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Original Research Paper

Nutritional Status Among Female adolescents aged (15 – 19 years) in Zambia: Why it Matters

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Background The improvement of adolescent (15 – 19) nutritional status may help address the reduction of all forms of malnutrition in a given country. This is because at this stage, they experience a growth spurt thus increasing the need for most nutrients, such as protein and vitamins which are needed for growth and also aids their future reproductive health. Therefore, the study aimed at assessing the levels of female adolescents' nutritional status and their associated factors in Zambia. Methods The study utilised nationally representative sample of secondary data from the 2007 Zambia Demographic and Health Survey consisting of 1569 adolescents with weight and height taken. Results Adolescent girl underweight was measured using the 2007 WHO internationally agreed upon standards of BMI categorisation. Adolescent underweight was high 13.7 percent. When disaggregated by place of residence, education and wealth index differences were noticed the relationships between adolescents and the variables were also noticed. Adolescents in rural areas were more likely to be underweight (OR=0.704, 95%CI: 0.527, 0.941; p=0.018). In addition, adolescents with primary educational level (OR=0.538, 95%CI: 0.397, 0.728; p<0.001) and from poorest or poorer and middle households were more likely to be underweight (OR=0.654, 95%CI: 0.471, 0.909; p=0.012 and OR=0.702, 95%CI: 0.479, 1.028; p=0.069). A positive correlation exits between diet diversity score and adolescents' nutritional status though an independent sample t-test revealed that differences exist between urban (*M*=3.63, *SD*=1.72) and rural (*M*=2.91, *SD*=1.43; *t*(222)=3.88, *p*<0.001) adolescents in terms of dietary intake. Further, consumption micronutrient rich foods such as vitamin A and haem-iron are very low with the exception of dark leaf vegetables. Conclusions Therefore, it can be seen that adolescent nutrition in Zambia requires urgent attention, and since there are multifaceted factors affecting it, strategies are required to improve diet diversification and socio-economic status of adolescents if better results are too be realised in future. Further, there is need for future research to assess the actual nutrient and mineral intake by female adolescents with disaggregation between rural and urban if effective interventions are to be made and positive changes in adolescent nutritional outcomes are to be seen for years to come.

Key words: Adolescents, Body Mass Index, Underweight, Socio-economic, Diet Diversity Score

Good nutrition is critical during adolescent years to ensure healthy growth and development (Dieticians Association of Australia, 2015 and UNICEF, 2000). Many adolescents experience a growth spurt and an increase in appetite and need healthy foods to meet their growth needs (University of Rochester Medical Centre, 2015). A healthy diet must meet the changing nutritional needs of a growing adolescent. The need for most nutrients including energy, protein, vitamins and minerals increases (Van de Weyer, 2005). Therefore, if not adequate, nutritional deficiencies have far reaching consequences, most especially in female adolescents. In addition, this period is a time of tremendous growth and development, during which 20% of final adult height, 45% of increments in bone mass and 50% of adult weight are attained (Chen 2012 and Giuseppina D, 2000). Girls achieve tremendous physical, mental and emotional maturity during this period. Overall, the nutritional status of female adolescents is critical given close associations that their growth status and reproductive health have with birth outcomes and child survival (Chen, 2012).

One way to break the intergenerational cycle of malnutrition is to improve the nutrition of female adolescents prior to conception. The vicious cycle of malnutrition, if not broken, can go on resulting in more severe consequences (Mulugeta et al. 2009). Most developing countries like Zambia usually suffer from adolescent under nutrition which may include stuntedness and deficiencies in vitamins and minerals (Dapi et al, 2009). However, over nutrition is also slowly becoming a problem, Zambia inclusive. Several studies that have been conducted in Zambia have concentrated more on the overall maternal and child nutritional status; and very little has been done on adolescent nutritional status (Bwalya, 2013, NFNC, 2009 and CSO et al, 2009). This may be due to adolescents been considered a low risk group for poor health and nutrition and often receive scant attention. As a result, resources in

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Zambia have traditionally been directed to children and mothers especially pregnant women (Mulugeta et al, 2009).

In Zambia, current statistics show that, 5.1 percent of female adolescents (15 – 19) have very short stature (less than 145 cm), 14.6 percent are underweight, 7.0 percent are overweight and 1.1 obese (CSO et al, 2009). The aforementioned statistics indicate that adolescent under nutrition is still high in Zambia and that over nutrition if not addressed will also soon become a public health problem. Several studies have shown that, in developing countries, factors associated with under nutrition of adolescents are: poor household economic condition, periodic food-shortage, child labour (marker of household income-poverty), burden of disease, poor knowledge about long-term consequences of under nutrition of adolescents, quantity and quality of food, and access to health and nutrition services (Alam et al, 2010 and; Kurz and Johnson-Welch, 1994). In addition, dietary knowledge and access to resources are significant in improving health and nutrition in sustainable ways. Particularly, health and nutrition knowledge and healthy habits of female adolescents will have critical roles to play in maintaining future family health and nutrition (Alam et al, 2010). However, in most developing countries, maternal underweight which may have been avoided during childhood or adolescence is the leading risk factor for preventable deaths and diseases (WHO, 2002).

Presently, Zambia embarked on addressing underweight and stuntedness in children below five years, but little was done to address female adolescents' malnutrition. Hence, posing an intergenerational trap for adolescent malnutrition for unforeseeable future as the girl child will grow into underweight mothers. To the best of our knowledge no study has been done on adolescent nutrition in Zambia. Therefore, this study was aimed at assessing the levels of adolescent nutritional status and their associated factors. It is hoped that the information that has been generated will be used to help the republic of Zambia and other relevant stakeholders dealing in food and nutrition in Zambia to incorporate adolescent nutrition as part of their agenda.

METHODS

The study utilized data from the 2007 Zambia Demographic and Health Survey. The dataset provided data on adolescent anthropometric measurements, bio-demographic variables (age) socio-economic variables (wealth index, education, place of residence) and dietary intake (food types consumed 24 hours prior the survey).

Statistical Analysis

Analysis of data was done using the Statistical Package for Social Sciences (SPSS). Analysis of the Body Mass Index (BMI) relied on WHO 2007 reference. BMI was used to measure thinness and obesity and was defined as weight in kilograms divided by height in metres squared (kg/m^2). A cut-off point of 18.5 was used to define thinness or acute under nutrition and a BMI of 25.0 or above, which usually indicate overweight or obesity. Correlation and Chi-Square tests were used to explore relationships between the prevalence of underweight and explanatory variables already stated. Independent samples t-tests were performed to compare differences in the means for BMI and DDS; and type of place of residence. Goodness-of-fit of the models was assessed using Akaike's Information Criterion (AIC) and adjusted-R^2 and partial regression residual plots showed that all had linear relationship. Normality of the data was assessed using a Q-Q plot and there was no need for transformation; outliers and influential observations were not as such influential as such they were retained in the final model. For predictor variables, collinearity was checked using Variance Inflation Factor (VIF); interaction and confounding variables were checked. In addition, binary unconditional logistic regression model were built to predict the likelihood of BMI. Statistical significance was considered as follows: *P < 0.05, **P-value < 0.01 and ***P < 0.001.

Limitations

The ZDHS data of 2007 is quite old and the hope is to carry out the same study using the 2013 ZDHS for comparison with the latest data once the report and data is made available for public use.

Study Results

The dataset had 1598 adolescents aged 15 – 19 years 29 cases were deleted as they had biologically implausible values (BIV). In the final analysis, this study had a sample of 1569 adolescents.

Table 1 below shows that, the mean weight, height and Body Mass Index of female adolescents were 51.81±8.42 kilograms, 1.56±0.07 meters and 21.32±2.90 kilograms per square meters between the ages 15 to 19 years. In addition, the mean household size of adolescents ranged from 1 to 24 with a mean of 6.82±3.00, though not shown in the table.

Nutritional Status of female adolescents 15 – 19 years of age

Table 2 shows that, overall, 13.7 percent of the female adolescents are underweight while 9.4 percent are either overweight or obese. Underweight decreased with increasing age in years (p<0.001): 25.7 percent of female adolescents aged 15 were underweight compared to 8.6 percent aged 19 years. More rural female adolescents (15.8 percent) were likely to be underweight than urban (11.7 percent) (p<0.001). In addition, an independent samples t-test was conducted to compare the BMI for urban and rural female adolescents. The results show that, there was a significant difference in scores for urban (*M*=21.73, *SD*=3.10) and rural (*M*=20.91, *SD*= 2.61; *t*(1538)=5.69, *p*=0.001) adolescents with equal variance not assumed.

Overweight or obese was twice as high (12.2 percent) in urban adolescents as compared to rural (6.5 percent). Further, 17.2 percent of female adolescents with primary education were underweight compared to those with secondary 10.0 percent (p<0.001). Adolescents in poorer, middle and poorest households were more likely to be underweight (17.6 percent, 15.7 percent and 15.5 percent) compared to those in wealthier households (11.6 percent and 11.4 percent) respectively (p=0.001).

Food Consumption, Dietary Diversity Score and Adolescent Nutritional Status

One of the commonly used index for assessing food availability and access at both individual and household level is the Dietary Diversity Score (DDS). This index measures the number of different food groups that are consumed over a given period (NFNC; 2009). DDS may be calculated as individual dietary diversity score (IDDS) or household dietary diversity (HDD). IDDS has been used as a proxy measure of individuals' food availability and access (ability to acquire sufficient quality and quantity of food to meet all household members' nutritional requirements for productive lives) and overall dietary quality (Savy, 2006). The scores for the food items that were eaten by women in the past 24 hours prior the survey were categorised into three categories so as to assess the diversification and quality of the food items eaten. These groups consist of Poor (less than 4 food items), Moderate (4 – 6 food items) and Good (More than 6 food items) (ibid, 2006).

Food Items Consumed by Adolescents

Table 1: Mean Weight (Kg), Height (m) and Body Mass Index (kg/M2) of Female adolescents by age in years.

		Mean and Standard Deviations		
Age (Years)	**N**	**Weight (Kg)**	**Height (M)**	**Body Mass Index**
15	362	48.25±7.89	1.54±0.07	20.29±2.80
16	323	51.32±7.37	1.56±0.07	21.18±2.52
17	298	52.64±7.97	1.56±0.06	21.48±2.72
18	295	54.33±9.70	1.57±0.06	22.06±3.35
19	291	53.38±7.67	1.56±0.06	21.87±2.73
Overall	**1569**	**51.81±8.42**	**1.56±0.07**	**21.32±2.90**

Table 2: Percentage distribution of adolescent nutritional status by age, place of residence, educational attainment and wealth index (n=1569)

	Body Mass Index (Kg/m)		
Explanatory Variables	**Underweight**	**Normal**	**Overweight or Obese**
	Percent	**Percent**	**Percent**
Age (Years)			
15	25.7	69.1	5.2
16	11.5	80.8	7.7
17	10.7	82.2	7.0
18	9.5	76.2	14.2
19	8.6	77.7	13.7
Place of Residence			
Urban	11.7	76.2	12.2
Rural	15.8	77.7	6.5
Highest Educational Level			
No education	16.4	77.6	6.0
Primary	17.2	75.8	6.9
Secondary	10.0	78.1	11.9
Higher	16.7	50.0	33.3
Wealth Index			
Poorest	15.5	79.5	5.0
Poorer	17.6	76.0	6.4
Middle	15.7	78.4	5.9
Richer	11.4	77.1	11.4
Richest	11.6	75.1	13.3
Overall	**13.7**	**76.9**	**9.4**

Table 3 below shows that, dark green leafy vegetables (68.7 percent) were the most commonly consumed food group by female adolescents, 24 hours prior the survey. Oils and Fats (60.1 percent); fish or shell fish (47.8 percent); cereal (37.3 percent); and sweets (36.4 percent) were also consumed in large quantities by adolescents. The least consumed food group by female adolescents were meat organs (7.3 percent); eggs (14.2 percent); milk and dairy products (15.2 percent) respectively.

Adolescent 24 hour Dietary

In order to measure both the quality of diet of female adolescents and the probability of micronutrient adequacy of their diets, a female Adolescent's 24 hour Diet Diversity score (ADDS) was used (FAO, 2010). This index measures the number of different food groups that are consumed over a 24 hour period (NFNC, 2009). In other studies, DDS has been used as a proxy measure of individuals' food availability and access (ability to acquire sufficient quality and quantity of food to meet all household members' nutritional requirements for productive lives) and overall dietary quality (Savy, 2006). Aggregation of certain food groups as shown in table 3 was done to create an adolescent girl's dietary diversity score. Out of the 15 food groups as collected in the ZDHS 2007, the following groups: Starchy staples (cereal and white tuber); dark green leafy vegetables; other vitamin A rich fruits and vegetables/tubers (vitamin A rich vegetables/tubers and vitamin A rich fruits); other fruits; meat organs (liver, kidney, heart or other organ meats); meat and fish (without bones and Shell Fish); eggs; legumes, nuts and seeds; and milk and dairy products (milk, cheese, yogurt or other dairy products) were computed to allow us come up with a score ranging from 0 to 9.

Table 4 below also shows that dark green leafy vegetables, meat and fish and starchy staple were the most consumed foods by female adolescents (68.7 percent, 60.4 percent and 56.0 percent respectively) in the 24 hours prior to the survey. The least foods consumed by female adolescents were Meat Organs 7.3 percent, Eggs, 14.2 percent and Milk and Milk Products 15.2 percent.

The relationship between adolescent nutritional status (as measured by BMI) and 24 hour ADDS was investigated using Pearson product-moment correlation coefficient. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. The results shows that, there was a positive correlation between the two variables [r=0.147, n=316, p=0.009]. The overall mean female adolescents' DDS was found to be 3.19±1.59 foods. However, in order to know whether there were differences in ADDS between urban and rural female adolescents, an independent samples t-test was conducted to compare their DDS. The results show that, there was a significant difference in scores for urban

Table 3: Percentage distribution of adolescents consuming various types of foods in the 24 hours prior the survey (n=316)

Food Item	Yes	No or Don't Know
Cereal	37.3	62.7
White roots and tuber	27.2	72.8
Vitamin A Rich Vegetables and Tuber	28.8	71.2
Dark-Green leafy Vegetables	68.7	31.3
Vitamin A rich fruits	9.2	90.8
Other fruits	32.3	67.7
Meat Organs	7.3	92.7
Flesh Meats	21.5	78.5
Eggs	14.2	85.8
Fish and shell fish	47.8	52.2
legumes, nuts and seeds	30.4	69.6
Milk and Milk Products	15.2	84.8
Oils and Fats	60.1	39.9
Sweets	36.4	63.6
Spices, Condiments and Beverages	18.7	81.3

Table 4: Percentage distribution of the aggregation of food groups from table 3 to create ADDS (n=316)

Adolescents Dietary Diversity Score Food Groups		
Food Group	**Yes**	**No or Don't Know**
Starchy Staples	56.0	44.0
Dark Green Leaf Vegetables	68.7	31.3
Other Vitamin A rich Fruits and Vegetables	34.2	65.8
Other Fruits and Vegetables	32.3	67.7
Meat Organs	7.3	92.7
Meat and Fish	60.4	39.6
Eggs	14.2	85.8
Legumes, nuts and seeds	30.4	69.6
Milk and Milk Products	15.2	84.8

(*M*=3.63, *SD*=1.72) and rural (*M*=2.91, *SD*=1.43; *t*(222)=3.88, *p*<0.001) adolescents with equal variance not assumed.

Consumption of Micronutrient Rich Food Groups by Adolescents 24 hour Prior the Survey

Table 5 below shows that, 76.6 percent of female adolescents had consumed plant foods rich in vitamin A (vitamin A rich vegetables and tubers, dark green leafy vegetables, or vitamin A rich fruits). About one third (29.7 percent) of female adolescents had consumed vitamin A rich animal source foods (organ meat, eggs or milk and dairyproducts). In general, about 8 in every ten female adolescents consumed either a plant or animal source of vitamin A (vitamin A rich vegetables and tubers or dark green leafy vegetables or vitamin A rich fruits or organ meat, or eggs, or milk and milk products). Further, more than two thirds (62.7 percent) of female adolescents consumed haem-iron rich foods (organ meat, flesh meat, or fish).

‡The term vitamin A is used in this section for simplicity. It indicates foods containing retinol and foods of plant origin that contain retinol precursor carotenoids

†These three food groups all contain food sources of haem iron, which is more bioavailable than non-haem iron and also enhances the absorption of non-haem iron present in the same meal. Organ meats are the richest source of haem iron

Regression Analysis

Table 6 shows the binary logistic regression Odds Ratios (ORs), corresponding p-values and confidence intervals for the association between adolescents underweight by age, place of residence, educational level, wealth index, 24 hour dietary diversity score and household size. Among the aforementioned, only educational level and household wealth index were major factors associated with adolescent nutritional status.

Age of female adolescents was associated with underweight. Data in table 5 below shows that, for each increase in age by a year, there is a 40.4 percent decrease in the odds of a adolescent girl being underweight (OR=1.404, 95%CI: 1.260, 1.566; p<0.001). Female adolescents (15 – 19 years) whose place of residence is rural at the time of the survey were more likely to be underweight compared to those who reported their place of residence as being urban (OR=0.704, 95%CI: 0.527, 0.941; p=0.018).

In addition, education and households' wealth are also important markers on female adolescents' nutritional status. Female adolescents with primary education were more likely to be underweight compared to those with secondary or higher education (OR=0.538, 95%CI: 0.397, 0.728; p<0.001). The data also revealed that, there was a statistically significant association between household wealth index and female adolescents' nutritional status. Female adolescents (15 – 19 years) from poor and middle class homes (OR=0.654, 95%CI: 0.471, 0.909; p=0.012 and OR=0.702, 95%CI: 0.479, 1.028; p=0.069) were more likely to be underweight compared with those from wealthier homes.

In addition, in spite there not been any significant association between DDS and adolescent nutritional status. A simple linear regression was performed to predict adolescent BMI based on a 24 hour DDS. A significant regression equation was found (F (1, 314) =6.96, P=0.009), with an R^2 of 0.022. Adolescents predicted BMI was equal to 20.47+0.27 (DDS)

Table 5: Percentage distribution of Adolescents Consumption of Plant and Animal Vitamin A Foods; and Iron Rich **Foods (n=316)**

Micronutrient Consumption		
Food Group	**Yes**	**No or Don't Know**
Plant Based Vitamin A Foods		
Vitamin A rich Vegetables and Tubers	28.0	71.2
Dark Green Leaf Vegetables	68.7	31.3
Vitamin A Rich Fruits	9.2	90.8
Overall Plant Vit A	***76.6***	***23.4***
Animal Source Based Vitamin A Foods		
Meat Organs	7.3	92.7
Eggs	14.2	85.8
Milk and Milk Products	15.2	84.8
Overall Animal Vit A	***29.7***	***70.3***
Overall Vitamin A‡	**82.3**	**17.7**
Haem-Iron Rich Food†		
Meat Organs	7.3	92.7
Flesh Meats	21.5	78.5
Fish and Fish Shells	47.8	52.2
Overall	***62.7***	***37.3***

Table 6: Factors associated with underweight as measured by Body Mass Index (BMI) among adolescent aged 15 – 19 years in Zambia in 2007.

Explanatory Variable	**Underweight as measured by BMI**			
	Sig.	Odds Ratios	95.0% C.I.for EXP(B)	
			Lower	Upper
Age	0.000***	1.404	1.260	1.566
Place of residence				
Urban		1		
Rural	0.018**	0.704	0.527	0.941
Educational attainment				
No education	0.109	0.570	0.286	1.134
Primary	0.000***	0.538	0.397	0.728
Secondary or Higher		1		
Wealth Index				
Poorest or Poorer	0.012**	0654	0.471	0.909
Middle	0.069*	0.702	0.479	1.028
Richer or Richest		1		
Dietary Diversity Score	0.735	1.038	0.835	1.290

when dietary diversity score was measured based on the number of food groups consumed, adolescents average BMI increased by 0.27 for each additional food group consumed.

DISCUSSION

This present study shows that, underweight is prevalent among female adolescents (15 – 19 years) in Zambia 13.7 percent. This is supported by a similar study conducted in India and Bangladesh where it was found that, 21.9 percent and 25 percent of female adolescents were underweight (Singh and Devi, 2013; and Alam et al, 2010). A further study conducted by Mulugeta in rural Tigray Northern Ethiopia in 2009 found that, the mean weight, height and Body Mass Index (BMI) were 34.6kg, 1.47m and 15.7kg/m^2 were slightly less than what our study found 51.8kg, 1.56m and 21.3kg/m^2. Studies have further shown that height and body weight increases along with advancing age in female adolescents which is similar to what this study found, were, female adolescents weight, height and BMI increased with increasing age in years. The most probable reason that can be advanced, is that there is early occurrence of female adolescent growth spurts as compared to boys (Singh and Devi, 2013 and Assefa et al, 2013). The risk of underweight was significantly higher for younger female adolescents than older ones.

Besides the aforementioned, the household size of the female adolescents ranged from 1 to 24 with a mean of 6.82±3.00. This showed that, the female adolescents came from households with more dependants to be catered for either themselves or their parents/guardians meaning that each plate was to be shared by more persons (Danquah et al, 2013 and Bronte-Tinkew et al, 2003). Usually, big or large household sizes may imply that resource distribution in which ever form may be meagre for each individual and that this is translated into the nutritional health of family members with children, adolescents and women being the most affected.

Overall, underweight among female adolescents varied according to place of residence. Our study reveals that, female adolescents in rural areas are more likely to be underweight than those in urban areas ((OR=0.704, 95%CI: 0.527, 0.941; p=0.018). this is similar to what other studies have found (Chen, 2014). This may be due to differences in the socio-economic status and poverty levels among the two different groups of adolescents girls. On the contrary, according to a study by Assefa et al in 2013 conducted among adolescents of Jimma zone, south west Ethiopia, it was discovered that place of residence among adolescents had no association with their Body Mass Index

Female adolescents' level of education is also a vital asset to their proper growth as this gives them an edge to choose the right combination of nutritious foods whilst in their adolescence or during pregnancy, seek disease prevention and treatment and maintain a healthy environment (Panjsheri, 2009). Studies have suggested that a positive association between adolescent BMI and educational status exits (Assefa et al, 2013 and; Teller and Yamar, 2000) which is similar to what our results indicate, where, female adolescents with secondary or higher education are less likely to be underweight than those with primary education ($p<0.001$). It is argued that, female adolescents who receive higher education are generally more aware than those with basic or no education on how to utilise available resources for the improvement of their own nutritional status and their families. In addition, they are also rarely at risk to fall prey to their peers on engaging in activities that may put their health at risk.

Another major factor associated with adolescent girl underweight is the household wealth index. Our study findings reveal that, adolescents girls from poor and average homes were more likely to be underweight as compared to those from richer or richest households (OR=0.654, 95%CI: 0.471, 0.909; p=0.012 and OR=0.702, 95%CI: 0.479, 1.028; p=0.069). This may imply that adolescents nutritional status is not just dependant on individual factors such as education but also the social economic status of the households in which they reside (Tawari et al, 2014, Chen, 2012)

Furthermore, from our study, 24 hour dietary diversity score was not significantly associated with adolescent girl nutritional status. This is not surprising as a simple linear regression showed that the 24 hour dietary diversity score was only able to account for 0.27 of the adolescents change in BMI. The possible explanation for this is that most of the 24 hour recall is just too short a period for someone's nutritional status to change in a short period and as such it may not be a very good indicator. Moreover, most studies conducted elsewhere have actually used the seven-day food frequency or the 24 hour mean energy and nutrient intake when measuring dietary intake (Alam et al, 2010 and Danquah et al, 2013). As such it will be more ideal to conduct another study using either a cohort of girls entering their adolescents and follow them until they are 19 or use nutrient intake and seven day food frequency to determine their dietary pattern bearing in mind the cost implications. Though it also showed that dietary diversification is not the only factor but socio-economic and demographic variables are vital too in determining adolescent nutritional status.

In addition, our findings further reveal that, the foods eaten by these adolescents are significant in helping them grow in a healthy way. Our findings show that, mean ADDS 3.2 with a range of (0-9) which is low and was mainly influenced by the consumption of green leaf, meat and fish; and starchy staple foods. In addition, since micronutrient deficiencies are other forms of malnutrition that female adolescents suffer from, our findings also reveal that, consumption of Vitamin A and Haem Iron rich food groups was also low. Consumption of animal based vitamin A rich food groups extremely low, with only 15.2 percent, 14.2 percent and 7.3 percent of the female adolescents consuming milk and milk products, eggs and meat organs respectively. With regard to consumption of plant based vitamin A rich food groups, only 3 and 1 female adolescents consumed vitamin A rich vegetables and tubers; and vitamin A rich fruits. Furthermore, consumption of Haem-Iron rich food groups was also found to be low among female adolescents with about five, two and one in every ten consuming fish and shell fish, flesh meat and meat organs respectively. The findings above pauses a major challenge as most adolescents who develop anaemia in less developed countries are either not consuming enough haem-iron rich foods or are eating foods that inhibit the absorption of iron. Thus causing increased iron deficiency, anaemia and other micronutrient deficiencies in the country. Studies have shown that, female adolescents are particularly vulnerable to malnutrition because they are growing faster than at any time after their first year of life. They need protein, iron, and other micronutrients to support the adolescent growth spurt and meet the body's increased demand for iron during menstruation. Adolescents who become pregnant are at greater risk of various complications since they may not yet have finished growing. Pregnant adolescents who are underweight are especially likely to experience obstructed labour and other obstetric complications. There is evidence that the bodies of the still-growing adolescent mother and her baby may compete for nutrients, raising the infant's risk of low birth weight (defined as a birth weight of less than 2,500 grams) and early death if not in their required amounts (Maiti et al, 2011 and Ransom and Elder, 2003).

Conclusion

This study reveals that female adolescents' nutritional status is very poor in Zambia; and that it is very common among female adolescents with poor socio-economic status such as those residing in rural areas, with low educational levels and household wealth index. In addition, there is also poor intake of foods rich in vitamin A and haem-iron micronutrients that are much needed during this growth spurt. As seen from the foregoing statement, adolescent nutritional matters requires urgent attention and more efforts should be put in place in improving diet diversification and socio-economic status in society. Besides, since most of these girls in this age group are actually pupils, nutritional education should be at all levels of education if better results are to be realised in future. Therefore, it is envisaged that, a research be conducted to assess the actual nutrient and mineral intake of these adolescents girls with disaggregation between rural and urban areas if effective interventions are to be made and positive changes in adolescent nutritional outcomes are to be seen.

Competing Interests:

The author declares that I have no competing interests

Authors Contribution

BBB: conceived the paper, data manipulation including computation of new variables required for further analysis, actual statistical analysis and interpretation of the study findings, sequencing and alignment according to BMC authors' guidelines. The author read and approved the final manuscript

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BBB – Holds the following qualifications: Master of Arts Degree in Population Studies, Bachelor of Arts Degree Major (Demography) and Minor in (Economics), Certificate in Planning Monitoring and Evaluation; and Certificate Survey Data Analysis Using Stata. Currently is a Lecturer in Demography at Mulungushi University, Centre for Information Communication Technology, Department of

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