ABSTRACT

One of the countries with a high prevalence of stunting in East Africa is Zambia. Globally, 22% of children under 5 years old are stunted or 149.2 million children in 2020. Stunting prevalence in Zambia remains above 35% in children under 5 years old at the national level. Research in Zambia about determine of stunting is still few and limited. The aim of this study was to identify determine with stunting in children aged 0-39 months in Zambia. The method used is observational in secondary data from the 2018 Demographic and Health Survey (DHS) in Zambia. Mothers of toddlers are Respondents aged 15 - 49 years and having toddlers aged 15 - 49 months. The sample size used in this study was 3804 mothers with children under five. Bivariate analysis using Chi-square test and multivariate analysis using Multiple Logistic Regression. The results showed that the factors related to stunting were maternal age (p<0.164), marital status (p=0.187), wealth index (p=0.149), age of children under five (p=0.164) and order of children (p=0.077). Marital status OR 2.724 (0.846-8.769) the most influence the occurrence of stunting in children under five. The implication of this study is the more mothers who never married, the greater the risk of stunting.

INTRODUCTION

Stunting is a condition of toddlers with a length or height less than their age, where this condition is measured by length or height that is more than -2 Standard Deviation (SD) according to the World Health Organization (WHO) (1). Stunting is one of the significant obstacles in human development (2). Globally, 22% of children under 5 years old are stunted or 149.2 million children in 2020 (3). Stunting toddlers are spread across fourteen countries, 80%. There are ten countries with the largest absolute burden with stunting prevalence of 40% or more (4).

In 2016, there were 87 million stunted children in Asia, 59 million in Africa and 6 million in Latin America and the Caribbean (5). The five sub-regions with
stunting rates > 30% are West Africa (31.4%), Central Africa (32.5%), South Asia (34.1%), Oceania (38.3%) excluding Australia and New Zealand) and East Africa (36.7%) (6).

One of the countries with a high prevalence of stunting in East Africa is Zambia. In recent years, the prevalence of stunting in Zambia has gradually decreased but has not been significant because there are still many children at risk. Stunting prevalence remains above 35% in children under 5 years old at the national level (7). gender, child age, mother's age, mother's education level, wealth status, improved drinking water sources, duration of breastfeeding and place of residence are factors that have an association with stunting in Zambia (8).

Factors that contribute to stunted growth include poor maternal health and nutrition, inadequate CI, and infection. Maternal health and nutrition factors include health status before, during and after pregnancy that affect child development from an early age (2). Other factors that play a role in stunting are short maternal stature, birth spacing too close, pregnancy at a young age and lack of nutritional availability to the fetus during pregnancy (9).

Stunting also has an impact on socioeconomic conditions such as mothers with low education tend to have stunted children (10), Mothers with low incomes may also have more difficulty getting enough and varied foods that will provide good nutrition (11). Research in Zambia on the determinants of stunting is still few and limited. Further analysis is needed to reduce stunting rates. This study aims to identify the determinants of stunting in children aged 0-59 months in Zambia.

METHODS

This study uses quantitative research, cross-sectional design with secondary data. The data source comes from the 2018 Demographic and Health Survey (DHS) in Zambia. Participants in this study were mothers of toddlers aged 15-49 years and had toddlers aged 15-49 months. The number of samples used in this study were 3,804 mothers of children under five.

The dependent variable in this study was the incidence of stunting under five. While the independent variables are the age of the toddler, the gender of the toddler, birth weight, birth order, breastfeeding history, mother's age, area of residence, mother's education, marital status, occupation and economic status. Bivariate analysis was with Chi-Square test, Confidence Interval (CI) 80% and a significance level of p<0.20, and then analyzed using multiple logistic regression, showing 95% CI and a significance level of p<0.05.

RESULT

Variable characteristics of mothers, around 23.8% among mothers aged 30-34 years old and 60% of mothers lived in rural areas have education level of elementary school (51.2%) education and almost 80% are married. Mother's employment status is around 47% of mothers working seasonally and 45.7% with permanent jobs. The results also showed 25% of mothers with very poor economic status while very rich contributed 18%.

Table. 2 describes the characteristics of the child. The category of children aged 30-34 months has the highest frequency of 23.8% from the other categories. The frequency of male and female sexes is on average the same, with a low birth weight of 12.8%, while the results of the study show that the order of children 2-3 is 34% and children with a sequence of 7+ are 14%.

The results of the analysis of the relationship between independent variables on maternal characteristics showed an association between maternal age (p = 0.164), marital status (p = 0.187) and economic status (p = 0.149) with stunting under five while for the variable of residence (p = 0.618), mother's education (p=0.319), working status (p=0.792) and breastfeeding history (p=0.466) did not show any relationship with under-five stunting (Table 3).

The results of the analysis of the relationship between the independent variables on the characteristics of children showed that there was a relationship between the age of the toddler (p=0.164) and the order of the child (p=0.077) with the sex variable stunting (p=0.246) and birth weight (p=0.586) there was no relationship means with stunting (Table 4).

After the Chi-Square test was carried out, it was followed by a logistic regression test, namely the variables of mother's age, marital status, economic status, child's age, and child's order. The results of logistic regression analysis showed that marital status
and order of children had a significant effect on the incidence of *stunting* in children under five (p<0.05).

Table 1. Variable Frequency Distribution Based on Maternal Characteristics

| Mother’s Characteristics | N  | %  |
|--------------------------|----|----|
| **Age**                  |    |    |
| 15-19                    | 216| 5.7|
| 20-24                    | 797| 21 |
| 25-29                    | 868| 22.8|
| 30-34                    | 904| 23.8|
| 35-39                    | 626| 16.5|
| 40-44                    | 326| 8.6 |
| 45-49                    | 67 | 1.8 |
| **Residence**            |    |    |
| Rural                    | 2494| 65.6|
| Urban                    | 1310| 34.4|
| **Mother’s Education**   |    |    |
| No education             | 278 | 7.3 |
| Elementary School        | 1947| 51.2|
| Junior High School       | 1307| 34.4|
| Senior High School       | 272 | 7.2 |
| **Marital status**       |    |    |
| Never married            | 345 | 9.1 |
| Married/Living together  | 2995| 78.7|
| Widowed/divorced         | 464 | 12.2|
| **Working Status**       |    |    |
| Permanent                | 1738| 45.7|
| Seasonal                 | 1805| 47.5|
| Part time                | 261 | 6.9 |
| **Economic Status**      |    |    |
| Very poor                | 939 | 24.7|
| Poor                     | 820 | 21.6|
| Currently                | 694 | 18.2|
| Rich                     | 667 | 17.5|
| Very Rich                | 684 | 18  |
| **Breastfeeding History**|    |    |
| Breastfeeding            | 2527| 66.4|
| Not breastfeeding         | 1277| 33.6|

Table 2. Variable Frequency Distribution Based on Child Characteristics

| Child’s Characteristics | n  | %  |
|-------------------------|----|----|
| **Age**                 |    |    |
| 15-19                   | 216| 5.7 |
| 20-24                   | 797| 21  |
| 25-29                   | 868| 22.8|
| 30-34                   | 904| 23.8|
| 35-39                   | 626| 16.5|
| 40-44                   | 326| 8.6 |
| 45-49                   | 67 | 1.8 |
| **Gender**              |    |    |
| Male                    | 1904| 50.1|
| Woman                   | 1900| 49.9|
| **Birth Weight**        |    |    |
| LBW                     | 486 | 12.8|
| Normal                  | 3318| 87.2|
| **Child Order**         |    |    |
| 1                       | 768 | 20.2|
| 2-3                     | 1295| 34  |
| 4-6                     | 1207| 3.7 |
| 7+                      | 534 | 14  |

The probability of children in the order of 4-6 being 0.64 times greater than the first, second and third order children who have a risk of experiencing *stunting* is 0.46 and 0.26 times lower than the order of children to 4-6 (Table 5). Mothers who have never married tend to have *stunting* children by 5.42 times greater than mothers who are married or live with a partner.

Multivariate analysis with the ideal model chose two variables that were proven to be associated with *stunting*. The related variables were the age of the child and marital status. This multivariate analysis can be used to obtain variables related to *stunting* in toddlers by comparing the value of the Odds Ratio (OR) in the model. The marital status variable is the variable that has the most association with *stunting* in children under five.

Table 3. *Stunting* Prevalence Based on Maternal Characteristics

| Mother Characteristics | Stunting | No Stunting | Significance Value |
|------------------------|----------|-------------|--------------------|
|                        | n        | %           | n                  | %      |
| **Age (Years)**        |          |             |                    |        |
| 15-19                  | 313      | 5.6         | 3                  | 0.1    |
| 20-24                  | 788      | 20.7        | 9                  | 0.2    |
| 25-29                  | 858      | 22.6        | 10                 | 0.3    |
| 30-34                  | 887      | 23.3        | 17                 | 0.4    |
| 35-39                  | 615      | 16.2        | 11                 | 0.3    |
| 40-44                  | 315      | 8.3         | 11                 | 0.3    |
| 45-49                  | 66       | 1.7         | 62                 | 0.0    |
### Mother Characteristics

| Residence          | Stunting | No Stunting | Significance Value |
|--------------------|----------|-------------|--------------------|
| Rural              | 2451     | 64.4%       | 43                 | 1.1%   | 0.618 a |
| Urban              | 1291     | 33.9%       | 19                 | 0.5%   |

### Mother's Education

| Education          | Stunting | No Stunting | Significance Value |
|--------------------|----------|-------------|--------------------|
| No education       | 270      | 7.1%        | 8                  | 0.2%   | 0.319 a |
| Elementary School  | 1920     | 50.5%       | 27                 | 0.7%   |
| Junior High School | 1285     | 33.8%       | 22                 | 0.6%   |
| Senior High School | 267      | 7%          | 5                  | 0.1%   |

### Marital status

| Status                     | Stunting | No Stunting | Significance Value |
|----------------------------|----------|-------------|--------------------|
| Never married              | 338      | 8.9%        | 7                  | 0.2%   | 0.187 a* |
| Married/Living together    | 2943     | 77.4%       | 52                 | 1.4%   |
| Widowed/divorced           | 461      | 12.1%       | 3                  | 0.1%   |

### Working Status

| Status   | Stunting | No Stunting | Significance Value |
|----------|----------|-------------|--------------------|
| Permanent| 1710     | 45%         | 28                 | 0.7%   | 0.792 a |
| Seasonal | 1774     | 46.6%       | 31                 | 0.8%   |
| Part time| 258      | 6.8%        | 3                  | 0.1%   |

### Economic Status

| Status       | Stunting | No Stunting | Significance Value |
|--------------|----------|-------------|--------------------|
| Very poor    | 928      | 24.4%       | 11                 | 0.3%   | 0.149 a* |
| Poor         | 810      | 21.3%       | 10                 | 0.3%   |
| Currently    | 679      | 17.8%       | 15                 | 0.4%   |
| Rich         | 658      | 17.3%       | 9                  | 0.2%   |
| Very Rich    | 667      | 17.5%       | 17                 | 0.4%   |

### Breastfeeding History

| Status          | Stunting | No Stunting | Significance Value |
|-----------------|----------|-------------|--------------------|
| Breastfeeding   | 2489     | 65.4%       | 38                 | 1%     | 0.466a |
| Not breastfeeding| 1253    | 32.9%       | 24                 | 0.6%   |

* Using Chi-Square Test; ** Multiple Logistic Regression Candidate (p<0.20)

### Child Characteristics

| Age (Month) | Stunting | No Stunting | Significance Value |
|-------------|----------|-------------|--------------------|
| 15-19       | 313      | 5.6%        | 3                  | 0.1%   | 0.164 a* |
| 20-24       | 788      | 20.7%       | 9                  | 0.2%   |
| 25-29       | 858      | 22.6%       | 10                 | 0.3%   |
| 30-34       | 887      | 23.3%       | 17                 | 0.4%   |
| 35-39       | 615      | 16.2%       | 11                 | 0.3%   |
| 40-44       | 315      | 8.3%        | 11                 | 0.3%   |
| 45-49       | 66       | 1.7%        | 62                 | 0%     |

* Using Chi-Square Test; ** Multiple Logistic Regression Candidate (p<0.20)
Table 5. Stunting Determinant Logistic Regression Analysis Results

| Variable                        | B       | Significance Value | OR (95%CI)               |
|---------------------------------|---------|--------------------|--------------------------|
| **Mother Characteristics**      |         |                    |                          |
| Mother's Age                    |         |                    |                          |
| 15 - 19                         | 0.445   | 0.743              | 1.560 (0.116 – 22.177)   |
| 20 – 24                         | 0.325   | 0.786              | 1.385 (0.133 – 14.435)   |
| 25 – 29                         | 0.123   | 0.914              | 1.131 (0.122 – 10.460)   |
| 30 – 34                         | 0.508   | 0.640              | 1.661 (0.198 – 13.913)   |
| 35 – 39                         | 0.296   | 0.782              | 1.345 (0.166 – 10.925)   |
| 40 - 44                         | 0.913   | 0.389              | 2.493 (6.312 – 19.901)   |
| **Marital status**              |         |                    |                          |
| Never married                   | 1.691   | 0.021*             | 5.424 (1.289 - 22.814)   |
| Married/Living together         | 1.002   | 0.093              | 2.724 (0.846 – 8.769)    |
| **Economic Status**             |         |                    |                          |
| Very poor                       | 0.770   | 0.050              | 0.463 (0.214-1.001)      |
| Poor                            | 0.733   | 0.070              | 0.481 (0.217-1.062)      |
| Currently                       | 0.189   | 0.599              | 0.827 (0.409-1.675)      |
| Rich                            | 0.660   | 0.110              | 0.514 (0.227-1.114)      |
| **Child Characteristics**       |         |                    |                          |
| Age                             | 0.785   |                    |                          |
| 15 - 19                         | 0.445   | 0.743              | 1.560 (0.116 – 22.177)   |
| 20 - 24                         | 0.325   | 0.786              | 1.385 (0.133 – 14.435)   |
| 25 - 29                         | 0.123   | 0.914              | 1.131 (0.122 – 10.460)   |
| 30 - 34                         | 0.308   | 0.640              | 1.661 (0.198 – 13.913)   |
| 35 – 39                         | 0.296   | 0.782              | 1.345 (0.166 – 10.925)   |
| 40 - 44                         | 0.913   | 0.389              | 2.493 (6.312 – 19.901)   |
| Child Order                     |         |                    |                          |
| 1                               | -1.315  | 0.080              | 0.268 (0.102 – 0.708)    |
| 2-3                             | -0.773  | 0.031*             | 0.462 (0.228 – 0.933)    |
| 4-6                             | -0.472  | 0.168              | 0.642 (0.319 - 1.220)    |
| Constant                        | -4.475  | 0.000              |                          |

*Significant effect (p<0.05)

**DISCUSSION**

**Relationship of Mother's Age with Toddler Stunting Incidence**

The results of this study indicate an association between maternal age and the incidence of *stunting*. In line with studies conducted in the Democratic Republic of the Congo, it shows that maternal age >20 years will increase the risk of *stunting* (12). Research in Ghana also states that mothers aged 35-44 years tend to have children with stunted growth and maternal age is also a significant predictor of *stunting*. This result is also supported by a study conducted by (13) that maternal age is associated with *stunting*, which is 1.56 times higher in mothers aged <20 years and >30 years. Very young maternal age at delivery is associated with increased preterm birth, limited intrauterine growth, death and malnutrition. Young mothers have lower nutritional status which causes low birth weight, which makes them susceptible to *stunting* (14).

**Relationship of Marital Status with Stunting Incidence in Toddlers**

Marital status in this study is associated with the occurrence of *stunting*. The data show that mothers who have never been married have a higher risk of *stunting* than mothers who are married and live with their partners.

Different research conducted in sub-Saharan African countries found that mothers who had multiple marriages experienced a 5% increase compared to mothers who lived alone (15). Another study from the 2017 Indonesia Nutrition Status Monitoring Survey data in toddlers aged 0-5 months found that mothers with married marital status had a 0.8 times
greater risk of experiencing stunting and 0.77 times greater experiencing stunting (16).

Marital status is a factor related to the occurrence of stunting. Married mothers have a higher risk of stunting than single mothers (17). This is because the mother’s marital status can reflect the socioeconomic status in the household which is also related to the occurrence of stunting.

**Relationship between Economic Status and Incidence of Stunting**

Poverty is a limited ability to meet decent needs such as income, skills, health conditions, economy and limited access to information. The definition of poor is the inability to meet basic human needs (18). One of the demographic characteristics is socioeconomic status. This study shows that there is a relationship between economic status and the incidence of stunting. Research conducted in African countries conducted found that stunting children under five tend to experience higher stunting with very poor economic status (19). Another study on economic status with stunting was a conducted using epidemiological and socioeconomic data from 72 Demographic and Health Surveys. It was found that the difference between children from rich and very poor households during the first 5 months of life is an important moderator for stunting rates. in children (20). This is because poor households cannot meet the balanced consumption intake of children under five and their families.

**Connection Age of Children with Incidence of Toddler Stunting**

Stunting can be experienced by children under and over five years. The results of the study found that stunting and child age showed a significant relationship, the older the child, the greater the risk of stunting. The incidence of stunting in this study was experienced by children aged 30-34 months. These results are in line with research conducted in Nigeria which showed that children aged 0-23 and 0-59 months were the most consistent risk factors for stunting (21). This is because stunting occurs at a critical period during the first two years of life (22).

Children with anemia, low education and economic level of parents are among the risk factors for stunting in children aged 24-35 months (23); mothers who did not receive vitamin A supplementation after birth (24), family income, mother’s education and knowledge, exclusive breastfeeding, age of breastfeeding to weaning food (MP-ASI) age, zinc adequacy level, iron adequacy level, history of infectious diseases and genetic factors from parents (25) and a growth deficit that continues to worsen until the age of five are also contributing factors to stunting (22).

Other studies also say that children over 12 months of age significantly increase the likelihood of toddler stunting (26). It was also stated that children aged 24-59 months were 6.34 times more likely to experience stunting compared to children aged 6-23 and 0-6 months (27). This may also be caused by improper feeding during the weaning period when the baby is in transition from breastfeeding to weaning food (MP-ASI) period. Another study conducted in Tanzania with secondary data from Tanzania’s DHS (1991-2016) showed that children aged 24-35 months were 1.75 times at risk of experiencing stunting (28).

**Relationship between Child Sequence and Stunting Incidence**

From an economic point of view, the birth order of children has an impact on child mortality, child education, diabetes and asthma in children (29). In addition, research conducted in 2016 stated that birth order is a significant predictor of stunting. Third, fourth, and fifth or higher order children are more likely to be stunted (29).

However, there are differences in research results which say that the order of children is not related to the incidence of stunting (13). Research in Qazvin, Iran, found the same thing, that the child’s birth order had a significant effect on the presence of stunting in toddlers (30). This is because the effects of birth order reflect differences in the environment that are not shared in a family and the advantages of first-order children being better with later-born children such as better health and consumption and parental affection compared to later offspring (31).
CONCLUSIONS AND SUGGESTIONS

Conclusion

There is a relationship between maternal age, marital status, economic status, child age, and order of children with stunting in toddlers. However, there are only two factors that have been shown to significantly influence the incidence of stunting, namely marital status and child birth order. Toddlers who are cared for by parents who have never been married have a 5,424 times greater risk of stunting than toddlers who are cared for by parents who are married. Furthermore, toddlers who are the first to third children are at risk of not experiencing stunting than toddlers who are born in order of four or more.

Suggestion

Based on these conclusions, stunting is caused by factors not only from diet but also influenced by various factors indirectly. It is hoped that mothers of toddlers can detect stunting from the start and mothers and families should always monitor growth and development from infancy so that chronic nutritional problems can be overcome. It takes cooperation and support from relevant cross-sectors in community empowerment to improve parenting and efforts to increase knowledge and increase visits to posyanda.

Suggestions are for health practitioners to improve nutrition program counseling for mothers under five in dealing with stunting. To overcome these stunting-related factors, it is necessary for community-based education and nutrition interventions.

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