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Prevalence and Determinants of Childhood Stunting among Children Aged 6–59 Months in Pawie District, Northwest Ethiopia: A Community Based Study

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ABSTRACT

Introduction: Childhood stunting has remained as a major public health problem for decades in developing countries, including Ethiopia. This study was carried out to assess prevalence and determinant factors associated with stunting among children aged 6–59 months in Pawie district, Northwest Ethiopia.

Methods: Community based cross–sectional study was conducted from March to April/2019. Data was collected by an interviewer administered, pre–tested and structured questionnaire. A multi-stage sampling followed by a systematic sampling technique was used to include participants. Anthropometric body measurement of "Height/Length and Age" was assessed to determine child stunting. The measurements were analyzed by the WHO ANTHRO software. Stunting was defined as having of "Height–for–Age" Z–score (HAZ) lower than minus two standard deviations (HAZ <–2 SD) compared to the WHO reference population of the same age and sex group. Data was entered into Epi–Info–7 and exported to SPSS version 20 for further analysis. Variables with P–Values of < 0.2 in the bivariate analysis were transferred to the multivariate analysis. Both Crude Odds Ratio (COR) and Adjusted Odds Ratio (AOR) with a 95% Confidence Interval (CI) were computed to determine the level of significance. Finally, all factors at P–Values of < 0.05 in the multivariate regression analysis were declared as determinants of stunting.

Results: A total of 841 children aged 6–59 months were included in the study. All the interviews were carried out with mothers of study subjects. The overall prevalence of stunting was 37.2% [95% CI: 33.9-40.49. Child age [AOR= 2.0, 95% CI: 1.14, 3.47], colostrum feeding [AOR= 2.5, 95% CI: 1.31, 4.85], malaria infection [AOR= 1.9, 95% CI: 1.26, 2.86] and meal frequency [AOR= 1.9, 95% CI: 1.08, 3.18], maternal level of education [AOR= 5.2, 95% CI: 1.21, 22.10] and employment status [AOR= 4.9, 95% CI: 1.72, 14.39] were independently associated with stunting in the study area.

Conclusions: Childhood stunting was important public health problem in the study area. It was significantly associated with child age, colostrum feeding, malaria infection and meal frequency in the past 24 hours, maternal education and employment status. Improving maternal education, and age-appropriate child feeding and health care utilization practices are vital interventions to decrease burden of childhood chronic under nutrition in Northwest Ethiopia.

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List of Abbreviations

ANC: Ante Natal Care
AOR: Adjusted Odds Ratio
CI: Confidence Interval
COR: Crude Odds Ratio
EDHS: Ethiopian Demographic and Health Survey
ETB: Ethiopian Birr
FMOH: Federal Ministry of Health
HAZ: Height-for-Age Z score
IYCF: Infant and Young Child Feeding
PNC: Post Natal Care
SDS: Standard Deviations Score
SPSS: Statistical Package for Social Science
UNICEF: United Nations Children's Fund
WHO: World Health Organization

Introduction

Stunting (Height–for–Age) is linear growth retardation, which is a chronic form of under nutrition. It is showing having of a Z–score lower than two standard deviations (HAZ<-2 SDs) as compared to the reference population of the same age and sex. Child stunting can happen in the first 1000 days after conception, and reflects the cumulative effects of poor socioeconomic conditions, maternal

nutrition, unpleasant hygiene and sanitation, co–morbidity and poor dietary intakes [1-4].

Stunting in early child life is associated with a multiple long–lasting adverse consequences [5]. It has critical negative functional effects including poor physical and cognition development, greater behavioral problems and deficient social skills, low adult wages and productivity [6-8]. Stunted children are more likely to drop out and repeat grades in schools [9]. The low levels of education children attained, often makes them less qualified for work, and thus reducing income-earning potential for non-manual work [10]. In addition, stunting increases the risk to acquire excessive weight gain and nutrition related chronic diseases in the later life [11]. Finally, it destroys human capital, social progress and countries level of economic development in the long term, and contributing to the intergenerational cycle of poverty [12].

In recent decades, many developing countries have experienced rapid economic, demographic and nutritional transitions, resulting in changes in dietary habits, nutritional status and lifestyles [13, 14]. Despite changes child stunting still remains a pressing public health problem, affecting about 200 million children aged under five years in the region [15]. Similarly the problem is considerable in the continent of Africa, which is two in every five (about 60 million) children aged under 5 years are stunted [16]. Ethiopia is a country by having a high rate of child stunting in the continent. It continues a serious problem as nearly half (40 per cent) of children aged under five years are stunted in the country [17]. Surprisingly, it has a great variation from region to region, which is 42.1 %, 45.7 %, 46.1 %, 40.3 %, 22.9 % and 22.4 % in Amhara, Tigray, Afar, Benishangul–Gumuz, Addis Ababa and Gambella regions respectively [18].

The cause of stunting is a multidimensional in its nature [19]. It has a complex and interrelated ranging factor; such as socio–demographic characteristics of child and the family; co–morbidity and health care service utilization related factors of child and mother; environmental, hygiene and sanitation related factors; child feeding and dietary practice related characteristics; and socio-economic and family size related factors [20-47].

Since past decades, the government of Ethiopia has been implementing ranges of corrective measures to reduce the burden of child stunting [48]. However, stunting is still remains underlying cause of child morbidity and mortality in the country, suggesting the need to further monitoring of the problem. Knowledge on determinants of stunting among children aged 6–59 months has a crucial role in improving health and nutritional wellbeing of children. In addition, it has a significant role in monitoring trends, determining priorities, and evaluating the effectiveness of health and nutrition related interventions [18, 49]. With this background, the present study was aimed to reveal determinant factors of stunting among children aged 6–59 months in Pawie district, Northwest Ethiopia. Furthermore, results in the present study will provide important information for policy makers, and other stakeholders to design and implement appropriate interventions to overcome childhood stunting in Ethiopia.

Methods

Study Design, Period and Area

A community based cross-sectional design was conducted from March to April/2019. Pawie district is found in Benishangul-Gumuz Regional State, Northwest Ethiopia. It is among the seven districts in Metekel Zone, Benishangul-Gumuz Regional state. Pawie district has an estimated of 5, 244 square kilometers catchment. The district is located at 623 and 447 KMs away from the capital city of Ethiopia (Addis Ababa), and Metekel Zone (Assossa) respectively. According to the 2016 of Metekel Zone finance and economic development projection, a total of 51,895 population size is living in the district (of which 25,639 female and 26, 257 male). Administratively, Pawie district has a total of 20 (one urban and 19 rural) kebeles (the smallest administrative unit in Ethiopia). According to the 2019 bi-annual report of Pawie district Health Office, a total of 6,566 children aged 6–59 months are living in the area. Currently, the district has one general hospital, 4 public health centers and 20 health posts [50].

Sample Size Determination, Sampling Procedure and Study Population

The required number of study participants was estimated by using a single population proportion formula. The prevalence of stunting (P) was determined as 50.3% (21) and through consideration of the following critical assumptions. Such as, a 95% of confidence level and 5% margin of error (d). Finally, a sample size of 846 was calculated after adjusting 2 and 10% as a design effect and non-response rate respectively. First, kebeles found in the district were stratified as urban and rural kebele. Then, the urban kebele in the district was selected purposively and four rural representative kebeles were selected by using a lottery method. Finally, a total of five kebeles were selected for the study. A number of children aged 6–59 months living in the selected kebeles were determined from each kebeles health posts. It was used to calculate the sampling fraction (k). After a proportional allocation to each selected kebeles, a systematic sampling technique was employed to recruit study subjects. For those households with multiple children aged 6–59 months of age, only one was selected by using a lottery method. Finally, the source population for the present study was all those children aged 6–59 months and living in Pawie district, Northwest Ethiopia.

Data Collection Procedure and Tools

The required data for the study was collected through an interviewer administered pretested and structured questionnaire. The questionnaire was constructed in to three sections. For example, socio-demographic and economic characteristics, health care and environmental related factors, and feeding and dietary practice related characteristics. Initially, to maintain the consistency, the questionnaire was prepared in English version and translated to Amharic language (*language of the study area*), and then retranslated back to English by professional language translators. A total of 12 data collectors (two supervisors and ten as data collectors) were involved for the data collection of the study.

Meal frequency practice of participants was determined by using a 24–hour recall technique. Mothers/caretakers were asked to count the number of meals eaten by a child in the previous 24–hours of the interview. Meal frequency was categorized as; ≤ 2 Times and ≥ 3 Times [51]. Anthropometric measurements of "Height and Age" were used to determine child stunting. The measurement is a practical and applicable technique for assessing children's growth and development patterns in the first five years of life. It provides an indirect measurement of the quality of life of an entire population [52].

Two techniques were employed to assess participants Height/Length. Height for a total of 583 children was measured through using the seca vertical height scale standing upright in the middle of the board. A child's head, shoulders, buttocks, knees, and heels touch the vertical board. In other way, about 258 children's length was measured in a recumbent position to the nearest 0.1 cm

by using a board with an upright wooden base and a movable headpiece, on a flat surface.

Child age was determined on the information given by the mothers. Anthropometric measurements of "Height and Age" were transferred to the ANTHRO software. Children with a measurement of Height–for–Age Z score (HAZ <-2 SD) from the reference population was considered as "Stunted" [3]. Monthly income was assessed to measure the living standards of the family. The level of income was classified into three categories, such as; < 500.00, 500.00–100.00 and ≥ 1001.00 Ethiopian Birr (ETB).

Data Quality Management

Two days of training was given to employed data collectors and supervisors. The training was mainly focused about study objective, mechanism of interview, ways of data collection, and relevant ethical issues during data collection process. The questionnaire was pre–tested among a total 43 (5% of the sample size) sample size in out of the study area (*Genete Mariam Kebele*). During the pre–test, order and clarity of questionnaire, sensitiveness, ambiguity, and options for the questions and skipping pattern was evaluated accordingly. Furthermore, to ensure the consistency and data quality, the questionnaire prepared in English language and translated into the local language then back into English version. All the interviews were conducted with mother/responsible caretakers of a child. Moreover, all questionnaires were checked for completeness, clarity and consistency by the respective supervisors, in day to day of data collection period. The investigators were coordinated the overall activities of data collection. The principal investigator was coordinated the overall data collection process.

Data Processing and Analysis

The analysis was started by data entering, coding and cleaning. Data entry into the computer was carried out using the Epi info version 7. After completion of data entry, the data was exported to SPSS software version 20 for analysis. Frequencies and cross-tabulations were used to summarize descriptive statistics of the data. Bivariate logistic regression was employed to see the association of each variable with dependent variables. Finally, independent variables with p-values less than 0.2 in the bivariate logistic regression were entered to multivariate logistic regressions to control the effect of confounding. Furthermore, analysis and variables having P–values of less than 5% was considered as variables which has significant association with outcome variable.

Results

Socio–Demographic and Economic Characteristics of Participants

A total of 841 mother child pairs with a response rate of 99.4% participated in this study. About 53.3% study subjects were females. The mean age children were 32.76 months with SD +16.1 months. Near to thirty percent of (28.1%) children were found in the age range of 48–59 months. About 69.8% and 59.5% of child mother/caretakers were Amhara and Orthodox Christianity follower in their Ethnicity and religion respectively. More than ninety percent (93.1%) of child mother/caretakers were married. Regarding educational status, about 54.2% of mothers/caretakers were not read and write. Near to eighty five percent (84.7%) respondents were house wives in their employment status. In this study, the mean household income was 1,747.00 Ethiopian Birr (ETB) (Table–1).

Table-1: Socio-demographic and economic related characteristics of children and their parents in Pawie district, Northwest Ethiopia, March–April, 2019 (841).

Background characteristics	Frequencies	Percentage (%)
Child age (in months) (n=841)		
6-11	101	12.0
12–23	157	18.7
24–35	176	20.9
36–47	171	20.3
48–59	236	28.1
Sex of a child (n=841)		
Male	393	46.7
Female	448	53.3
Weight of a child at birth (K.G) (n=841)		
< 2.5 kg	74	8.8
2.5–4 kg	420	49.9
≥ 4 kg	23	2.7
Not known	324	38.5
Age of the mother (in years) (n=841)		
< 20	102	12.1
20–29	412	49.0
30–39	294	35.0
≥ 40	33	3.9
Residence (n=841)		
Rural	672	79.9
Urban	169	20.1
Ethnicity (n=841)		
Amhara	587	69.8
Agew	77	9.2
Kembata	76	9.0
Shinasha	10	1.2
Oromo	66	7.8
Tigray	11	1.3
Gumuz	10	1.2
Hadya	4	0.5
Religion (n=841)		
Orthodox	500	59.5
Muslim	260	30.9
Protestant	65	7.7
Catholic	16	1.9
Marital status (n=841)		
Married	783	93.1
Divorced	58	6.9
Maternal educational level (n=841)		
Not read and write	496	59.0
Primary (grade 1–8)	239	28.4
Secondary (grade 9–12)	60	7.1
College and above	46	5.5
Educational level of the father (n=841)		

Not read and write	334	39.7
Primary (grade 1–8)	322	38.3
Secondary (grade 9–12)	92	10.9
College and above	93	11.1
Maternal employment status (n=841)		
House wives	712	84.7
Governmentally employed	51	6.1
Merchant	28	3.3
Daily laborer	20	2.4
Others	30	3.6
Employment status of the father (n=841)		
Farmer	429	51.0
Governmental employed	140	16.6
Merchant	114	13.6
Self-employed	74	8.8
Daily laborer	17	2.0
Others	67	8.0
Household monthly income (in ETB) (n=841)		
< 500.00 ETB	65	7.7
500–1000 ETB	276	32.8
≥ 1001.00 ETB	500	59.5

Health Care Service and Environmental Related Characteristics

In this study, about 90.6% of study subjects were fully vaccinated during the interview. About 16.3% and 16.4% of children had malarial and diarrheal infection in the past two weeks of the survey respectively. More than sixty percent (67.1%) respondents had ≥ 4 times ANC visits during their child pregnancy. In addition, only 10.6% households had piped water for drinking. All most, all (98.3%) of households had a functional toilet during the study period (Table–2).

Table 2: Health care service and environmental related factors among children aged 6–59 months in Pawie district, Northwest Ethiopia, March–April, 2019 (n=841)

Background characteristics	Frequencies	Percentage (%)
Maternal ANC visits during child pregnancy		
Yes	782	93.0
No	59	7.0
Frequency of ANC visits (n=841)		
≤ 1 Visit	66	7.8
2–3 Visit	211	25.1
≥ 4 Visit	564	67.1
Maternal PNC service visits (n =841)		
Yes	128	15.2
No	713	84.8
Child place of delivery (n = 841)		
Health institution	605	71.9
Home	236	28.1
Immunization status a child (n = 841)		
Fully vaccinated	762	90.6
Currently on vaccination	76	9.0
Not vaccinated	3	0.4
Birth order of a child (n = 841)		
1st	270	32.1
2nd –3rd	388	46.1
4th –5th	151	18.0
≥ 6	32	3.8
Birth intervals (n = 841)		
No previous birth	277	33.0
< 24 Months	165	19.6
≥ 24 Months	399	47.4
Child diarrheal episode in the past 2 weeks (n = 841)		
Yes	138	16.4
No	703	83.6
Child malarial infection in the past 2 weeks (n = 841)		
Yes	137	16.3
No	704	83.7
Family source of drinking water (n = 841)		
Piped Water	89	10.6
Hand dug well	562	66.8
Protected well	150	17.8
Un protected well	40	4.8
Toilet availability (n=841)		
Yes	827	98.3
No	14	1.7

Feeding and Dietary Practice Related Characteristics of Children

About 99.5% of study subjects were ever breast feed during the survey. About 88.5% of children were breast feed in the first one hour of their birth. Near to sixty five percent (63.6%) of children was started complementary feeding at the age of six months. About 31.8% and 16.9% of children had continued breast feeding and history of early (< 6 months) initiation complementary feeding practice of during the study period respectively. There was bottle feeding practice among 28.5% of study community. Furthermore, more than ninety percent (94.5%) of children had ≥ 3 times of meal frequency in the past 24 hours of the interview (Table–3).

Table 3: Feeding and dietary practice related characteristics of children aged 6–59 months in Pawie district, Northwest Ethiopia, March–April, 2019 (n=841)

Background characteristics	Frequencies	Percentage (%)
Ever breast fed child (n=841)		
Yes	837	99.5
No	4	0.5
Time to initiation of breast feeding (n=837)		
≤ 1 hour of birth	742	88.65
Within first 24 hours	89	10.64
≥ 24 hours	6	0.71
Child colostrum feeding (n=841)		
Yes	789	93.8
No	52	6.2
Pre-lacteal feeding (n=841)		
Yes	21	2.5
No	820	97.5
Duration of breast feeding (n=837)		
< 6 Months	24	2.8
6–24 Months	547	65.4
≥ 24 Months	266	31.8
Complementary feeding initiation (n = 841)		
< 6 Months	142	16.9
6 Months	535	63.6
> 6 Months	164	19.5
Meal frequency in the past 24 hours of the interview (n = 841)		
≤ 2 Times	43	5.1
≥ 3 Times	798	94.9
Spoon for feeding (n = 841)		
No	384	45.7
Yes	457	54.3
Cup feeding practice (n = 841)		
No	422	50.2
Yes	419	49.8
Hand feeding practice (n = 841)		
No	104	12.4
Yes	737	87.6
Bottle feeding practice (n = 841)		
No	601	71.5
Yes	240	28.5

Prevalence of Stunting among Children Aged 6-59 Months

The overall prevalence of stunting was 37.2% [95% CI: (33.9–40.4)] in the study area. The problem was higher (41.5%) in the age range of 48–59 months (Figure–1).

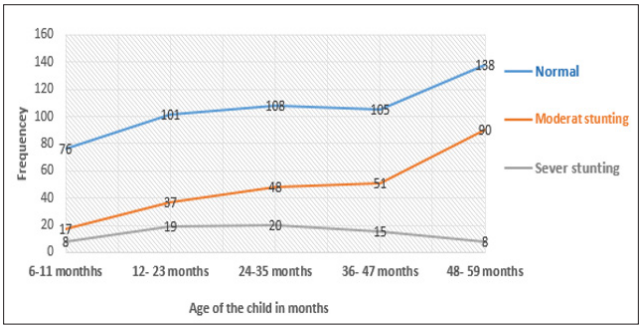

Figure 1: Prevalence of stunting among children aged 6–59 months in Pawie district, Northwest Ethiopia, March–April, 2019 (n=841)

Factor Associated with Stunting among Children Aged 6–59 months

In the bivariate regression analysis child age, place of delivery, pre-lacteal feeding, malaria infection in the past two weeks of the interview, colostrum feeding, meal frequency practice in the previous 24 hours of the interview, maternal level of education and employment status, and number of ANC visits were statistically associated with the outcome variable. But in the multivariate regression analysis; child age, colostrum feeding, malarial infection, meal frequency in the past 24 hours of the interview, maternal level of education and maternal occupational status were independently associated with stunting.

Hence, stunting was two times more likely among children aged 48–59 months than those 6–11 months of age [AOR =2.0 (95% CI: 1.14, 3.47)]. Likewise, the likelihoods of stunting were more than two times higher among children without history of colostrum feeding [AOR= 2.5 (95% CI: 1.31, 4.85)]. The odds of stunting increased among those children who had ≤ 2 times of meal frequency during the interview [AOR= 1.9 (95% CI: 1.08, 3.18)]. In addition, child malarial infection in the past two weeks of the survey was significantly associated with stunting [AOR= 1.90 (95% CI: 1.26, 2.86)]. Maternal level of education was another possible risk factor of child stunting in the study area. Therefore, the odds of child stunting were extremely higher among those mothers who had not read and write during the interview [AOR = 5.16 (95% CI: 1.21, 22.10)]. Furthermore, maternal employment status was statistically associated with stunting. Then, the likelihoods of child stunting were more likely among those daily laborer mothers [AOR= 4.98 (95% CI: 1.72, 14.39)] (Table–4).

Table 4: Factors associated with stunting among children aged 6–59 months in Pawie district, Northwest Ethiopia, March–April, 2019 (n=841)

Back ground characteristics	Stunting		COR (95% CI)	COR (95% CI)
Child age (in months)	Yes (#)	No (#)		
6–11	25	76	1.00	1.00
12–23	56	101	1.69 (0.97, 2.94)	1.55 (0.86, 2.78)
24–35	68	108	1.91 (1.11, 3.23)	1.79 (0.99, 3.18)
36–47	66	105	1.91 (1.11, 3.30)	1.69 (0.94, 3.03)
48–59	98	138	2.16 (1.28, 3.63)	1.97 (1.13, 3.44)
Maternal educational status				
Not read and write	213	283	2.71 (1.32, 5.58)	5.01 (1.17, 21.43)
Primary (Grade 1–8)	72	167	1.55 (0.73, 3.30)	2.98 (0.69, 12.80)
Secondary (Grade 9–12)	18	42	1.54 (0.63, 3.77)	3.13 (0.72, 13.51)
College and above	10	36	1.00	1.00
Maternal employment status				
House wife	267	445	1.00	1.00
Governmental employed	14	37	0.63 (0.34, 1.19)	2.35 (0.62, 8.97)
Merchant	6	22	0.46 (0.18, 1.14)	0.66 (0.24, 1.81)
Daily labourer	12	8	2.50 (1.01, 6.20)	5.24 (1.83,14.95)
Others	14	16	1.46 (0.70, 3.04)	1.95 (0.87,4.39)
Frequency of ANC visits				
≤ 1 Visit	34	32	1.89 (1.13, 3.15)	1.74 (0.97, 3.11)
2–3 Visits	76	135	1.00 (0.72, 1.39)	0.94 (0.65, 1.36)
≥ 4 Visits	203	361	1.00	1.00
Place of delivery				
Health facility	210	395	1.00	1.00
Home	103	133	1.46 (1.07, 1.98)	0.85 (0.59, 1.23)
Malaria infection				
Yes	74	63	2.29 (1.58, 3.31)	1.94 (1.30, 2.92)
No	239	465	1.00	1.00
Child colostrum feeding				
Yes	279	510	1.00	1.00
No	34	18	3.45 (1.92, 6.23)	2.46 (1.28, 4.73)
Pre-lacteal feeding				
Yes	13	8	2.82 (1.15, 6.87)	0.42 (0.16, 1.14)
No	300	520	1.00	1.00
Meal frequency/day				
≤ 2 Times	43	29	2.74 (1.67, 4.49)	1.87 (1.09, 3.21)
≥ 3 Times	270	499	1.00	1.00

Note: *Significant association in the multivariate analysis. COR; Crude Odds Ratio. AOR: Adjusted Odds Ratio

Discussion

The overall prevalence of stunting was 37.2 % [95% CI: (33.9–40.4)] in the study area. The result was consistent with local findings in Ethiopia [34.4–40.4%] and another study from Tanzania [35.5%] [20, 30, 47, 53]. The possible explanation could be due similarity in studies area through sample size determination, study design, socio-cultural resemblance and child feeding practices. However, the present report was slightly higher than studies from Egypt [18.7%], China [27%], Ghana [28%], Nigeria [28.1%] and Indonesia [29%] [25, 27, 29, 54, 55]. The possible reason might be due to differences in studies setting, where about 79.9% of participants in the current study were from rural area.

This is fact that childhood stunting is more likely in rural areas than urban, which is explaining that low maternal education, low living standards, poor water supply, high incidence of infectious disease and taboos about child feeding practices in rural [56].

Conversely, studies reported that stunting is higher among children's of urban resident than rural [57, 58]. On the other hand, other findings also showed that no a significant association between child stunting with urban or rural location [59, 60].

This study noted that child age, malaria infection, colostrum feeding, meal frequency, maternal education and maternal employment were significantly associated with stunting among study community. Consequently, the odds of stunting were more likely among children fund at the age of 48–59 months. The result was consistent to studies from Ethiopia and elsewhere [18, 25, 26, 46, 61, 62]. This may be due to children in this age group may have high nutritional demand than their younger children. The other reason could be most children were stop breast feeding before thirty-six months of age and they feed family foods. So, until they adapt with this food, they are more vulnerable for stunting. In addition, most of the time child stunting develop during the weaning period and rise after the first ages of 2–3 years. This is moreover supported that, age is a considerable factor in assessing child stunting, where the risks of stunting increases as the age of child increases [63].

Child malaria infection in the previous two weeks of the survey was independently associated with stunting. The likelihoods of stunting were near to two times more likely among those children with history of malaria infection. It was in congruent with other reports in Kenya, Niger, Zambia and Beninese [33, 64-66]. It could be due to the immunological impact of malaria infection, which may simultaneously increase the risk of child stunting. Likewise, the present study was carried out in one of malaria endemic areas in Ethiopia. This might result children for frequent malaria infection attacks, and cause high distraction of red blood cells, which leads to develop anemia. This could inversely increase the likelihoods of stunting among participants. It is fact that low hemoglobin level has a compromising effect on the linear growth of children [67]. However, different studies have a paradoxical result about the effects of malaria infection on child stunting. For example, some studies have been reported that no any significant association between malaria infection with any forms of under nutrition [68-70]. Conversely, other findings have been suggested that child stunting has a protective effect against malaria infection [71, 72]. Heterogeneity across reports may be possibly due to variances in epidemiology of malaria infection. In addition, it may be due to differences in malaria transmission intensity, growth metrics, small sample sizes and probably confounding by other interrelated factors.

Colostrum feeding was another possible determinant of stunting among participants. The odds of stunting were more likely among children who didn't feed colostrum during birth. Our current finding was comparable with available reports in Ethiopia and elsewhere [32, 73-76]. The possible reason could be probably due to the protective effects of colostrum against intestinal infectious diseases, which may reduce infection related risks of child stunting. It is fact that colostrum is a yellowish liquid that contains proteins, vitamin A and maternal antibodies [26, 77]. Colostrum feeding has strong protective effects for infectious diseases, stunting and other forms of under nutrition [63].

Meal frequency practice was another child related characteristics, significantly associated with stunting. As a result, stunting was more likely among those children who had ≤ 2 times of meal frequency in the past 24 hours of the interview. Our finding was in line with a similar study done in Indonesia [24]. The previous studies reported that, age-inappropriate meal frequency practice of children significantly increase the risk of stunting. This is fact that, meal frequency is a proxy measure for the energy requirement of a child [78]. It examines a practice of age appropriate meal frequency (by considering specific age) in the past 24 hours [51]. Low meal frequency practice of a child has a devastating negative consequence for growth and development, and nutritional status [79].

Maternal characteristics were independently associated with stunting in the study area. Likewise, stunting was more likely among children who had not read and write mothers. The present result was matched with available studies in Ethiopia and elsewhere [18, 20, 29, 36, 63, 80]. It could be due to that non–educated mothers' having of low level of knowledge, and less to be able to obtain specific information about child feeding practices and the consequences on child growth and development. In other way, non–educated mothers may have more difficult situation to afford nutritious foods for their family, which could indirectly increase the likelihoods of stunting. It is fact that, non–educated mothers are more likely to have stunted children [19, 81]. In addition, maternal education is a proxy indicator to measure the living status of the family. This argues that non–educated mothers tend to have low income level than educated [82]. Furthermore, maternal education is a vital intervention in improving child health and nutritional status, and economic advancement of a nation [83].

The likelihoods of stunting were more likely among children of daily laborer mothers. The result was consistent with findings done in Ethiopia and somewhere else [23, 84]. The possible reason could be, daily laborer mothers may not have adequate time to implement appropriate child feeding and good health practices.

In addition, these mothers may expend more energy (due to nature of the work) during their working time and tried to implement recommended feeding practices. Furthermore, daily laborer mothers may find at low-income status, which could limit the family in having of adequate access for nutritious foods. This may adversely affect the health and nutritional conditions of the family, particularly the young children. It is fact that mothers' time allocation to child care and feeding is among strong determinant factors of child health and nutrition [85]. As well, the more mothers' time allocation to child care and feeding has a significant role to improve health and nutritional wellbeing [86].

Some limitations have to note in our study. There may be a potential of recall bias among respondents when answering questions related to some events happening in the past. However, the study showed important trends that can be used in the formulation of other studies and interventions to decrease burden of child stunting in the study area.

Conclusions

The magnitude of stunting is a public health problem in Pawie district, Northwest Ethiopia. It was statistically associated child age, colostrum feeding, malaria infection in the past two weeks of the interview, meal frequency in the previous 24 hours of the interview, and maternal level of education and occupational status.

Declarations

Ethical Considerations

The ethical clearance for the present study was obtained from the institutional review board of Institute of Public Health, College of Medicine and Health Sciences, the University of Gondar. The ethical clearance was submitted to Pawie District Health Office. An official permission letter for the next steps was obtained from the Office. The written permission letter from the district health office was submitted to each kebeles administration office, which is the actual data collection was carried out. All mothers of children were informed about the objective of the study. Then after the objective of the study was explained, informed verbal consent

from every mothers/caretakers of children was obtained. The right to participant or withdraw from the study at any time, without any requirement was disclosed clearly. Furthermore, the confidentiality of the information obtained from participants was guaranteed by all data collectors and investigators by using code numbers and keeping the questionnaires locked.

Authors Contributions: SM; Designed the study and carried out statistical analysis. WZ; MB; CY: Reviewed and approved the proposal with some corrections. SM; MB; CY; HD; prepared the manuscript. All authors read and approved the manuscript for publication.

Consent for publication: Not applicable.

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