Factors Associated with Stunting among Children Aged 6-23 Months in Zambian: Evidence from the 2007 Zambia Demographic and Health Survey

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Publication Date: 28 April 2015

Article Link: http://medical.cloud-journals.com/index.php/IJANHS/article/view/Med-210

Abstract The reduction of child stunting requires an understanding of the major factors that are associated with it most especially before and during infancy of the child. This is because, the velocity of linear growth is highest during first months of life for most infants, and especially in less developed countries like Zambia. Children aged 6–23 months are usually vulnerable to stunting because of various factors such as lack of complementary foods containing the necessary nutrients during the early stages of life which leaves them vulnerable to opportunistic infections resulting in poor health outcomes and outmately stuntedness. The aim of this study was to determine factors associated with stunting among children aged 6–23 months in Zambia. The study used the 2007 Zambia Demographic and Health Survey data, which had data on anthropometric measurements for both children (6–23 months) and women of child bearing age (15–49 years); and various bio-demographic and socio-economic variables. Prevalence of stunting among children 6–23 months was very high 44.5 percent p<0.001. The study further revealed that stunting was associated with various factors. Mothers age was also associated child stunting (AOR=1.756, 95%CI: 1.168, 2.641; p=0.007 and AOR=2.568, 95%CI: 1.268, 5.200; p=0.009). Children whose birth weight was small or average (AOR=1.919, 95%CI: 1.350, 2.727; p<0.001 and AOR=1.365, 95%CI: 1.090, 1.710; p=0.007) were 91.9 percent and 36.5 percent more likely to be stunted compared with children whose birth weight was large at birth. Children whose mothers had not taken iron tablets whilst pregnant (AOR=0.600, 95%CI: 0.405, 0.890; p=0.011) more likely to be stunted than those whose mothers had taken the tablets. Mother and child’s IDDS were also significant predictors of stunting (AOR=1.101, 95%CI: 1.021, 1.186; p=0.012 and AOR=1.101, 95%CI: 1.021, 1.186; p=0.001). Children (6–23 months) who were not being breastfed at the time of the survey were more likely to be stunted compared to those who reported being breastfed at
the time of the survey (AOR=1.384, 95% CI: 1.067, 1.796; p=0.014). In Zambia, stunting in children aged 6–23 months is high. Stunting is significantly associated with mothers’ age, Childs’ birth weight, mothers taking iron tablets whilst pregnant and breastfeeding. These findings implies that, measures targeted at reducing child stunting should not be taken in isolation but should include a multifaceted approaching looking at both the mother and the children aged 6–23 months at all societal levels in the country as once this window of opportunity is lost then the problem of stunting shall continue to be a public health problem for unforeseeable future.

Keywords Children (6–23 Months); Determinants; Stunting; Zambia

1. Introducion

Stunting or low Height-for-Age z-score (HAZ) is a worldwide phenomenon affecting growth potential in children. Globally, nearly one in four children under the age of 5 (165 million or 26 percent in 2011) are stunted. This problem is in fact more pronounced in sub-Saharan Africa and South Asia which is home to three quarters of the world stunted children below the age of 5. In sub-Saharan Africa, 40 percent of the children under 5 are stunted of which Zambia is part of (UNICEF, 2013). At national level stunting prevalence has persistently remained above 45 percent among children below the age of 5 (CSO, et al., 2009).

Beyond regional and national averages, there are disparities by wealth and area of residence. Globally, one third of rural children under the age of 5 are stunted, compared to one quarter in urban areas. Similarly, children under 5 in the poorest communities are more than twice as likely to be stunted as children in the richest communities (UNICEF, 2013).

The world over, under-5 nutritional status is usually used as a good indicator for any given countries health and nutritional status of the population at large (Sumonkanti, et al., 2008). Nonetheless, among all the nutritional indicators of child malnutrition, HAZ is a useful anthropometric measure for child health (Rayman and Khan, 2006). Data shows that, Zambia has chronic malnutrition among children under the age 5. According to the 2007 Zambia Demographic Health Survey, about five in every ten children aged below the age of five are stunted (CSO, et al., 2009).

In addition, Stunting (reflects failure to receive adequate nutrition over a long period of time and may also be caused by recurrent illness (Chen, et al., 1980). Stunting is an important public health problem in developing countries because of its association with poor functional outcomes such as impaired cognitive development (UNDP, 2011; Wamani, et al., 2007; and Pollitt, et al., 1995), increased susceptibility to infection (Rayman and Khan, 2006; and Brown and Pollitt, 1996), and increased risk of mortality (Rayman and Kahn, 2006; Tomkins, 1988; and Bairagi, 1985). Other long term consequences of childhood stunting include poor work capacity, elevated risk of poor productive outcomes, and chronic diseases (Rayman and Khan, 2006).

It is also argued that, the most crucial time to meet a child’s nutritional requirements is during the 1,000 days beginning from pregnancy to the child’s second birthday. Evidence from 54 low- and middle-income countries indicates that growth deficiencies begin during pregnancy and continue until about 24 months of age. Catch-up growth later in childhood is minimal as the damage caused is largely irreversible (UNICEF, 2013).

Scientific evidence suggests that stunting is associated and caused by quite a number of factors. In general, and for Zambia specifically, demographic and socio-economic variables put certain groups of the population at greater risk of being poor and consequently resulting into experiences of malnutrition which is known to be one of the fundamental causes of child morbidity and mortality (UNDP, 2011). Presently, stunting accounts for up to 52 percent of under-5 deaths in Zambia. In
the same vein, Low Birth Weight, poverty, food insecurity, rural urban differentials, sub-optimal infant feeding practices among others are some of the factors associated with stunting in children.

While the foregoing issues contribute a great deal to child stunting, there is significant evidence suggesting that failure to provide adequate complementary foods containing the necessary nutrients and minerals besides breast milk during the early stages of life leaves children vulnerable to opportunistic infections resulting in poor health and outmately stuntedness. Studies also indicate that, the velocity of linear growth is highest during the first months of life for most infants; hence this is the period of particularly increased susceptibility. However, exclusive breastfeeding, in the absence of supplements in societies such as those in Zambia protects early post-natal stunting (WHO, 1995).

Presently, Zambia has embarked on addressing other forms of malnutrition such as underweight and wasting which have reduced from 21 to 15 percent and 6 percent to 5 percent respectively. However, stunting still remains quite substantial among children aged 6–23 months. Given this situation, there seems to be little information on what is driving high stunting levels among children aged between 6–23 months. In this view therefore, this paper was aimed at studying factors associated with stunting in this age group using data from the 2007 ZDHS.

1.1. Study Objective

The main objective of this study was to determine factors associated with stunting among children aged 6–23 months in Zambia. The question this study aimed at answering was: what bio-demographic and socio-economic factors contribute significantly to stunting in children aged between 6–23 months in Zambia?

2. Methods and Materials

The study utilized data from the 2007 Zambia Demographic and Health Survey. The dataset provided data on child anthropometric measurements, socio-economic variables, food types and other variables. These variables were selected based on United Nations Children’s Emergency Fund (UNICEF) framework of the factors that determine nutritional status. The factors usually include immediate (dietary intake and health status), underlying (quantity and quality of foods, feeding practices, knowledge on quality of care and health services), basic factors which looks at (resources potentially available to a household).

2.1. Statistical Analysis

Analysis of data was done using the Statistical Package for Social Sciences (SPSS). Chi-Square tests were used to explore relationships between the prevalence of stunting and explanatory variables already stated. Independent Samples tests were performed to compare differences in the means for HAZ and sex, type of place of residence etc. Both bivariate and multivariate analyses were used to determine correlates between mother’s Body Mass Index (BMI) and stunting in children aged 6–23 months (low height-for-age). Statistical significance was considered as follows: *P < 0.05, **P-value < 0.01 and ***P < 0.001.

In addition, binary unconditional logistic regression models were built to predict the likelihood of height-for-age Z-scores. Analysis of the HAZ z-scores relied on the World Health Organization (WHO) recommendations, which define limits for acceptable Height-for-age to be between: <-5.0 and >+3.0. Z-scores. In this paper, fixed exclusion range was used because the mean z-score for HAZ was above -1.5. This limit has been used in analyses of anthropometric data worldwide because it is always necessary to identify outlier observations, or observations that are considered
to be “biologically implausible values (BIVs)” which are beyond what you expect to find in a population.

2.2. Limitations

The ZDHS data of 2007 is quite old currently and the hope is to carry out the same study using the 2013 ZDHS for comparison and latest data. Secondly, some of the variables especially the basic determinants were not available in the data set so such we only used what was available.

2.3. Study Results

The dataset had 1,855 children aged 6–23 months; 11 cases were deleted because they had no data on height. Of the remaining 1,844 184 cases were disqualified or deleted from the analysis because they were outside the 1977 NCHS/WHO HAZ condition of <-5 and >+3 (86 cases had greater than 3 z-scores while 98 had less than -5 Z-scores respectively). In the final analysis, this study had a sample of 1, 660 children age 6–23 months.

2.4. Stunting among Children aged 6–23 Months of Age

Table 1 shows that, overall, 44.5 percent of children aged 6–23 months in Zambia are stunted (p < 0.001). Prevalence increased with age. The mean HAZ score was 1.69±1.59 with the corresponding confidence interval and range of ±0.08 and (1.61-1.77) respectively. Disaggregation of this data by sex brings specific differentials. About five in every ten boys were likely to be stunted compared to four in every ten girls (p< 0.001). Further, stunting increases with decreasing reported size at birth: 53.2 percent of children born small (very small/smaller than average) were likely to be stunted compared to those born with average and large size (very large/larger than average) 45.9 and 38.6 percent respectively (p=0.002).

Table 1: Percentage distribution of Stunting by Age, Sex and Reported Size of the Child at Birth

| Explanatory Variables | Height-for-Age | p-value |
|-----------------------|----------------|---------|
|                       | <2SD | ≥2 SD | |
| Age in Months         |      |       |         |
| 6 - 11                | 168  | 30.7  | 380     | 69.3 |
| 12 - 17               | 246  | 45.1  | 299     | 54.9 | 0.001*** |
| 18 - 23               | 325  | 57.3  | 242     | 42.5 |
| Overall               | 739  | 44.5  | 921     | 55.5 |
| Sex of children       |      |       |         |       |
| Male                  | 399  | 49.8  | 402     | 50.2 | 0.001*** |
| Female                | 340  | 39.6  | 519     | 60.4 |
| Total                 | 1660 |       |         |       |
| Childs Size at Birth  |      |       |         |       |
| Large                 | 203  | 38.6  | 323     | 61.4 |
| Average               | 428  | 45.9  | 505     | 54.1 | 0.002*** |
| Small                 | 99   | 53.2  | 87      | 46.8 |
| Don’t Know            | 7    | 53.8  | 6       | 46.2 |
| Total                 | 1658 |       |         |       |
### 2.5. Stunting in Children Aged 6 - 23 Months by Mother’s Demographic and Socio-Economic Characteristics

Table 2 shows that stunting in children was high among mother’s aged 20–24 and 40–44 years (49.7 percent and 56.9 percent respectively p=0.007). Children in rural areas were likely to be more stunted (46 percent) compared to children in urban areas (41.1 percent; p=0.063). Disaggregation by province shows that, Luapula had the highest percentage of children stunted (55.2 percent p=0.006).

Children whose mothers have attained higher education are less likely to be stunted (about three in every ten compared to about five in every ten with primary education; p=0.058). In the same way, children in households with wealth quintiles described as poorest, poorer or middle are more likely to be stunted compared to those whose households are or were classified as belonging to the richer quintile (four in every ten p=0.046).

Further, children whose mothers had a moderate BMI were likely to be stunted compared to other BMI measures. In addition, children living in households where mother’s reported their marital status as "living together" and "never been married" were less likely to be stunted (27.3 percent and 29.9 percent) compared to those mother’s reporting either as widowed or divorced (74.2 percent and 57.4 percent) respectively (p<0.001). By parity, stunting was more pronounced in mother’s reporting to have had 8 or more children ever born about (48 percent than those with about 4-7 children 43.1 percent). Stunting was also evident in mothers whose ages at first marriage were 15–19 years and 25 years or more (47.1 percent and 50 percent respectively).

**Table 2:** Prevalence of Stunting of Children Aged 6 - 23 Months by Mother’s Age, Residence Province, Education, and Wealth quintile, BMI, Total Children Ever Born and Age at 1st Marriage

| Explanatory Variables | Height-for-Age | p-value |
|-----------------------|----------------|---------|
|                       | < -2SD  | ≥ 2 SD |         |
|                       | n       | Percent | n       | Percent |
| **Age Group**         |         |         |         |         |
| 15 - 19               | 61      | 35.3    | 112     | 64.7    | 0.007** |
| 20 - 24               | 237     | 49.7    | 240     | 50.3    |         |
| 25 - 29               | 191     | 42.7    | 256     | 57.3    |         |
| 30 - 34               | 131     | 43.7    | 169     | 56.3    |         |
| 35 - 39               | 74      | 41.3    | 105     | 58.7    |         |
| 40 - 44               | 41      | 56.9    | 31      | 43.1    |         |
| 45 - 49               | 4       | 33.3    | 8       | 66.7    |         |
| **Residence**         |         |         |         |         |
| Urban                 | 211     | 41.1    | 302     | 58.9    | 0.063*  |
| Rural                 | 528     | 46.0    | 619     | 54.0    |         |
| **Province**          |         |         |         |         |
| Central               | 68      | 48.2    | 73      | 51.8    |         |
| Copperbelt            | 78      | 46.4    | 90      | 53.6    |         |
| Eastern               | 99      | 47.6    | 109     | 52.4    |         |
| Luapula               | 96      | 55.2    | 78      | 44.8    |         |
| Lusaka                | 70      | 43.2    | 92      | 56.8    |         |
| Northern              | 96      | 43.8    | 123     | 56.2    |         |
| North-Western         | 82      | 44.6    | 102     | 55.4    | 0.006** |
| Southern              | 74      | 33.6    | 146     | 66.4    |         |
| Western               | 76      | 41.3    | 108     | 58.7    |         |
| **Educational Attainment** |  |  |  |  | 0.058*  |
| No Education          | 90      | 42.1    | 124     | 57.9    |         |
| Primary               | 488     | 47.0    | 551     | 53.9    |         |
Table 3 shows that stunting in children was high among households with less than 5 members (47.9 percent) compared to those with five or more (45.0 percent and 42.8 percent). Four in every ten children residing in male headed households were stunted compared to about five in every ten children in female headed households (p=0.101).

2.6. Stunting in Children Aged 6 - 23 Months by Household Size and Sex of Household Head

Table 3: Prevalence of Stunting of Children Aged 6 - 23 months by Household Size and Sex of Household Head

| Explanatory Variables | Height-for-Age | p-value |
|-----------------------|----------------|---------|
|                       | <2 SD | ≥2 SD | n | Percent | n | Percent |
| Household Size | | | | | | |
| Less than 5 members | 213 | 47.9 | 232 | 52.1 | 0.202 |
| 5 members | 130 | 45.0 | 159 | 55.1 |
| More than 5 members | 396 | 42.8 | 530 | 57.2 |
| Sex of household head | | | | | | |
| Male | 607 | 43.6 | 784 | 56.4 | 0.101 |
| Female | 132 | 49.1 | 137 | 50.9 |
| Total | 1660 | | | | |
2.7. Stunting in Children Aged 6-23 Months by Mothers Receipt of Supplements and Place of Delivery, Number of Antenatal Visits, Birth Order and Preceding Birth Intervals

Table 4 shows that children whose mothers were given or bought iron tablets, took anti-malarial drugs, took de-worming tablets and also were given Vitamin A post-partum were less likely to be stunted (43.0 percent, 43.8 percent, 41.7 percent and 41.5 percent) compared to those whose mothers reported that they never took these supplements (55.8 percent p=0.006, 45.8 percent p=0.683, 45.3 percent p=0.158 and 46.4 percent p =0.058 respectively).

The findings further shows that, four in every ten children whose mothers delivered at a health facility were likely to be stunted than those whose mothers delivered at home five in every ten p=0.038. About six and five in every children whose mothers did not go for antenatal or went for less than four visits were likely to be stunted compared to only four in every ten among those whose mothers went for four or more times for antenatal (p=0.024). About 47.2 percent of the children whose mothers previous birth interval is less than 24 months are stunted compared with 45.0 percent whose mothers previous birth interval is 24 or more (p=0.297).

Table 4: Prevalence of Stunting of Children Aged 6 - 23 Months by Mothers Receipt of Supplements, Number of Antenatal Visits, Birth Order and Preceding Birth Intervals

| Explanatory Variable | Height-for-Age | p-value |
|----------------------|----------------|---------|
|                      | <2SD           | ≥2 SD   |         |
|                      | n   | Percent | n   | Percent |
| Given or bought Iron tablets | 0.006 ** |
| Yes                  | 639 | 43.0    | 847 | 57      |
| No                   | 100 | 57.5    | 74  | 42.5    |
| Took any anti-malaria drugs | 0.683 |
| Yes                  | 631 | 43.8    | 810 | 56.2    |
| No                   | 75  | 45.5    | 90  | 54.5    |
| De-worming tablets   | 0.158 |
| Yes                  | 258 | 41.7    | 360 | 58.3    |
| No/Don't Know        | 448 | 45.3    | 540 | 54.7    |
| Vitamin A 2 Months Post-Partum | 0.058 * |
| Yes                  | 325 | 41.5    | 458 | 58.5    |
| No/Don't Know        | 381 | 46.4    | 440 | 53.6    |
| Place of delivery    | 0.038** |
| Health Facility      | 331 | 41.3    | 470 | 58.7    |
| Home                 | 404 | 47.6    | 445 | 52.4    |
| Other                | 4   | 44.4    | 5   | 55.6    |
| Number of antenatal visits | 0.024** |
| Less than 4 visits   | 276 | 45.6    | 329 | 54.4    |
| 4 or more visits     | 404 | 42.1    | 555 | 57.9    |
| No Visit             | 26  | 61.9    | 16  | 38.1    |
| Birth Order          | 0.303 |
| First                | 126 | 40.8    | 183 | 59.2    |
| 2nd – 4th            | 380 | 45.9    | 448 | 54.1    |
| 5th or more          | 233 | 44.6    | 290 | 55.4    |
| Previous Birth Interval | 0.297 |
| No previous/Missing  | 127 | 40.8    | 184 | 59.2    |
| < 24 months          | 94  | 47.2    | 105 | 52.8    |
| ≥24 months           | 518 | 45      |      |         |
2.8. Stunting in Children Aged 6 - 23 Months by Mother and Child’s 24 hour Individual Diet Diversity Score (DDS)

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 (Savy, 2006; Swindale, 2006; WFP; 2008; 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; NFNC, 2009). 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).

Table 5 shows stunting among children who are aged 6–23 months by mother and child’s 24 hour DDS. The IDDS ranged between 0 and 11 food items, with the mean IDDS of mothers’ 4.37±2.12 and children -5 3.99±2.02 food items in the 24 hours prior to the survey respectively. Children in households with mother’s who had a good DDS were less likely to be stunted (39.5 percent) compared to those who had a poor DDS (48.2 percent (P=0.036)). In addition, about five in every ten children in who had poor or moderate diet were stunted compared to about four among those who had a good DDS 24 hours prior the survey p=0.267.

| Explanatory Variable               | Height-for-Age | p-value |
|------------------------------------|----------------|---------|
|                                    | <2SD n Percent | ≥2 SD n Percent |
| Mother’s Diet Diversity Score      |                |         |
| Poor                               | 305 48.2       | 328 51.8 |
| Moderate                           | 331 43.2       | 435 56.8 |
| Good                               | 103 39.5       | 158 60.5 |
|                                     |                | 0.036**  |
| Childs Diet Diversity Score        |                |         |
| Poor                               | 325 45.9       | 383 54.1 |
| Moderate                           | 341 44.5       | 425 55.5 |
| Good                               | 73 39.2        | 113 60.8 |
|                                     | 739 44.5       | 921 55.5 |

2.9. Current Breastfeeding Status and Initiation of Breastfeeding

This chapter presents information on initiation of breastfeeding. Early initiation of breastfeeding has benefits for survival and beyond. Breastfeeding promotes child survival, health, brain and motor development (Edmond, et al., 2006; Horta, et al., 2007 and Mullany et al, 2008). Early initiation of breastfeeding prevents neonatal and infant deaths by reducing the risk of infectious diseases. This is because: colostrum, contain a large number of protective factors that provide passive and active protection to a wide variety of known pathogens. It is rich in these protective factors and its ingestion within the first hour of life prevents neonatal mortality, and exclusive breastfeeding or feeding only breast-milk eliminates the ingestion of pathogenic micro-organisms through contaminated water, other fluids etc.

Table 6 below shows that, among the children who are stunted, 43.2 percent were currently being breastfed compared with 50.3 percent who were not (p=0.024). In addition, of the stunted children,
only 43.8 percent were initiated to the breast within one hour after birth compared with 56.2 percent with normal HAZ (p=0.217).

**Table 6: Prevalence of Stunting by Current Status of Breastfeeding and Initiation of Breastfeeding among children aged 6 – 23 months in Zambia**

| Explanatory Variable | Height-for-Age | p-value |
|----------------------|----------------|---------|
|                      | <2SD n Percent | ≥2 SD n Percent |       |
| Currently Breastfeeding |                |           |         |
| No                   | 153 50.3       | 151 49.7        | 0.024* |
| Yes                  | 586 43.2       | 770 56.8        |         |
| Initiation of breastfeeding |        |           |         |
| Within 1 hour of birth | 359 43.8 | 460 56.2 | 0.217 |
| within a day after 1 hour | 279 42.7 | 375 57.3 |         |
| After a day           | 62 51.2        | 59 48.8         |         |
| Total                | 700 43.9       | 894 56.1        |         |

3. Multivariate Analysis

3.1. Factors Associated with Stunting Among Children

Table 7 shows the binary logistic regression Adjusted Odds Ratios (AORs), corresponding p-values and confidence intervals for the association between stunting by immediate, underlying, basic and other factors of children aged 6–23 months of age in Zambia. Among the immediate factors of stunting, the major factors associated with a child being stunted are: mothers receiving iron tablets whilst pregnant, child’s and mothers individual dietary diversity scores (IDDS). Mothers receipt of anti-malaria tablets, de-worming drugs and vitamin A post-partum did not contribute significantly to the model. Children reported to have been breastfeeding at the time of the survey, mothers having attended antenatal clinics during the previous pregnancy and place of delivery were some of the underlying factors of child stunting. Furthermore, maternal education, mother's age, wealth index and mothers earning more or same as partner were also basic factors. The model further reveals that, sex, age in months and size at birth are some of the other determinants of stunting.

Children whose mothers had not taken iron tablets whilst pregnant (AOR=0.600, 95%CI: 0.405, 0.890; p=0.011) more likely to be stunted than those whose mothers had taken the tablets. Mother and child’s IDDS were also significant predictors of stunting (AOR=1.101, 95%CI: 1.021, 1.186; p=0.012 and AOR=1.101, 95%CI: 1.021, 1.186; p<0.001).

Children (6–23 months) who were not being breastfed at the time of the survey were more likely to be stunted compared to those who reported being breastfed at the time of the survey (AOR=1.384, 95%CI: 1.067, 1.796; p=0.014). Children whose mothers had attended antenatal clinics less than three times and four or more times had reduced odds of being stunted (AOR=0.562, 95%CI: 0.294, 1.074; p=0.081 and AOR=0.483, 95%CI: 0.255, 0.917; p=0.026) compared to those whose mothers did not attend. The model further shows that, children (aged 6–23 months) who were delivered at a healthy facility (AOR=0.771, 95%CI: 0.630, 0.944; p=0.012) were less likely to be stunted compared to those who reported to have been delivered at home or other places.

Education, age of the mother and wealth are also important markers on child stunting. Children whose mothers had no education were more likely to be stunted compared with those whose mothers had primary education (AOR=1.306, 95%CI: 0.961, 1.775; p=0.088). In the same way, mothers age was also associated child stunting (AOR=1.756, 95%CI: 1.168, 2.641; p=0.007 and
AOR=2.568, 95%CI: 1.268, 5.200; p=0.009). Children (aged 6–23 months) from richer households (AOR=0.682, 95%CI: 0.454, 1.022; p=0.064) were less likely to be stunted compared with those from poorest households. Child stunting was also associated with household earnings (AOR=1.710, 95%CI: 1.103, 2.651; p=0.016).

The data also shows that sex of a child is associated with stunting. Female children (AOR=0.649, 95%CI: 0.531, 0.795; P<0.001) were less likely to be stunted compared with male children within the same age group (6–23 months). Age of the child is also associated with stunting. Data in table 6 shows that for each increase in age by a month, there is a 9.8 percent increase in the odds of a child being stunted (AOR=1.098, 95%CI: 1.077, 1.120; p<0.001). Children whose birth weight was small or average (AOR=1.919, 95%CI: 1.350, 2.727; p<0.001 and AOR=1.365, 95%CI: 1.090, 1.710; p=0.007) were 91.9 percent and 36.5 percent more likely to be stunted compared with children whose birth weight was large at birth.

**Table 7: Immediate, Underlying, Basic and Other Factors Associated With Stunting among Children Aged 6-23 Months in Zambia In 2007**

| Explanatory Variable | Stunting | 95.0% C.I. for EXP(B) | 95.0% C.I. for EXP(B) |
|----------------------|----------|----------------------|----------------------|
|                      | Sig.     | Adjusted Odds Ratios |                                    |
| Immediate Factors    |          |                      |                                    |
| Mothers received Iron|          |                      |                                    |
| No                   | 0.011**  | 0.600               | 0.405                 | 0.890          |
| Mothers received malaria drugs |          |                      |                                    |
| No                   | 0.405    | 1.159               | 0.819                 | 1.641          |
| Mothers received De-worming drugs |          |                      |                                    |
| No                   | 0.651    | 0.952               | 0.769                 | 1.179          |
| Mothers received Vitamin A Post-Partum |          |                      |                                    |
| No                   | 0.198    | 0.874               | 0.711                 | 1.073          |
| Childs Individual Dietary Diversity Score (IDDS) |          |                      |                                    |
| No                   | 0.012**  | 1.101               | 1.021                 | 1.186          |
| Mothers’ Individual Dietary Diversity Score (IDDS) |          |                      |                                    |
| No                   | 0.000*** | 0.860               | 0.800                 | 0.924          |
| Underlying Factors   |          |                      |                                    |
| Currently Breastfeeding |          |                      |                                    |
| No                   | 0.014**  | 1.384               | 1.067                 | 1.796          |
| Initiation of breastfeeding |          |                      |                                    |
| Within 1 hour of birth | 0.849  | 1.020               | 0.835                 | 1.245          |
| After 1 hour of birth |          |                      |                                    |
| Quantity of food items consumed by child |          |                      |                                    |
| Less than 4 food items |          |                      |                                    |
| No                   | 0.434    | 0.922               | 0.753                 | 1.129          |
| Number of Antenatal Visits |          |                      |                                    |
| No Visits/ Don’t Know |          |                      |                                    |
| Less than 3 Visits | 0.081*   | 0.562               | 0.294                 | 1.074          |
| 4 or more visits     | 0.026**  | 0.483               | 0.255                 | 0.917          |
| Place of Delivery    |          |                      |                                    |
| Home or other place | 1 |
|---------------------|---|
| Health facility     | 0.012** 0.771 0.630 0.944 |

### Basic Factors

#### Maternal education

| Level               | RC | 1 | 2 | 3 |
|---------------------|----|---|---|---|
| No education        |    | 1 |   |   |
| Primary             | 0.088*| 1.306 | 0.961 | 1.775 |
| Secondary           | 0.816 | 1.045 | 0.719 | 1.521 |
| Higher              | 0.701 | 0.846 | 0.36  | 1.99  |

#### Mothers age

| Age group       | RC | 1 | 2 | 3 |
|-----------------|----|---|---|---|
| 15 – 19**       |    | 1 |   |   |
| 20 - 24         | 0.007**| 1.756 | 1.168 | 2.641 |
| 25 - 29         | 0.162 | 1.383 | 0.878 | 2.178 |
| 30 - 34         | 0.184 | 1.421 | 0.846 | 2.386 |
| 35 - 39         | 0.367 | 1.311 | 0.727 | 2.364 |
| 40 - 44         | 0.009**| 2.568 | 1.268 | 5.200 |
| 45 - 49         | 0.867 | 0.894 | 0.239 | 3.341 |

#### Place of residence

| Location        | RC | 1 | 2 | 3 |
|-----------------|----|---|---|---|
| Urban           |    | 1 |   |   |
| Rural           | 0.629 | 0.918 | 0.65  | 1.297 |

#### Wealth index

| Index            | RC | 1 | 2 | 3 |
|------------------|----|---|---|---|
| Poorest**        |    | 1 |   |   |
| Poorer           | 0.922 | 0.985 | 0.733 | 1.325 |
| Middle           | 0.758 | 1.048 | 0.778 | 1.41  |
| Richer           | 0.064*| 0.682 | 0.454 | 1.022 |
| Richest          | 0.405 | 0.809 | 0.491 | 1.333 |

#### Earnings

| Earnings         | RC | 1 | 2 | 3 |
|------------------|----|---|---|---|
| Less or Don’t Know** |    | 1 |   |   |
| Earns more than partner | 0.016**| 1.710 | 1.103 | 2.651 |

#### Decision making on how to spend more

| Decision        | RC | 1 | 2 | 3 |
|-----------------|----|---|---|---|
| Respondent/Husband/Partner | 0.357 | 1.135 | 0.867 | 1.484 |
| Husband/Partner/Others | 0.960 | 1.010 | 0.672 | 1.520 |
| Don’t Know/Missing** |    | 1 |   |   |

#### Household Size

| Size             | RC | 1 | 2 | 3 |
|------------------|----|---|---|---|
| < 5 members      |    | 1 |   |   |
| 5 members        | 0.735 | 1.050 | 0.791 | 1.394 |
| > 5 members**    |    | 1 |   |   |

#### Sex of household head

| Head            | RC | 1 | 2 | 3 |
|-----------------|----|---|---|---|
| Male**          |    | 1 |   |   |
| Female          | 0.128 | 1.234 | 0.941 | 1.616 |

#### Birth Order

| Order           | RC | 1 | 2 | 3 |
|-----------------|----|---|---|---|
| First born**    |    | 1 |   |   |
| 2nd - 4th       | 0.862 | 1.285 | 0.076 | 21.580 |
| 5 or more       | 0.873 | 1.261 | 0.074 | 21.567 |

#### Preceding birth interval

| Interval        | RC | 1 | 2 | 3 |
|-----------------|----|---|---|---|
| No previous birth** |    | 1 |   |   |
| < 24 months     | 0.943 | 0.902 | 0.054 | 15.199 |
| > 24 months     | 0.895 | 0.827 | 0.05  | 13.775 |

#### Other Factors

| Factor            | RC | 1 | 2 | 3 |
|-------------------|----|---|---|---|
| Sex of the child  |    | 1 |   |   |
| Male**            |    | 1 |   |   |
| Female            | 0.000***| 0.649 | 0.531 | 0.795 |
| Childs age in months | 0.000***| 1.098 | 1.077 | 1.120 |
| Childs size at birth | 0.410 | 1.626 | 0.512 | 5.163 |
4. Discussion of Results

The main objective of this study was to determine factors associated with stunting among children aged 6–23 months in Zambia. Researchers suggest that, bio-demographic and socio-economic factors contribute significantly to stunting in children. Our study reveals that, stunting among children 6–23 months of age is quite high in Zambia (44.5 percent) and comparatively, much higher than what is obtaining in other developing countries (Tiwari, et al., 2014). Stunting increases as the age of a child (in months) increases; this is similar to what Adeladza (2009, Kenya) and Alemayehu (2014, Ethiopia) found in their studies. This could be due to extended periods of inadequate food intake and increased morbidity among children 6–23 months in the past years or months prior the survey which could account for why stunting increases with age in the area.

Stunting is also clearly associated with both the sex and the birth weight of a child. In this study, this aspect has also been amplified. Similarly, research conducted elsewhere shows that, male children are slightly more likely to be stunted compared to female children (Alemayehu, et al., 2014, Adeladza, 2009, Bwalya, 2013 and Wolde, et al., 2014). These findings further show that, Children whose birth weight was recorded as “small or average” were likely to be stunted compared with children whose birth weight was recorded as “large” at birth. This fact was also found by Ajao and Girmay (2010, Nigeria). Similarly, Tiwari (2014) found that Nepalese children perceived to have been small had a higher risk of being stunted compared to those perceived to be average or large.

Other prominent findings in this study are that maternal age and education play a significant role in determining stunting in children. (Intuition and studies confirm that higher educated mothers understand and, generally, act more responsively to the nutrition of their children, seek disease prevention and treatment, and maintain sanitary living conditions (Panjsheri, 2007; and Bwalya, 2013)). Results in this study indicate that, children whose mothers had no education were likely to be stunted compared to those whose mothers had primary education. Maternal education generally has an inverse relationship with stunting levels and has consistently shown to be critical for child health, nutrition and survival (Alemayehu, et al., 2014 and Bwalya, 2013). Evidence from various studies indicates that knowledge and practices are key pathways. Educated women are likely to be more aware of nutrition, hygiene and health care; and they can easily introduce new feeding practices which can improve the nutritional status of children (Ajao, et al., 2010 and Sumonkati and Islam, 2008). Similarly, it is also one of the most important resource that enable women to provide appropriate care for their children, which is an important determinant of children’s growth and development (Engle and Menon, 1996). In the same vein, maternal age plays a significant role in determining stunting in children. In this study, results show that children born to mothers aged 20– 24 and 40–44 years were more likely to be stunted compared to those born to mothers aged 15– 19 years. This finding is consistent with a study conducted in Nepal by Tiwari et al. in 2014 where, children 0–23 months born to mothers <20 years were less likely to be stunted as compared to those born to older women > 20 years. However, it is really not clear how children born to younger mothers in Zambia and Nepal could exhibit positive outcomes. This may require more research since under normal circumstances, mothers who are less than 20 years are not only physically immature, but also socially and economically unstable. At this age, most of
these mothers could still be potentially attending school and most likely unemployed or not in any income generating venture. Linked to this argument is also the effect wealth has on stunting. This study shows that children from richer households were less likely to be stunted compared to those in poorer households. In the same way, this study shows that stunting is a function of household earning (AOR=1.710, 95%CI: 1.103, 2.651; p=0.016). The fact that only the richer and households with better earnings were statistically significant means that there is some threshold level of income and socio-economic status above which families have access to a number of important socioeconomic factors such as education, employment, and healthcare which considerably impact the health of their children (Odunayo and Oyewole, 2006 and Panjsheri, 2007).

This study also found that, children (6–23 months) who were not being breastfed at the time of the survey were more likely to be stunted compared to those who reported being breastfed (AOR=1.384, 95%CI: 1.067, 1.796; p=0.014). This finding can be attributed to the fact that, breastfeeding in general promotes child survival, health, brain and motor development (Edmond, et al., 2006; Horta, et al., 2007 and Mullany, 2008). Early initiation of breastfeeding prevents neonatal and infant deaths by reducing the risk of infectious diseases.

Another aspect pertinent to stunting is antenatal care. Studies have found that antenatal care contributes significantly and positively to the child’s nutrition (IFPRI, 2009). In the same way, this study found that, children whose mothers had attended antenatal clinics less than three times and four or more times had reduced odds of being stunted compared to those whose mothers did not attend. In the same way, a study conducted by Kanjilal (2010), found that, institutional births were less likely to be stunted compared to non-institutional births (p<0.001). This finding is similar to findings under this study. This may be due to the quality of service received when antenatal visits and deliveries are made at health facilities defined by the calibre of qualified healthcare providers attending to expectant mothers amongst other factors.

This study has also shown that iron supplement is a deterministic aspect affecting stunting in children. Children born to mothers who had not taken iron tablets whilst pregnant were more likely to be stunted compared to those whose mothers had taken the iron tablets. This finding further compounded by the result showing that mother and child’s IDDS were also significant predictors of stunting (p<0.05 and p<0.001). Siimens and Perheenpupa (1984) and Dallman (1986) also found that iron in breast milk (though present in low concentration) (0.06-0.09 mg/100ml) is uniquely well absorbed and utilised, although reasons for this aspect are unclear. Ideally, absorption of about 0.8 mg or iron per day from the diet is required, of which 0.6 mg is needed for growth, and 0.2 mg to replace loses (Dallman 1986). The reference nutrient intake for iron (mg/day) is 7.8 for children aged 7–10 months (Department of Health, 1991). Meaning therefore, that increased additional sources of iron is required to maintain haemoglobin concentration during the rapid phase of growth between 4 and 12 months of a child.

5. Conclusion

From this study, it is clear that stunting among children 6–23 months is a major challenge and that there are several bio-demographic and socio-economic factors associated with stunting in Zambia. Among them being, mother and child’s Dietary Diversity Score, Mothers non-receipt of iron tablets whilst pregnant, increased age in months of a child’s, non-attendance of antenatal clinics, home deliveries, mothers not being educated and increased aged, household wealth (poorest), household earnings, sex of the child, and child’s size at birth. Therefore, it implies that measures targeted at reducing child stunting should not be taken in isolation but should include a multifaceted approaching looking at both the mother and the children aged 6–23 months at all societal levels in the country as once this window of opportunity is lost then the problem of stunting shall continue to be a public health problem for unforeseeable future. As a forward, this study
proposes more detailed and focussed research to investigate for example how results in Zambia and Nepal seem to suggest low prevalence of stunting in very young mothers (<20 years) compared to those aged 20–29 years

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