They found out that obese patients had a lower mean cumulative gain in QALYs versus non-obese patients at 2-years. Morbidly obese patients had lower QALYs gained (0.17) and higher cost per QALYs gained at 2 years.

Konnopka, Bödemann and König, (2011) also estimated the health burden and the direct as well as indirect costs of morbidity and mortality attributable to obesity and overweight in Germany for the year 2002. They estimated 36,653 obesity-and overweight-attributable deaths with 428,093 consecutive YPLL and 367,772 QALYs lost. Jia and Lubetkin (2010) examined trends in the burden of obesity by estimating the obesity-related quality-adjusted life years (QALYs) lost-defined as the sum of QALYs lost due to morbidity and future QALYs lost in expected life years due to premature deaths-among U.S. adults along with differences by gender, race/ethnicity, and state. Their results show that QALYs lost due to obesity in U.S. adults have more than doubled from 1993 to 2008. Black women had the most QALYs lost due to obesity, at 0.0676 per person in 2008. This number was 31% higher than the QALYs lost in black men and about 50% higher than the QALYs lost in white women and white men. A strong and positive relationship between obesity-related QALYs lost and the percentage of the population reporting no leisure-time physical activity at the state level (r=0.71) also was found. Several studies have found a connection between obesity and mortality.

Jia and Lubetkin (2010) reviewed studies that demonstrated that morbidity-mortality curves for smoking and obesity in the US have crossed as the latter appears to have become the greater health threat, when measured by quality-adjusted life-years (QALYs) lost. They attributedthe prevalence of smoking the in US as declined from 18.5% between1993 &2008, with most of the loss occurring in the lattersix years; during the same period, the proportion of obese people (body-mass index >30 kg/m^2) rose steadily to 85%. Khan, Jeff and Brien, (2012) also estimated the obesity related burden of disease arising from a weight related reduction in the quality of life in Australia. Their objective entailed two tasks: (i) the validation of the AQoL-8D instrument in the context of overweight and obesity; and (ii) the use of the instrument to measure the loss of Quality Adjusted Life Years (QALYs) associated with this problem. Their results showed that AQoL--8D was sensitive to variation in each of the dimensions of the SF36. A statistically significant relationship was obtained between AQoL-8D utilities and BMI which implied an obesity related loss of QALYs approximately twice the size of the loss derived from previous estimates. According to Finkelstein, Trogdon, Cohen and Dietz, (2009), Health policy makers do not understand value in terms of cost per kilogram lost, but if told that an intervention improves QALYs at better than $50K per QALY saved, they recognize that as good value for money.

Looking at the about reviews, it can be clearly seen that there exit little or no works on the calculation of obesity QALY in Cameroon talk less of the Bamenda Municipality. This thus leaves a research gap which is necessary to be filled by other researchers. It is thus based on these facts that, this study purport to calculate the obesity QALY and ACUR and to scrutinize the effect of obesity on mobility index and age at death in the Bamenda Municipality of the North West region of Cameroon as a step towards the assembly of data to inform policy in Cameroon

METHODOLOGY

To calculate the QALY and ACUR, we carried out participatory observation in two separate gyms(MACO and LANGO gyms) in the Bamenda Municipality and collected data for 149 individuals who died in the Bamenda general hospital from the year 2016 to 2018 from obesity related illnesses. From the data set, we selected 103 individuals for those who aged 50+, thus

having 64 obese and 39 non obese for our analysis. This was to exclude children from the sample and work only with the aged, since it is mostly at higher age that obesity starts affecting the health of individuals. To calculate the mobility index, the researchers issued and corrected the EQ-5D-5L questionnaire for testing quality of life to 238 individuals in the Bamenda municipality. We calculated the QALY and ACUR according the formulae used by (Wang et al., 2003) specified in our results section below.In addition, we equally used chi-square and simple regression to analyze the influence of obesity onmobility index andon age at death.

Modeling Obesity QALY

$$QALY = Remaining\ Life\ Expectancy(RLE) x\ Quality\ of\ Life\ (QL)$$

To better illustrate the quality and years of life lost to obesity, it was necessary to calculate the Average cost utility Ratio equation (ACUR)

$$ACUR = \frac{costs\ in\ monetary\ units}{QALYs\ gained}$$

Table 1. Description of Variables used in the Estimation QALY

Variable	Meaning	Description
RLE	Remaining life Expectancy	This will be gotten from the difference between the life expectancy of obese and non-obese
QL	Quality of Life	This will be from the differences in mobility scores between obese and non-obese, gotten using the EQ-5D-5L Questionnaire for Testing Quality of Life. 1 = perfect health and 0 = death
	Additional cost	Gotten from the cost of the treatment of obesity (calculated from the cost of the treatment of obesity related diseases)
	Additional benefit	This was gotten from the QALYs saved from not being obese

Source: produced by authors

RESULTS

This section presents the findings of the results starting with the summary statistics and then the inferential statistics made up of chi-square and regression results.

Table 2: Summary Statistics on Age Quality of Life and Obesity

	N	Minimum	Maximum	Mean	Std. Deviation
All Age	149	20	120	59.62	19.26
All Weight	149	37	125	68.98	13.44
Non Obese Age	64	56	102	71.59	10.79
Obese Age	39	54	87	68.28	12.38
Body Mass Index and Quality of Life Results					
Body Mass Index	238	15.39	29.93	24.46	2.95
All Mobility Index	238	0.60	1	0.89	0.07
Mobility Index Non Obese	238	0.60	1	0.892	0.07
Mobility Index for Obese	68	1	1	0.809	0.151

Table 2 presents summary statistics for the data collected from the field for this work.Two major findings are peculiar on the table. First, we can see from section one above that, the mean age and weight at death for individuals who died from 2016 to 2018 in the general hospital is 59.62 and 68.98 respectively. The mean age at death for non-obese and obese stood at 71.59 and 68.28 respectively. This gives a difference in the mean age at death of 3.31years. Secondly, the mean mobility index for none obese and obese stood at 0.892 and 0.809 respectively. This gives a difference in the mobility index between obese and non-obese individuals of 0.083.
This thus means that obese individuals compared to non-obese have lower mean age and mobility index. The chi square results on table 3 in panel 1 demonstrate that age at death depended on obesity status and is independent of sex (p=0.32) in panel 2. In the panel 3, the results shows that mobility index is statistically dependent on the individual's obesity status (P=0.00).

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Table 3: Results on Age at Death, Mobility Index and Gender

Variable	OBESITY		
	NON OBESE	OBESE	Totals
PANEL 1			
Age at death			
50-59	7(6.8%)	12(11.7%)	19(18.4%)
60-69	24(23.3%)	3(2.9%)	27(26.2%)
70-79	15(14.6%)	14(13.6%)	29(28.2%)
80-89	15(14.6%)	9(8.7%)	24(23.3%)
>90	4(3.9%)	0(0%)	4(3.9%)
X^2(P-Value)			0.0020.32
PANEL 2			
SEX	FEMALE	MALE	TOTAL
Age			
≤49	17(11.4%)	30(20.1%)	49(31.5%)
50-59	5(3.4%)	13(8.7%)	18(12.1%)
60-69	8(5.4%)	19(12.8%)	27(18.1%)
70-79	4(2.7%)	25(16.8%)	29(19.7%)
80-89	5(3.4 %)	19(12.8%)	24(16.1%)
>90	0(0%)	4(2.7%)	4(2.7%)
X^2(P-Value)			0.32
PANEL 3			
MOBILITY INDEX	NON OBESE	OBESE	TOTAL
HIGH	149(65.6 %)	50(22 %)	199(87.7 %)
MEDIUM	11(4.8%)	13(5.7%)	24(10.6%)
LOW	0(0%)	4(1.8%)	4(1.8%)
X^2(P-Value)			0.000

The frequencies for causes of death and its different dependent variables have been represented on figures below.

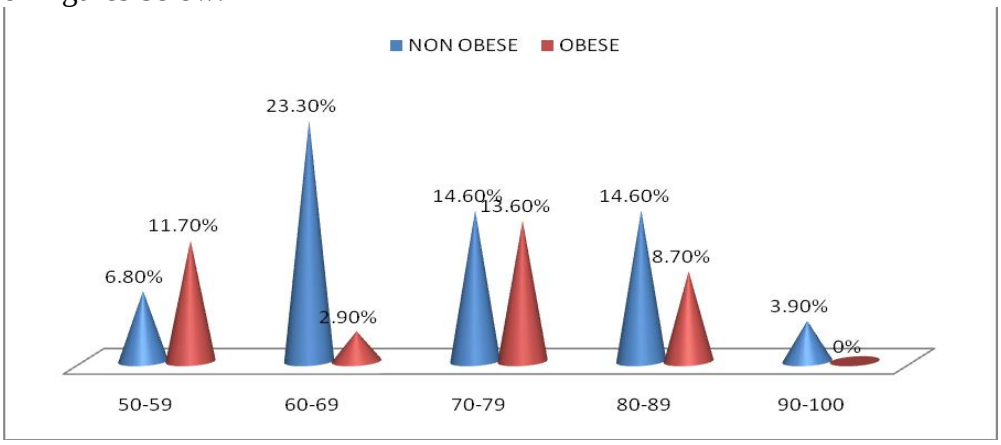

Figure 1: Obesity and Age at Death

From figure 1, above, one can observe that, with the exception of age group 50 to 59, compared to obese, more non-obese die at each age group. At age group 50 to 59, up to 11.7% obese patients died as oppose to the 6.8% of non-obese patients who died at that age group.

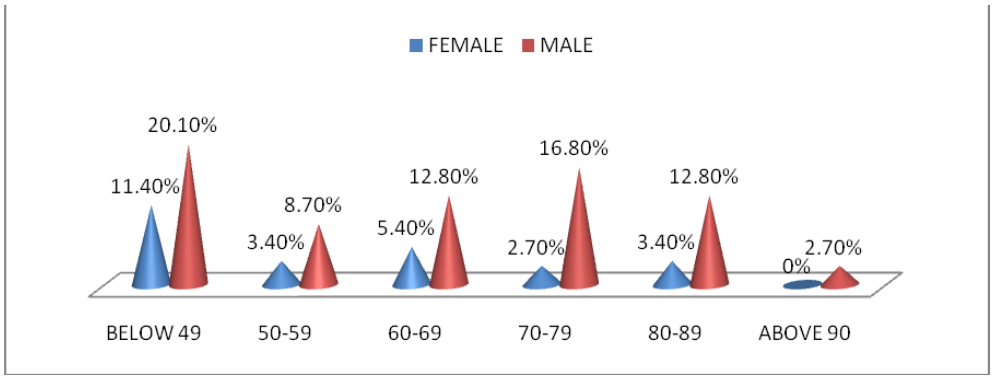

Figure 2: Age at Death and Gender

Looking at Figure 2 above, we can observe that in all age group, more men than female died in this study population.

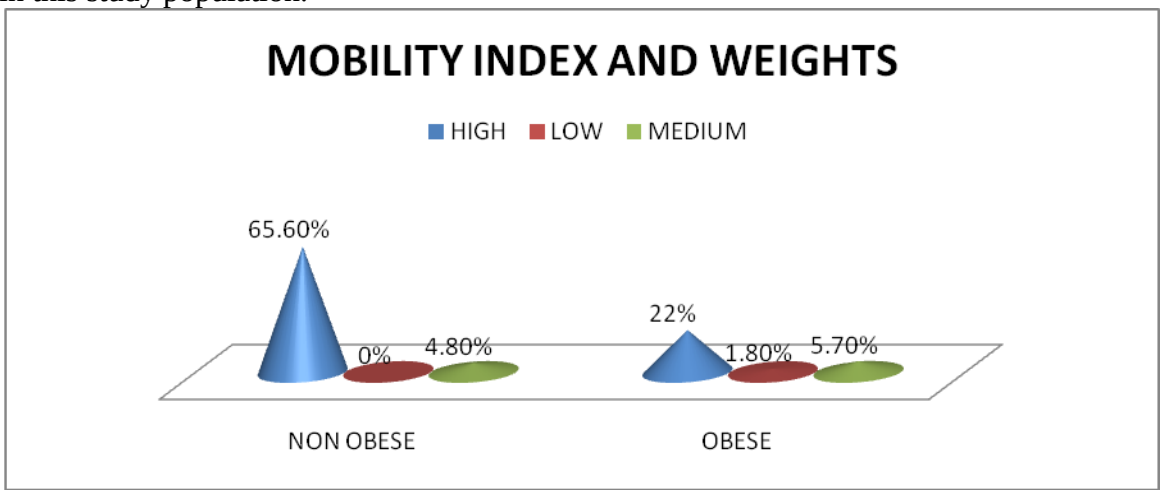

Figure 3: Mobility index and weight

One can observe that both obese and non-obese have high scores in the mobility index test. However, more of the non-obese (65.6%) had a high mobility index compared to the obese (22%). It can also be observe that, no non-obese individual had low scores for mobility index (Fig. 3)

Presentation of Inferential Analysis Results

Table 4: Regression Results for Age at Death and Obesity

	REGRESSION	CORRELATION
Variable	Coefficient (Standard error)	Coefficient Sig. (2-tailed)
Obesity	0.682*** (0.132)	0.476** 0.000
constant	12.55 (9.222)	
F(1, 147) = 26.64	Prob.> F = 0.0000	
Number of observations	149	

Dependent variable: Age at death

A simple regression results on the influence of obesity on the age at death is presented on table 4 above. The general result indicates a positive coefficient (0.682) of the ages at death which is also statistically significant at 1%. This positive and significant result is in corroboration with the correlation test results (0.476, p-value 0.000). This positive coefficient of the results (0.682) suggests that as the weights of the individual's increases, the ages at death equally increase. One unit increase in obesity will lead to a 0.682 unit increase in ages at death.Results demonstrate a negative coefficients (-0.00843) between obesity and mobility index. This result is statistically significant at1% level of significant. This suggests that increase in obesity figures by 100% will lead to fall in the mobility index scores by 0.843%. The correlation result confirms the negative and significant relationship between obesity and mobility index (Table 5).

Table 5: Obesity and Mobility Index

	REGRESSION	CORRELATION
Variable	Coefficient (Standard error)	Coefficient Sig. (2-tailed)
Obesity	-0.00843*** (0.00170)	-.445** 0.000
constant	1.097*** (0.0431)	
F(1, 304) = 26.64	Prob.> F = 0.0000	
Number of observations	306	

Dependent variable: mobility index

After confirming the relationship between obesity, age at death and mobility index from the above demonstrations, the next sub section that follows focus on the calculation of QALY and ACUR which is the main objective of this work.

Calculation of QALYS

$$QALY = Remaining\ Life\ Expectancy(RLE) x\ Quality\ of\ Life\ (QL)$$

From the summary statistics on table 1 above, we observed that the mean age at death is 71.58 for the non-obese as oppose to 68.28 for the obese with a mean age difference of 3.31.

The mobility index for non-obese and obese were 0.892 and 0.809 respectively. This gives a difference in the mobility index between obese and non -obese individuals of 0.083.The formulae for the calculation of QALYs is

$$QALY = Remaining\ Life\ Expectancy(RLE) x\ Quality\ of\ Life\ (QL)$$

= QALY gained from an obesity intervention
= difference in life expectancy × difference in quality of lifebetween obese and non-obese.

This thus gives us 0.083×3.31 =0.275 QALY gained

This means that any intervention in the Bamenda Municipality aimed at reducing the general obesity level will lead to a 0.275 QALYs gained. To better illustrate the quality and years of life lost to obesity, we went step further to calculate the Average cost utility ratios' (ACURs).

$$ACUR = \frac{costs\ in\ monetary\ units}{QALYs\ gained}$$

In order to get the cost of treating obesity we did the below calculations according to the WHO recommendations of treating obesity, rather than considering any fixed diet plan we calculated our cost based on the WHO (2014) recommendation and our market prices around. The world health organization's prescription for sliming is for individuals to increase exercises, reduce the consumption of fat, salt and sugar especially in carbonated drinks and increase the consumption of fruits and vegetables. Like the recommendation of the WHO, from our participatory observation, we noticed that most of those who succeeded to lose up to 10kg a month in a weight lost competition we participated it, simply reduced their consumption of carbohydrate and increase their consumption of fruits, vegetables and physical exercise.

Table 6: Obesity Treatment Cost in the Bamenda Municipality

Activity	Cost per day(FCFA)	Cost per month(FCFA)	Cost per year(FCFA)
Gyms(physical activities)	167	10000 * 12	120,000
Fruits	500	15,500*12	186,000
Vegetable	500	15,500*12	186,000
Total	1,167	36000	492000

The yearly ACURs = 492000/0.275 = 1,789,090.909FCFA($3578.18)
Our results shows that obesity treatment will result to a 0.275 QALY gained to the individual and a monthly ACURs of $3578.18/QALY. This result is in line with the work of Hampp et al. (2008) who revealed that obesity treatment benefits included gains in quality-adjusted life-years (QALYs) and reduced incidence of type-2 diabetes mellitus and coronary heart disease (CHD). Their incremental benefits (costs) was estimated at 0.0984 QALYs ($5209) compared to no treatment and 0.0581 QALYs ($4182) compared to placebo, producing ICURs of $52,936/QALY (95% confidence interval $39K–$69K) and $71,973/QALY ($51K–$98K), respectively. The results is also in line with Wang et al., (2003) study who estimated that 4.1 QALYs would be saved by a weight lost program, and society could expect to save an estimated $15, 887 in medical care costs and $25, 104 in loss of productivity costs. Chotai et al. (2016) also found out that, morbidly obese patients had lower QALYs gained (0.17) and higher cost per QALYs gained at 2 years. Jia and Lubetkin (2010) also estimated the QALY lost to obesity at 0.0676 per person in 2008.

All of the above studies predict QALY gained for obesity treatment. This thus warrants individuals to be more actively involved in the treatment of obesity so as to have a better quantity and quality of life. In our environment, we can attribute the fall in the quality of life to obesity. This is because obese individuals usually have lower mobility compared to non-obese and obese individuals are more exposed to obesity related sickness, thus making them have a lower lifeexpectancy and mobility compared to non-obese individual. This lower mobility and life expectancy gives the obese a lower quality of life (QALY) and a higher ACUR compared to non-obese.

CONCLUSION

The objective of this study was twofold. First to calculate of the QALY lost to obesity and the Average-cost utility ratio (ACUR) of obesity treatment and Secondly, to scrutinize the influence of obesity on mobility index and age at death in the North West region of Cameroon. In order to do this, we collected data for 149 individuals who died in the Bamenda general hospital from obesity related illness from the year 2016 to 2018. From the data set, we selected 103 for those who were aged 50+ and thus having 64 obese and 39 non-obese for our analysis. We also issued the EQ-5D-5L questionnaire for testing quality of life to 238 individuals in the Bamenda municipality. We used both observatory, descriptive and causal research design to present the findings of our analysis. The QALY and ACURs was calculated using standard formula.
Our results show that obesity treatment will result to a 0.275 QALY gained to the individual and yearly ACURs of $3578.18/QALY. We thus concluded that for every effective treatment an individual carries out, he/she will gain 0.275 QALY and it will cost him $3578.18per QALY gain. The results also showed that obesity significantly and negatively influences mobility index and age at death.

RECOMMENDATIONS

From the findings of our QALY and ACURs results, the researchers recommend individuals in the Bamenda municipality to be activity involve in the weight lost process so as to improve on their quality of life and thus gain additional years and quality of life. It also recommend that

the QALY and ACURs should be blown own in sensitization campaign. This is because the pass campaigns against obesity have concentrated on the health consequences of obesity. The researchers strongly feel that if current campaigns concentrate on the financial consequences and quality of life reduced due to obesity, the impact will be remarkable. This will surely stimulate more individuals to consciously engage in the fight against obesity. Lastly, the researchers recommend the implementation of a compulsory day for physical exercise once a week in Cameroon in General and Bamenda Municipality in Particular.

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