Research Article

Nutritional status and haemoglobin levels of pregnant adolescent girls in the city of Yaoundé, Cameroon

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Abstract

Recently, there has been so much attention on adolescent health issues such as adolescent pregnancy, sexually transmitted infections, and Human Immune Virus infections but adolescent pregnancy and nutrition have aroused very little interest. This cross-sectional study was carried out to evaluate the nutritional status of adolescents aged 15 to 19 years in the city of Yaoundé, Cameroon. Three referral hospitals were selected at random for the recruitment of subjects in Yaoundé. Body Mass Index (BMI), hemoglobin level, a 24-hour recall, food frequency and socio–demographic data were collected using a pretested questionnaire. Hemoglobin level and BMI were used as dependent variables to evaluate nutritional status. The data were analyzed using SPSS 17.0 (ANOVA and student (t) test) with $p < 0.05$. Sixty-two percent (62%) of subjects had a normal BMI, 28 % were overweight, and 10% were obese. Based on ANOVA analysis, Meal frequency, diet quality and the term of pregnancy had significant effect on BMI ($p = 0.003 < 0.05$). Diet quality had a significant effect on hemoglobin levels ($p = 0.003 < 0.05$). The term of pregnancy, especially at the third trimester, significantly affected BMI due to foetus additional weight. Thus, nutritional status depends on the quantity and quality of food intake.

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Résumé

Récemment, on a accordé tant d'attention aux problèmes de santé des adolescents tels que la grossesse chez les adolescentes, les infections sexuellement transmissibles et les infections à virus immunitaire humain, mais la grossesse et la nutrition des adolescentes ont suscité très peu d'intérêt. Cette étude transversale a été réalisée pour évaluer l'état nutritionnel des adolescents âgés de 15 à 19 ans dans la ville de Yaoundé, au Cameroun. Trois hôpitaux de référence ont été sélectionnés au hasard pour le recrutement des sujets à Yaoundé. L'indice de masse corporelle (IMC), le taux d'hémoglobine, un rappel de 24 heures, la fréquence d'alimentations et les données sociodémographiques ont été recueillis à l'aide d'un questionnaire prétesté. Les taux d'hémoglobine et l'IMC ont été utilisés comme variables dépendantes pour évaluer l'état nutritionnel. Les données ont été analysées en utilisant SPSS 17,0 (ANOVA et test de Student (t)) avec $p < 0,05$. Soixante-deux pour cent (62%) des sujets avaient un IMC normal, 28% étaient en surpoids et 10% étaient obèses. Sur la base d'une analyse ANOVA, la fréquence des repas, la qualité du régime alimentaire et la durée de la grossesse ont eu un effet significatif sur l'IMC ($p = 0,003 < 0,05$). La qualité de l'alimentation avait un effet significatif sur les taux d'hémoglobine ($p = 0,003 < 0,05$). La durée de la grossesse, en particulier au troisième trimestre, a considérablement affecté l'IMC en raison du poids supplémentaire du fœtus. Ainsi, l'état nutritionnel dépend de la quantité et de la qualité de l'apport alimentaire.

Mots clés :

Introduction

The nutrient needs for the female gender increase sharply during adolescence, and even more for the pregnant adolescent (1). Pregnant teenagers are girls usually between the ages of 13 to 19 years who become pregnant and are still undergoing the growth spurt. Adolescence is a period characterized, among others, by unsteady eating habits (2). Improving nutritional habits during pregnancy may also improve adolescent birth outcomes (3). In the developed world, the United States has the highest teenage birth rate (55.6%) [a]. Teenage pregnancy in Africa has important social and economic outcomes, the most highly publicized of which stem from lost educational opportunities when pregnancy forces young women to leave school (4). The nutritional status of adolescents in developing countries reveals a high prevalence of low Body Mass Index (BMI) (5). The highest rate of teenage pregnancy in the world is in sub Saharan Africa where women tend to marry at an early age [b]. In Cameroon, an adolescent fertility rate of 141 births per 1000 women aged 15 to 19 years has been reported (6). Early pregnancy in Cameroon for teenagers between the ages of 15 to 19 years is 127 teenage pregnancies per 1000 teenagers (7) · Cameroon therefore, has one of the upper adolescent fertility rates in West and Central Africa (8). A study carried out in 2007 by Kongnuy et al (9), revealed that adolescent pregnancies are associated with both adverse fetal and maternal outcomes in Cameroon. Findings on the nutritional status of adolescents in Cameroon revealed a general low BMI and an anemic rate of 32% [c] while another study on young university students in Cameroon has shown a prevalence of 13% obesity amongst youths (1).

The adolescent growth period requires more nutrient intake in order to support the growth spurt that occurs during this period (11). Pregnant adolescents need to gain more weight during pregnancy as compared to other pregnant adults (11). Physiologic iron requirements are 3 times higher during pregnancy than in menstruating women (11) . Anemia is one of the key nutritional problems in adolescents and Cameroon is not excluded (5). In Cameroon, the prevalence of iron deficiency anemia affects 40% of child bearing age women (12). Hence, this study was carried out to assess the nutritional status and hemoglobin levels of pregnant adolescents in the city of Yaoundé.

Materials and methods

This study was carried out in 3 referral hospitals that were randomly selected from all the Referral Hospitals of Yaoundé. They included the Gynecological and Obstetric Hospital of Ngoussou, the University Teaching Hospital and the Central Hospital of Yaoundé. Necessary approvals were obtained from the administrative authorities of these hospitals prior to the start of the study.

A cross sectional study was carried out on pregnant adolescents whose ages ranged from 15 to 19 years. The study populations were recruited through a random sampling procedure at the antenatal services of the three referral hospitals. The deduced convenient sample size of the study was 100. All subjects completed a pre-tested questionnaire containing a number of specific questions on socio-demographic profile including educational background, source of income and parity. There were also questions on anthropometric measurements, a 24-hour recall, food frequency questionnaire and hemoglobin levels.

Anthropometric measurements (weight and height) were fitted into the standard equation for the calculation of BMI (in kg/m^2}. The 24-hour recall and food frequency provided information on food intake and on food diversification. The

hemoglobin level was determined by an automated cell counter. As full blood count is one of the biological lab exams requested to pregnant women, their hemoglobin status levels were obtained from their lab results.

All of these procedures provided data to determine the nutritional status [d]. Data was analyzed using ANOVA and the student (t) test and the significance level was taken at p-value <0.05. The dependent variables for nutritional status were BMI and hemoglobin (anemia) and the independent variables were food intake, food frequency and age of pregnancy. Univariate analyses were carried out using BMI and hemoglobin levels as dependent variables.

Results

Socio-demographic profile

Figure 1 shows the age distribution of the study population from the three referral hospitals. The most represented age was 18 years.

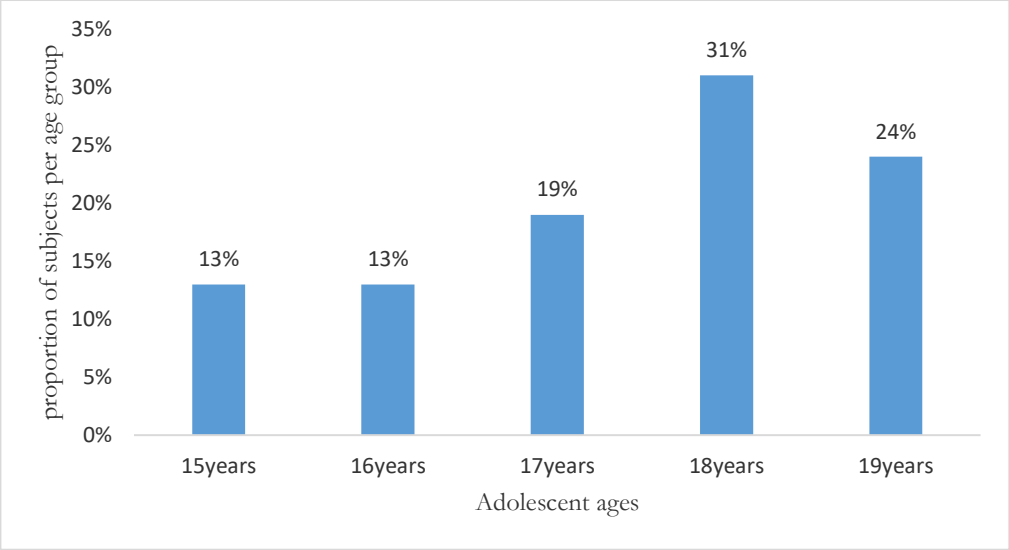

Figure 1: Age distribution of study population

The majority (58%) of the adolescents depended on parents or tutors for food and most of them had a secondary school level of education. Seven percent (7%) of the participants completed primary school, 71% completed secondary school and 22% were in the university.

Table 1: Level of education of the subjects

Education level	Frequency	Percent
Primary school	7	7%
Secondary School	71	71%
University	22	22%
Total	100	100

Twenty-four percent (24%) were married and 76% were single.

Figure 2: Distribution of subjects according to the zone of origin

The study population was either in the 1st or 2nd parity. Seventy-one percent (71%) of the participants were in their first pregnancy and 29% were in their second pregnancy. Forty percent (40%) were unemployed, 49 % were students and 11 % were self-employed as shown in figure 3

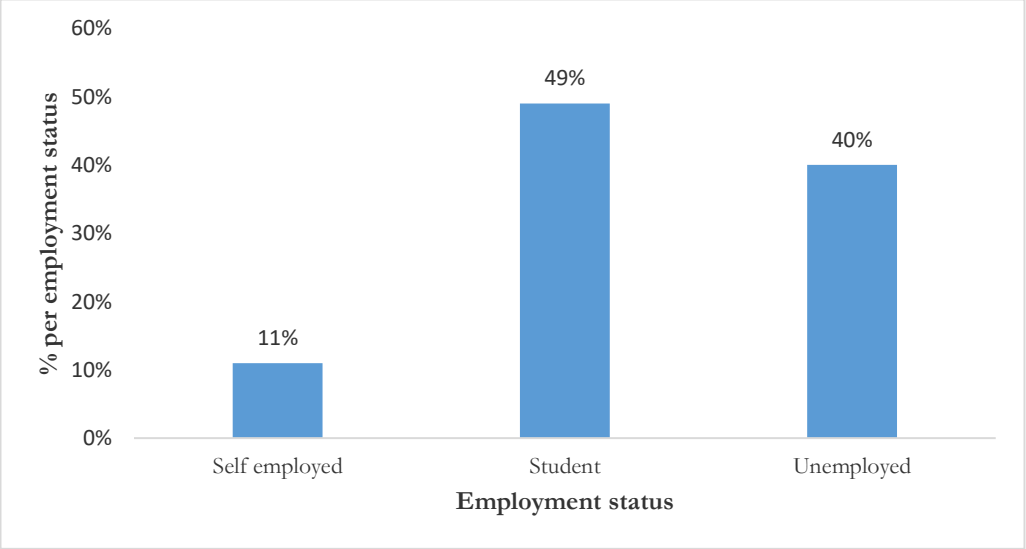

Figure 03: Occupation of participants

a) Anthropometric measurements

As shown in figure 4, BMI before pregnancy and during pregnancy were calculated to have a comparative view of the nutritional status. Before pregnancy, none of the subjects were obese (0%) while 10% were obese during pregnancy. There were underweight subjects before pregnancy (13%). Before pregnancy, 79% of the study population had a normal BMI, while 8% were overweight and 13% underweight. During pregnancy, 62% of the participants had a normal weight, 28% of the pregnant adolescents were overweight and 10% were obese. BMI increased with gestational age.

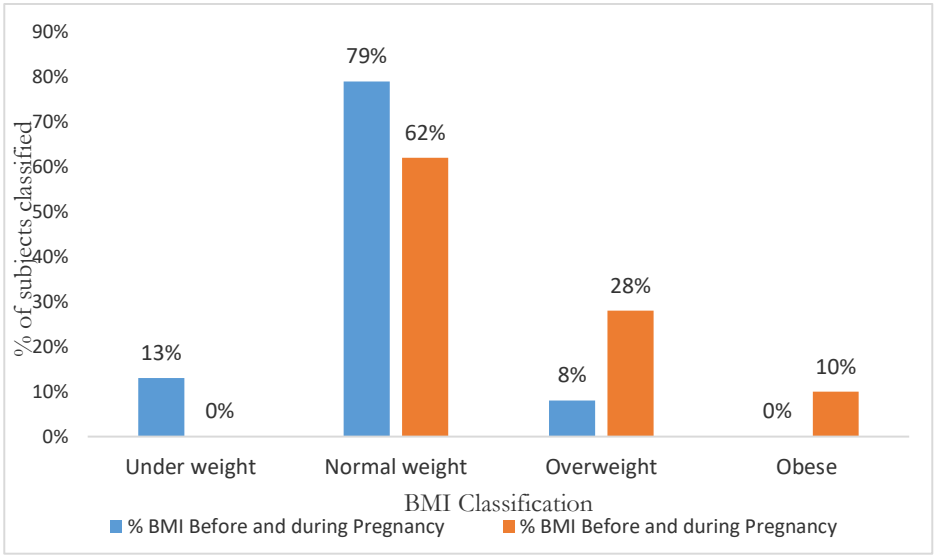

Figure 4: Comparison of nutritional status using BMI before and during pregnancy

When nutritional status was compared with the occupation of subjects, as shown on figure 5, it was observed that for the self-employed subjects who were 11 in number, 7 (70%) had a normal weight range, 3 (27.2%) were overweight, and 1 (9%) was obese. Among 49 subjects who were students, 32 (65.3%) had a normal weight range, 15 (30,6%) were overweight and 2 (4%) were obese. For the 40 who were unemployed, 23 (57,5%) had a normal weight range, 10 (25%) were overweight and 7 (17.5%) were obese. Nutritional problems of obesity were more 7- (17.5%) in unemployed subjects than in the other groups of the study population.

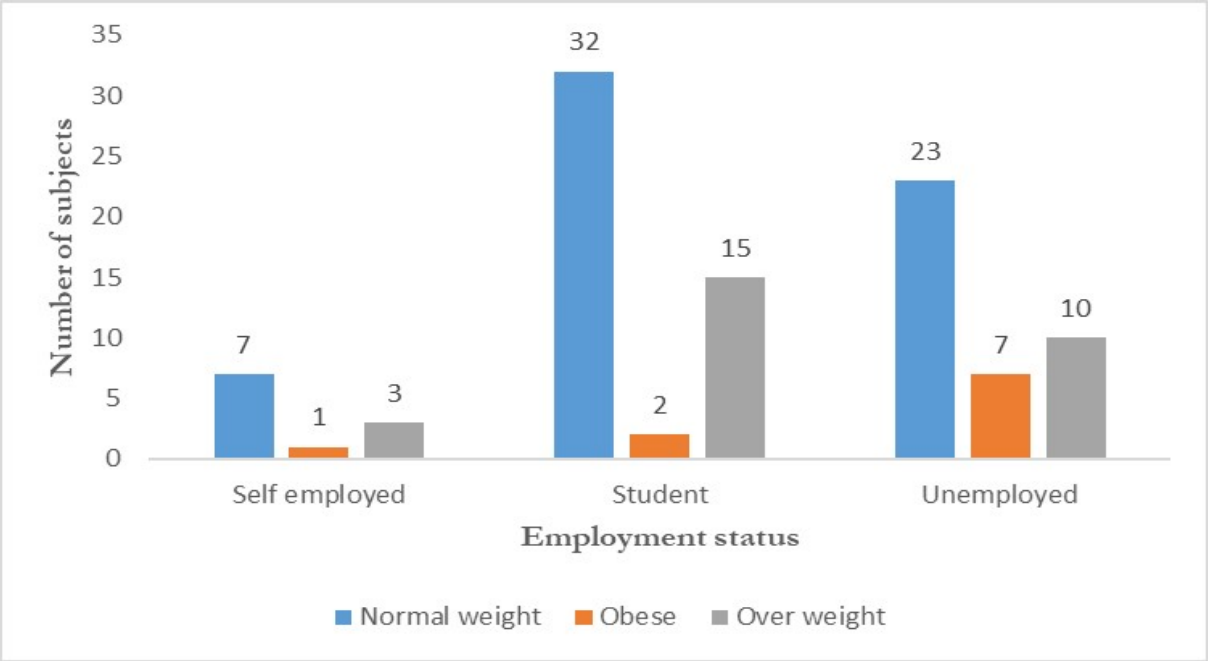

Figure 5: Distribution of nutritional status according to occupation

Meal frequency had a significant effect on BMI respectively ((Sig.) p = 0.002 less than 0.05) as shown on table 3.

Table 3: Parameter estimates for meal frequency (BMI=U+ meal frequency+ error)

Dependent Variable: BMI		**Tests of Between-Subjects Effects**			
Source	Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	184.262a	4	46.066	6.668	.000
Intercept	9107.491	1	9107.491	1318.302	.000
Meal frequency	184.262	4	46.066	6.668	.002
Error	656.308	95	6.909		
Total	63791.38	100			
Corrected Total	840.57	99			

R Square = .219 (Adjusted R Square = .186)

Pregnancy age had a significant effect on BMI respectively ((Sig.) p = 0.003 = less than 0.05) as shown on table 4.

Table 4: Parameter estimates of pregnancy age (BMI=U+ pregnancy age+ error)

Dependent Variable: BMI						
					95% Confidence Interval	
Parameter	**B**	**Std. Error**	**t**	**Sig.**	Lower Bound	Upper Bound
Intercept	26.345	.367	71.857	.000	25.617	27.072
[Trimester=1]	-2.815	.711	-3.958	.000	-4.227	-1.403
[Trimester=2]	-1.711	.557	-3.074	.003	-2.816	-.606
[Trimester=3]	0[a]	.	.	.	.	.

R square =33%

a) Meal Frequency Questionnaire

According to figure 6, eleven percent (11%) of the participants spent less than 1,000 F CFA on food daily, 75% spent 1000 to 2,000 FCFA, and 14% spent 3,000 to 4,000 FCFA.

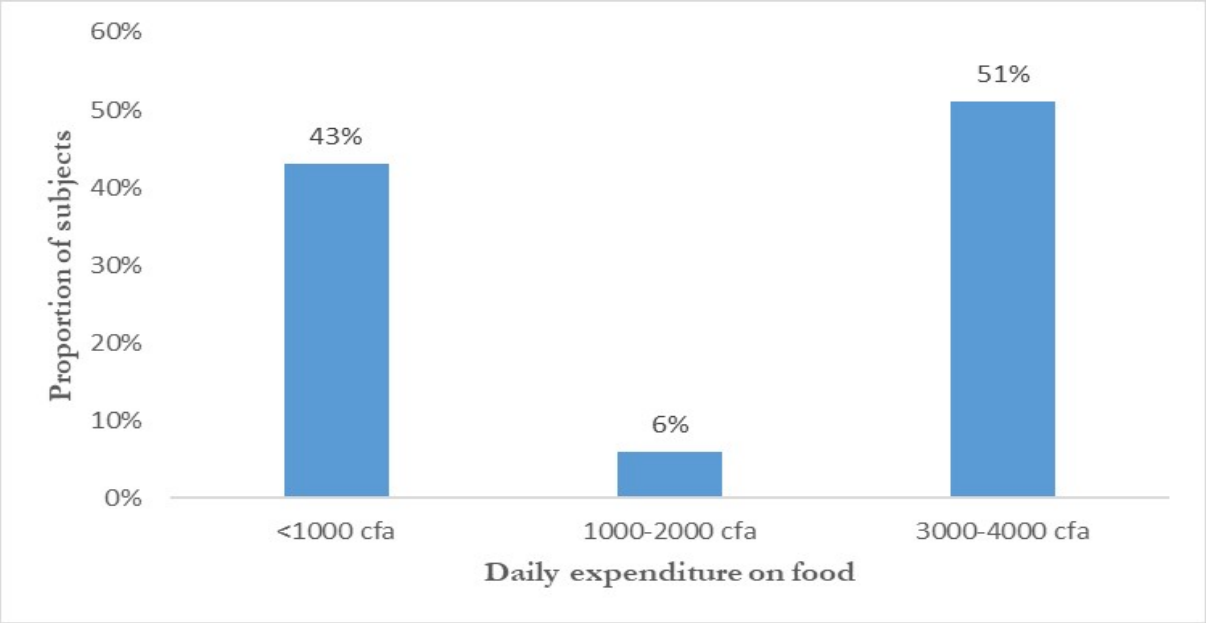

Figure 6: Participants daily expenditure

From figure 7, thirteen percent (13%) of the participants ate more than three times a day, 64% ate three times a day, 21% ate 2 times a day and 2% once a day.

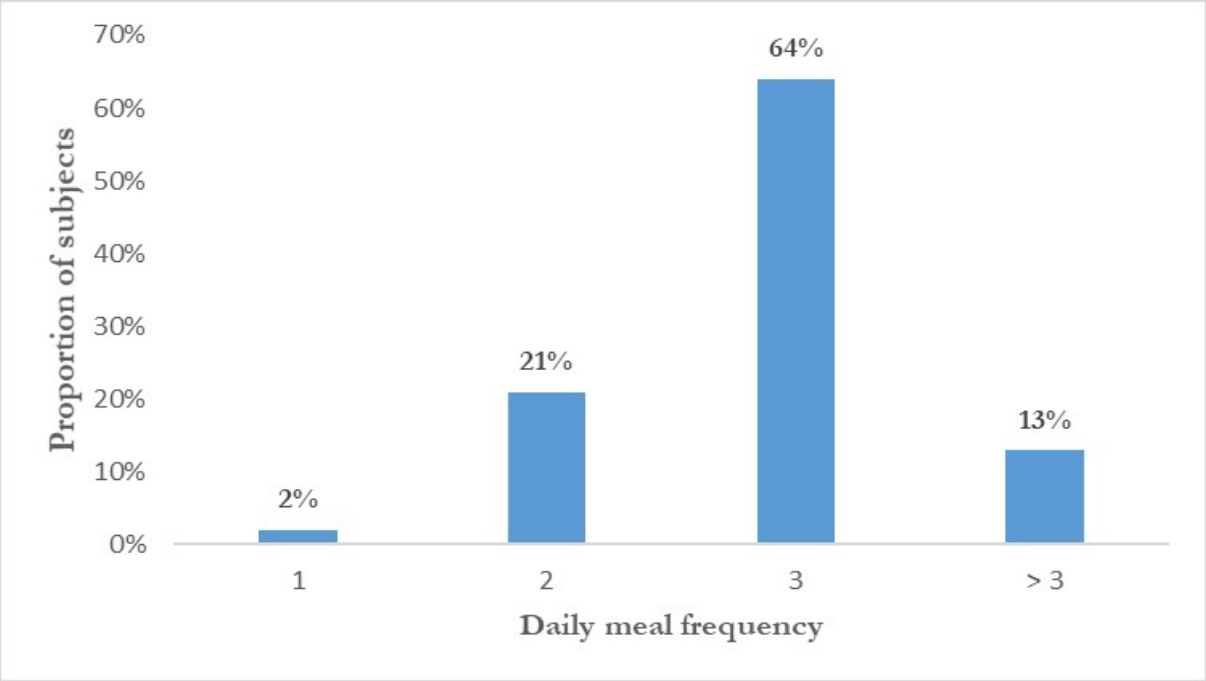

Figure 7: Subjects eating schedule

Thirty-five percent (35%) of subjects skipped one of these major three classical meals for different reasons. Fourteen (14)- 40% skipped breakfast because there was no appetite. Another 14- 40% skipped lunch amongst which 4 subjects gave reasons of not feeling hungry, 5 said they had no appetite and the other 5 said they were busy. Seven (7) - 20% skipped super because of lack of appetite and tiredness, 2 were busy and 3 were not hungry. It was noticed that the number of subjects who skipped a meal for the

reason of no appetite reduced in the 2nd and 3rd meals of the day. The percentage of participants who suffered from loss of appetite was more in the 1st trimester than in the 2nd and 3rd trimesters as shown on figure 8.

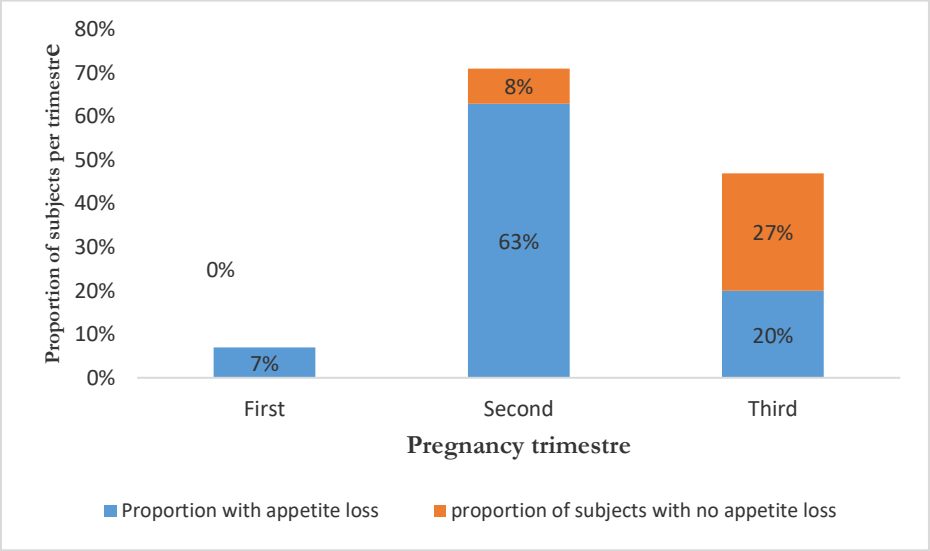

Figure 8: Distribution of loss of appetite by trimester

a) The 24-hour recall

Using the 24-hour recall and the food frequency questionnaire methods of verifying food intake for nutritional status, the consumption of the four food groups containing carbohydrates, Proteins, Fats and Oils and Dietary fibre (fruits and vegetables) was assessed. It was observed that roots and tubers were the main sources of carbohydrates. Those cited were cassava, coco yams, sweet potatoes and ripe plantains. The study population consumed at least one of these foods every day of the week in correct proportions. On an average of 3 days per week, 17% consumed cassava, 14% coco yams, only 4% consumed sweet potatoes and up to 37% for ripe plantains as shown on figure 9.

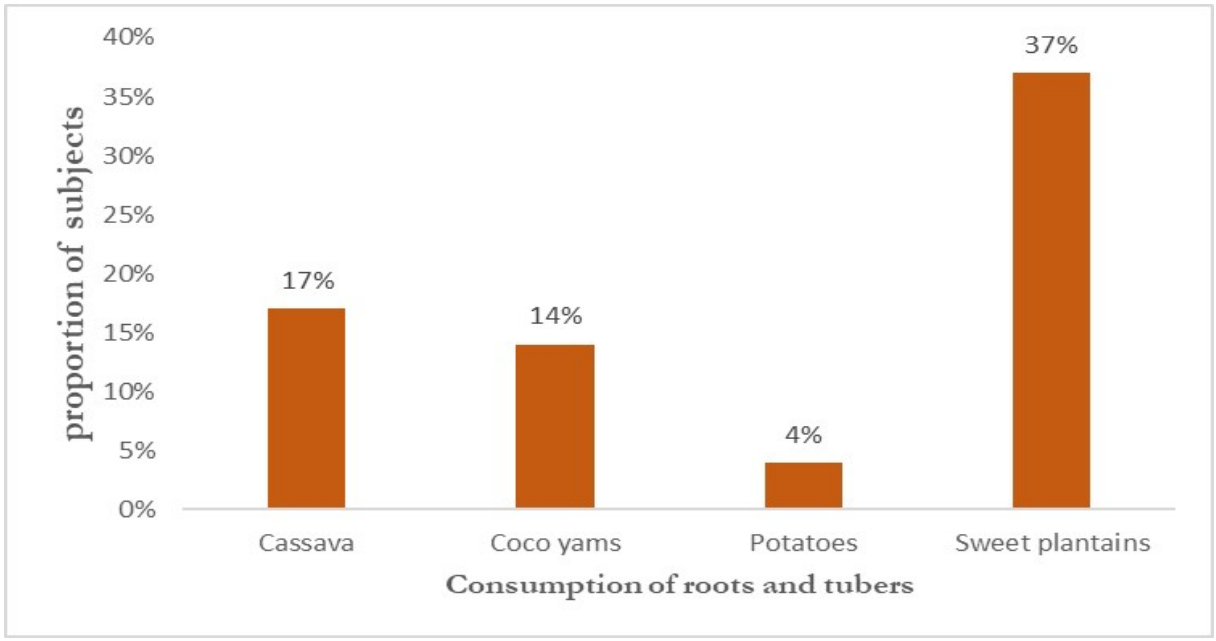

Figure 9 : Frequency of consumption of roots and tubers

None of the subjects consumed dairy products daily as recommended when pregnant. Three servings (3 glasses of milk) per day is recommended [e]. Twenty-three percent (23%) did not consume dairy products at all, 29% consumed dairy products on a daily basis, 21% more than 3 days per week, 27% three days per week. Only 18% of the population took more than one serving of dairy products per day as required and 82% took only one serving per day.

Table 5: Frequency of dairy product consumption

	Days	Frequency	Percent
Valid	>3 days	21	21
	3 days	27	27
	Daily	29	29
	Never	23	23
	Total	100	100

While assessing the fruit and vegetable group, it was observed that fruits were more consumed as compared to vegetables. Pine-apple was the most consumed fruit since it was the seasonal fruit at the time of the study. From figure 10, ten percent (10%) of the study population consumed leafy vegetables more than 3 times per week, 20% thrice per week, 22% two times per week, 41% once per week and 7% never took vegetables. Thirty-six (36%) of the participants ate fruits on a daily basis, 29% more than 3 days per week, 27% three days per week, and 8% less than 3 days per week.

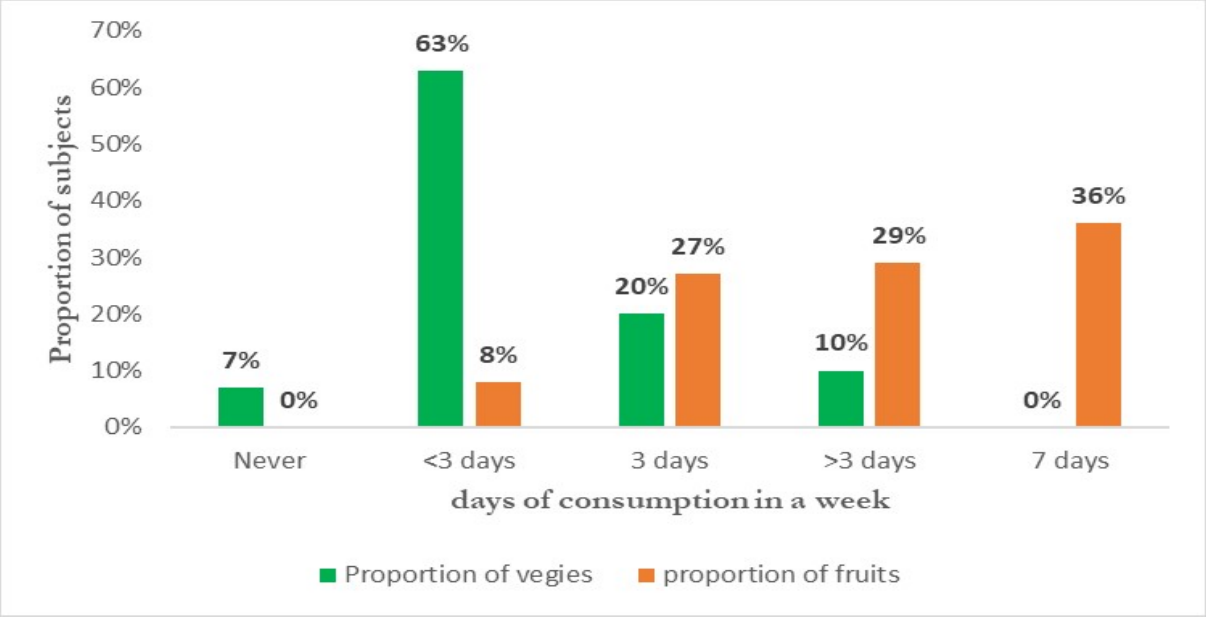

Figure 10: Consumption of fruits and vegetables in a week.

The cereals consumed during this study were wheat, maize and rice. There was a good consumption of cereal foods daily but with a remarkable consumption of rice and wheat (in the form of bread). As shown on figure 11, bread was consumed every day of the week by 77%, while rice was consumed every day by only 1% of the study population. When considering the frequency of consumption of each of these cited cereals at 3 days per week, every day and never, the following results were obtained. Bread and rice were the most frequently consumed cereals. Seventy-seven (77%) of the study population ate bread every day and 50% ate rice at least 3 times per week. Meanwhile 34 % ate neither maize or rice.

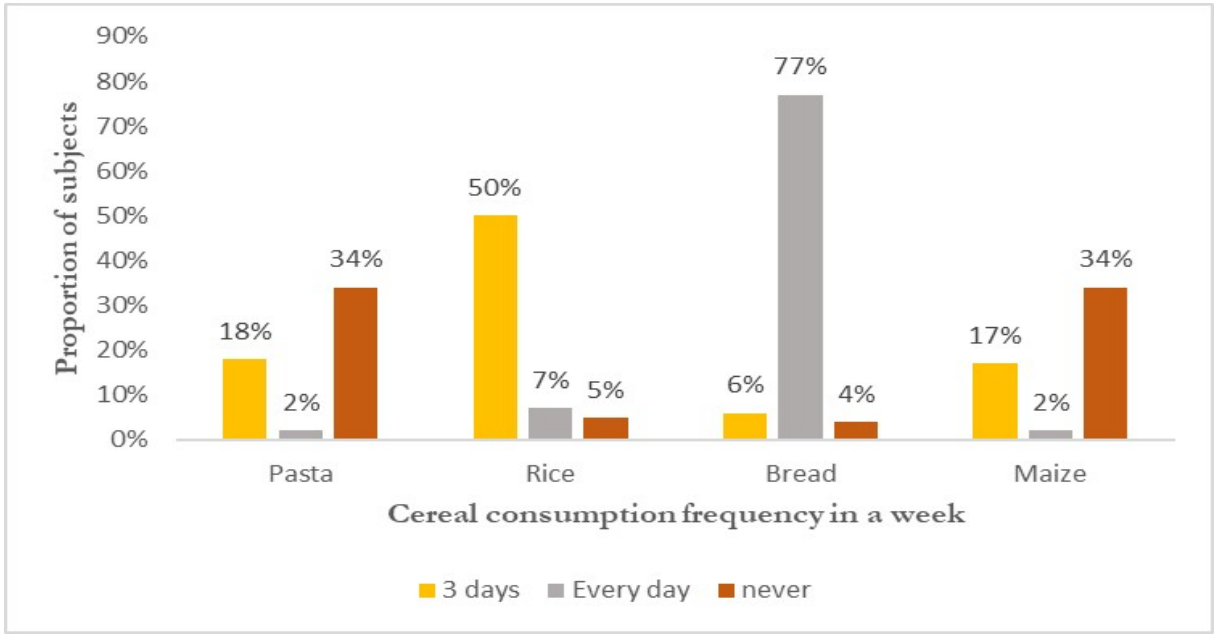

Figure 11: Frequency of cereal consumption per week

Meat, fish and eggs were the main sources of animal proteins identified and beans was the main source of vegetable protein. Seven percent (7%) of the study population ate beans more than 3 days per week, 11% three days, 8% two days, 29% one day and 45% never ate beans at the time of the study as shown on figure 12.

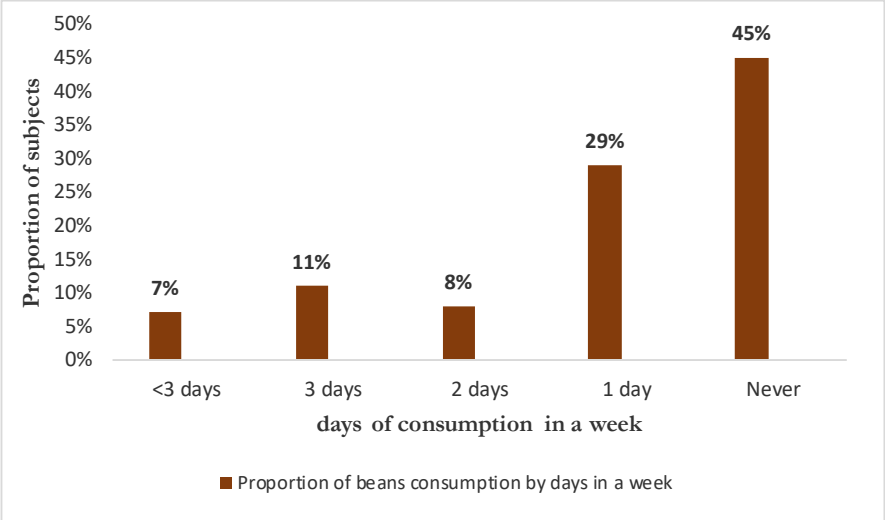

Figure 12: Frequency of beans consumption

As represented on figure 13, six (6%) of the population ate meat more than 3 days per week, 25% three days per week, 20% two days, 22% one day and 27% never consumed meat. Thirteen (13%) ate fish daily, 14% more than three days, 25% two days, 5% one day and 7% never ate fish. Five percent (5%) of the study population consumed eggs on a daily basis, 6% more than 3 days per week, 21% two days, 16% one day and 25% never consumed eggs. It was observed that fish was the main source of animal protein mostly opted for.

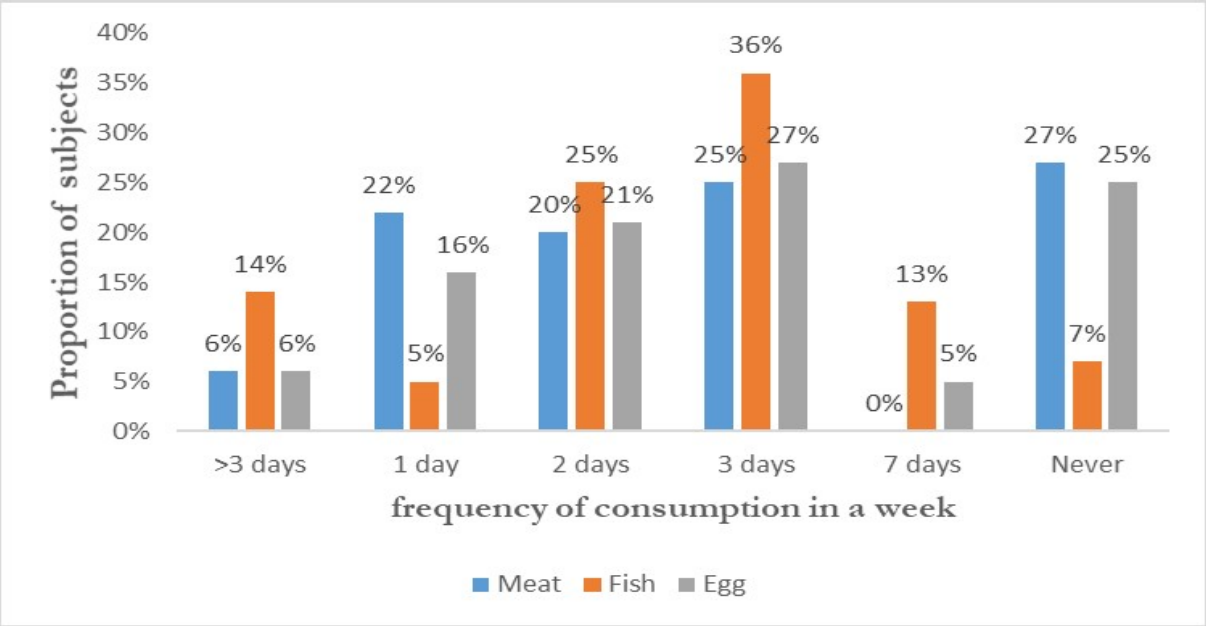

Figure 13 : Showing the frequency of consumption of Meat,Fish and egg

Fifty-three (53%) of the subjects were knowledgeable about a balanced diet. Ninety-nine percent (99%) of them learnt about a balanced diet from school.

		Frequency	Percent
Valid	No	47	47
	yes	53	53
	Total	100	100

Thirty-one percent (31%) of the pregnant adolescents were not on iron supplements. Among those who were not on iron supplements, 61.3 % did not have anaemia, 25.8% had moderate anaemia and 12.9% had severe anaemia. Diet quality was associated with iron status. Among those who did not have anaemia, 21.4% did not have a balanced diet. For the subjects who had moderate anaemia, 69.2% did not have a balanced diet. For those who had severe anaemia, 50% did not have a balanced diet. Diet quality significantly affected hemoglobin levels (P=0.003< 0.05).

Table 7: **Tests of Between-Subjects Effects of diet quality and hemoglobin** (HB=U+ diet quality + error)

Dependent Variable: hemoglobin level					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	84.548[a]	2	42.274	7.383	.003
Intercept	1027.540	1	1027.540	179.451	.000
Diet quality	84.548	2	42.274	7.383	.003
Error	160.329	28	5.726		
Total	4528.340	31			
Corrected Total	244.877	30			

Discussion

The sample size turned out to be a convenient sample size of 100 subjects even though 109 was the target for the study. The most represented age group was 18 years (31%) implying that it is at this age where there is a high prevalence of teenage pregnancy. This is in line with the United States Center for Disease Control natality data report, which states that most adolescents who give birth are 18 years or older. In 2017, 75 percent of all teen births occurred among 18 to 19 years old [f]. It is not surprising that most of the study population (58%) depended on their parents for food given that adolescence is a transition period from childhood to adulthood needing parental attention, thus dependence. This agrees with findings of Hoffmann et al (13) which demonstrated that most pregnant adolescents were socio- economically dependent on either tutors or community social services (14). Most (71%) of the subjects were in secondary school (71%), This is because the study population age group (15-19 years), corresponds to secondary school age. This also explains why up to 76% of the study population were single and 26% were married (14)(15)(16). Fifty-one percent (51%) of the study population originated from the high plateau zone of Cameroon. This representation was probably due to the study site, while 43% originated from the forest zone and only 6% from the Sahel zone. Manning and Cohen (14) observed that most pregnant adolescents are at their first pregnancy (71%) while 29% were at the second pregnancy. Forty-nine percent (49%) of the populations were students who continued studies despite being pregnant while 50% were unemployed as they were compelled to abandon school because of pregnancy. This confirms the findings of Kane et al (16) which showed that teenage pregnancy has a negative impact on educational career as most victims are obliged to abandon school especially in developing countries.

There was little or no bias of forgetfulness since all the subjects could remember their weight before pregnancy. This could imply that individuals are generally knowledgeable about their body weight. Before pregnancy, BMI calculations showed that 13% of the adolescents were underweight. This is similar to the study by Li et al (17) which showed that adolescent poor eating habits can result in a high prevalence of underweight BMI at this age group. There were no obese subjects before pregnancy but during pregnancy, up to 10% of the pregnant adolescents became obese and 28% overweight. This showed that there was a general weight gain during pregnancy which is physiologically recommended at this state (18). Our data showed that meal frequency and pregnancy age significantly affected BMI while food quality did not. Food quality however significantly affected hemoglobin levels when hemoglobin level was used as the dependent. Therefore, the hypothesis that nutritional status is influenced by meal frequency and the food quality is true and this is in confirmity with the findings of Schmidt et al (19). The significance of pregnancy age was probably due to the impact of the additional weight of the growing fetus.

The information concerning the amounts spent daily for food showed that most of the study population was from the lower end of the middle / moderate social class and mostly still dependent on parental income[f][g]. The variation in the number of times the subjects ate in a day could be due to appetite disorders like pregnancy morning sickness that are related to the physiology of pregnancy (20). The proportion of subjects who suffered from the loss of appetite reduced in the second and third trimester and this confirms the report by Bowen who showed that aversions during the first trimester were more severe than at any other point during the course of pregnancy (21).

The results of the evaluation of the consumption of a balanced diet containing the four food groups using the 24-hour recall reflected the food habits of the study participants and the foods commonly available in the study area. The low consumption of dairy products indicates that the participants were probably unaware of the importance of this food group during pregnancy given its high Calcium (Ca+) content. Fruits were consumed more frequently than leafy vegetables probably because of their ready to eat nature. The

participants may also not have been aware of the vital role vegetables play in easing digestion due to their high roughage content (fiber). Among the cereals, wheat in the form of bread was highly consumed on a daily basis by 77% of the subjects. This is similar to the findings of Räsänen (22) which showed that bread is the most consumed cereal (22).

There was a wide variation in the consumption meat, fish, eggs and beans as the main sources of animal and vegetable proteins. The choice of what to eat could have been made based on the costs, appetite and nausea related to the physiological state of pregnancy. Surprisingly, 47% of the subjects did not know the definition of a balanced diet. This implies that notions on appropriate nutrition should start from basics .

Conclusion

Meal frequency and the quality of diet had a significant effect on the nutritional status of a pregnant adolescent when using BMI and hemoglobin levels as the dependent variables. It may be necessary to further investigate food quality by using the Household and Individual Dietary Diversification Score (HDDS and IDDS) which was not applied in the data collection tool. The significance of the age of pregnancy on the BMI is due to the additional weight of the growing fetus giving an answer to why 10% of the subjects were obese and 28% overweight. The majority of the diets had good food diversification and most of it was balanced. However, 47% of the subjects did not know about a balanced diet and the importance of a daily intake of recommended servings of the four food groups. Dairy product consumption which is an important source of calcium needed during pregnancy for fetal bone formation, was not consumed to meet the required servings for pregnant adolescents. It would be necessary to begin nutrition education/ sensitization as early as basic education so that adolescents who become pregnant can know the importance of good feeding. There was also suboptimal consumption of vegetables as compared to fruits. During prenatal consultation visits, counselling sessions should include topics on the type of foods to be consumed in sufficient quantities and frequently.

Acknowledgements

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References

1. Lenders M., McElrath F., and Scholl O., (2000); Nutrition in adolescent pregnancy. *Cur opinion pdtrs* 12(3) : 291-296.

2. Mousa Y., Al-Domi A., Mashal H., and Jibril M. (2010)*;* Eating disturbances among adolescent school girls in Jordan. *Appetite* 54(1): 196-201.

3. Gutierrez Y., and King C. Nutrition during teenage pregnancy. (1993); *Ped annals* 22(2):99-108.Dryburgh H. Teenage pregnancy. *Health reports* (2002); 12(1);9-18.4. Ngoa L.S., Ze O., and Melaman F. Obesity in young university students in Cameroon.*SOPEM Senegal* (2006); 53(4):197-200.

4. Dryburgh H. (2002)Teenage pregnancy. *Health reports*; 12(1);9-18.

5. Ngoa L.S., Ze O., and Melaman F. (2006); Obesity in young university students in Cameroon.*SOPEM Senegal* 53(4):197-200.

6. Demographic health study MICS 2011 Cameroon (2011). Fertility rates; *National Institute of statistics; Preliminary report. page 101*

7. Mayor S (2004);**.** Pregnancy and child birth are the leading causes of death in teenage girls in developing countries. *BMJ* 328(7449): 1152-1154

8. Anderson L., Stacy P., and Hudson G. (2000); Adolescent fertility birth rates per 1000

women aged 15-19; *Global health policy* 18(34). 201-208 ,415_16. 11

9. **Kongnyuy E. J.., Nana P.., Fomulu N.., Shey C., Kouam L.** (2007) ;Adverse perinatal outcomes of adolescent pregnancies in Cameroon. *MCHJ* 12(2): 149-154.
10. **Hediger L., Scholl O., Ances G., and Salmon R.** (1993) Rate and amount of weight gain during adolescent pregnancy. *AJCN*. 52(5):793-799.

11. Sean R., and Lynch. (2000); Potential impact on iron supplement during adolescence on iron status in pregnancy. *JN* 130:448-451.

12. Demographic health study MICS 2011 Cameroon (2011)**.** Nutritional Status, breast feeding and Feeding practices; *National Institute of statistics; Preliminary report* Page 159

13. Hoffman, S. D., & Maynard, R. A. (Eds.) (2008)**.** *Kids having kids: Economic costs and social consequences of teen pregnancy* (2nd ed.). Washington, DC: *Urban Institute Press.*

14. Manning W.D. and Cohen J.A. *(2016 Apr 1*); Teenage Cohabitation, Marriage, and Childbearing; *available in PMC* 34(2): 161–177 ,

15. Martin JA, Hamilton BE, Ventura SJ, Osterman MJK, Mathews TJ. (2013); National Vital Statistics Reports. 1. Vol. 62. Hyattsville, MD: National Center for Health Statistics; Births: Final data for 2011. Available at *http://www.cdc.gov/nchs/data/nvsr/nvsr62/nvsr62_01.pdf. [PubMed] [Google Scholar]*

16. Kane J.B. , Morgan S. P. , Harris K. M. , and Guilkey D.K. (2013 Dec)**;.** The Educational Consequences of Teen Childbearing. *PMC* 50(6): 2129–2150.

17. Li M., Dibley G., and Yan H. (2010)*;* Dietary habits and overweight/obesity in adolescents in Xi'an city China. *AJCN* 19(1): 76-82.

18. Abrams B., Carmichael S., and Selvin S. (1995); Factors associated with the pattern of maternal weight gain during pregnancy. *The ACOG* 82(8):547-552.

19. Schmidt A.L., Hemann M. S., Conde S. R. (2018); Relationship between food consumption, nutritional status and school performance; *J. Hum. Growth Dev.* vol.28 no.3 São Paulo set./dez.

20. Gatenby S.J. (1997); Eating frequency: methodological and dietary aspects. *British Journal of Nutrition* 77, Suppl. 1, S7-S20

21. Bowen D.J. (1992); Taste and food preferences changes across the course of pregnancy. *Appetite* 19: 233-42.

22. Räsänen L. (2007 Sep)**;.** Of all foods bread is the most noble: Carl von Linné (Carl Linneaus) on bread. *Scand J Food Nutr.* 51(3): 91–99.

Webography

a) UNICEF. A league table of teenage births in rich nations.http:// www.unicef-irc.org /publications/pdf/repcardze.pdf. (2001). *Accessed* 21/02/2020.

b) The World Bank data. Adolescent fertility Rates. https://data.worldbank.org/indicator/sp.ado.tfrt . *Accessed* 11/04/2020.

c) **Cameroon - Prevalence Of Anemia Among Pregnant Women. *https://tradingeconomics.com/cameroon/prevalence-of-anemia-among-pregnant-women-percent-wb-data.html*.** *Accessed* 11/04/2020.

d) **WHO (World Health Organization).** International classification of underweight, overweight and obesity according to BMI.http://apps.who.int/bmi/index.jsp?intropage=intro_3.html. (2004) *Accessed* 25/03/2010.

e) **SFGATE**; How Much Milk do you need to drink in a day for strong bones for adults. *https://healthyeating.sfgate.com/much-milk-drink-day-strong-bones-adults-3901.html. Accessed 05/10/2020*

f) Centers for Disease Control and Prevention. (2018). *Natality public-use data 2007-2017* [Data set]. Retrieved from http://wonder.cdc.gov/natality-current.html. *Accessed* 22/03/2020.

g) **NUMBEO.** Cost of living in Cameroon; https://www.numbeo.com/cost-of-living/country_result.jsp?country=Cameroon. *Accessed* 30/03/2020.