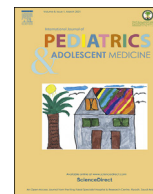


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Original article

Relationship between breastfeeding duration and undernutrition conditions among children aged 0–3 Years in Pakistan



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ABSTRACT

Background: The World Health Organization recommends that a child should be breastfed up to 2 years of age as it is essential for proper growth and development but population-based studies around the world have found conflicting results on the subject. Our study aims to analyze whether there is a relationship between the duration of breastfeeding and undernutrition among children aged from birth up to 3 years of age in Pakistan.

Methods: A secondary analysis of the Pakistan Demographic and Health Survey 2013–2014 with 1072 children aged 3 years and under was conducted. The relationship between breastfeeding duration and undernutrition status was estimated through multiple logistic regression analysis.

Results: The prevalence of stunting, wasting and underweight were 40.6%, 15.8% and 33.9% respectively, while prevalence of severe stunting is at 22.5%; severe wasting at 4.5% and severe underweight at 12.2% in children in our study. Odds of being stunted were significantly higher for children in their 3rd year of life [AOR: 4.35, CI 95% = (2.01, 9.33)] compared to children being breastfed in their 2nd year of life [AOR: 2.43, CI 95% = (1.55, 3.79)] after being adjusted for maternal, child, demographic and healthcare access variables. Similarly, children being breastfed in their third year of life were more susceptible to developing severe stunting [AOR: 6.19, CI 95% = (3.31, 11.56)] in comparison to children in their second year [AOR: 2.84, CI 95% = (1.81, 4.46)]. There was no significant association between breastfeeding and wasting/severe wasting, or between breastfeeding and underweight/severe underweight.

Conclusion: Breastfeeding in the 2nd and 3rd year of life was found to have significant relationship with stunting and severe stunting. Mothers need to be educated about the risks of prolonged breastfeeding to reduce the burden of undernutrition in the country.

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1. Introduction

Undernutrition conditions like stunting, wasting and underweight children are some of the most important public health issues in less economically developed regions like Southeast Asia and

Sub-Saharan Africa [1]. About 45% deaths around the world in under 5 children can be attributed to undernutrition [2,3]. Stunting is a relative height to age deficit and is responsible for delayed development, impaired cognitive function and increased susceptibility to infectious diseases in children. Wasting is severely low weight for height and can lead to debilitating diseases like protein energy malnutrition and is also a strong indicator of mortality [4]. Wasting is acute whereas stunting is chronic undernutrition condition. Globally, 149 million children have been reported to be stunted and another 49.5 million are wasted [5]. Thirty-nine percent of all stunted children in the world reside in less economically developed regions of South Asia including Pakistan,

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India and Bangladesh, which translates to 58 million stunted children in the Indian subcontinent alone [5,6]. The 2012–2013 demographic and health survey of Pakistan describes stunting rate at 45%, wasting at 15% and underweight children at 31.5% of under 5 children in the country [7]. These rates are alarming and they prove that Pakistan is showing no progress and is off track in achieving its Global Nutrition Targets [8].

The period from birth to second year of life is crucial for optimal growth and development [9,10]. Deprivation of proper nutrition during this time may lead to stunting which is why it is the key period for implementing any intervention strategy for control of undernutrition [1,11]. The World Health Organization (WHO) recommends that breastfeeding should be continued up to 2 years as it aids growth and development by improving both height and weight, protects against many infectious diseases and also increases chances of survival for the child [12–14]. Population based studies around the world have found conflicting results on the subject. Many researchers in developing countries have found little to no association between breastfeeding and undernutrition [15,16], whereas some studies even found that breastfeeding depresses growth if continued after the first year of life [17,18]. Possible explanations for these contradictory results can be effect modification or uncontrolled confounding, but some researchers argue that this is because of reverse causality, meaning that it is not breastfeeding that depresses growth but rather the depressed growth of the child which encourages the mother's decision to continue breastfeeding for longer than usual [19–21].

The literature is full of studies on undernutrition and its relation to breastfeeding but no research study has ever focused specifically on the duration of breastfeeding and undernutrition in Pakistan. This highlights the importance of a country-wide, population-based study on the subject which can further improve our understanding of the relationship between breastfeeding and the various forms of undernutrition. The study aims to examine the relationship between duration of breastfeeding and undernutrition in the light of Pakistan demographic and health survey. This will help policymakers and public health researchers in designing and implementing appropriate intervention programs which are specifically tailored to accommodate the needs and requirements of the country.

2. Methods

2.1. Data source

This study obtained data from the Pakistan Demographic and Health Survey 2013–14 [7]. It uses a two-staged, stratified, cluster sampling method. The sample is representative of the 4 provinces of the country as well as Gilgit Baltistan but excludes FATA, Kashmir and other restricted areas. A sample size of 14000 households was established containing 6944 urban households and 7056 rural households.

Assessment was carried out through four model questionnaires from measure DHS program which were modified to reflect relevant issues in the country. Sociodemographic information of the respondents required for this study as well as children eligible for anthropometric measurement were determined through the household survey. Complete anthropometric data was available from 3466 children, measured using SECA scales specially designed by UNICEF. Children under 2 years were measured by recumbent length whereas standing length was taken for older children. Information from ever married (15–49 years) was collected through women's questionnaire which was used in this study to obtain data regarding their literacy, antenatal and postnatal history, reproductive history, breastfeeding and weaning history as well as

childhood illness and vaccination history [7].

2.2. Dependent variables

Three indicators were examined to categorize children's nutrition: (i) Underweight (ii) Wasting and (iii) Stunting as the essential outcomes. Outcome variables were categorized as Class 0 [No stunting/severe stunting, no wasting/severe wasting, no underweight/sever underweight, ($>-2SD$) ($>-3SD$) above cut off values].

Class 1 [Stunting/severe stunting, wasting/severe wasting, underweight/severe underweight ($<-2SD$) ($<-3SD$) below cut off values].

2.3. Independent variable

Independent variable is breastfeeding duration, characterized as: "breastfeeding duration (both exclusive breastfeeding and supplementary feeding) among children born 3 years prior to the survey". Breastfeeding duration was classified into 1st year, 2nd year and 3rd year of life.

2.4. Other variables

Potential variables and individual factors were also investigated such as specific characteristics of every child and parent. We examined education and occupation of the parents, age and gender of child, mother's age and her status of marriage, nature and place of delivery and access to health facilities.

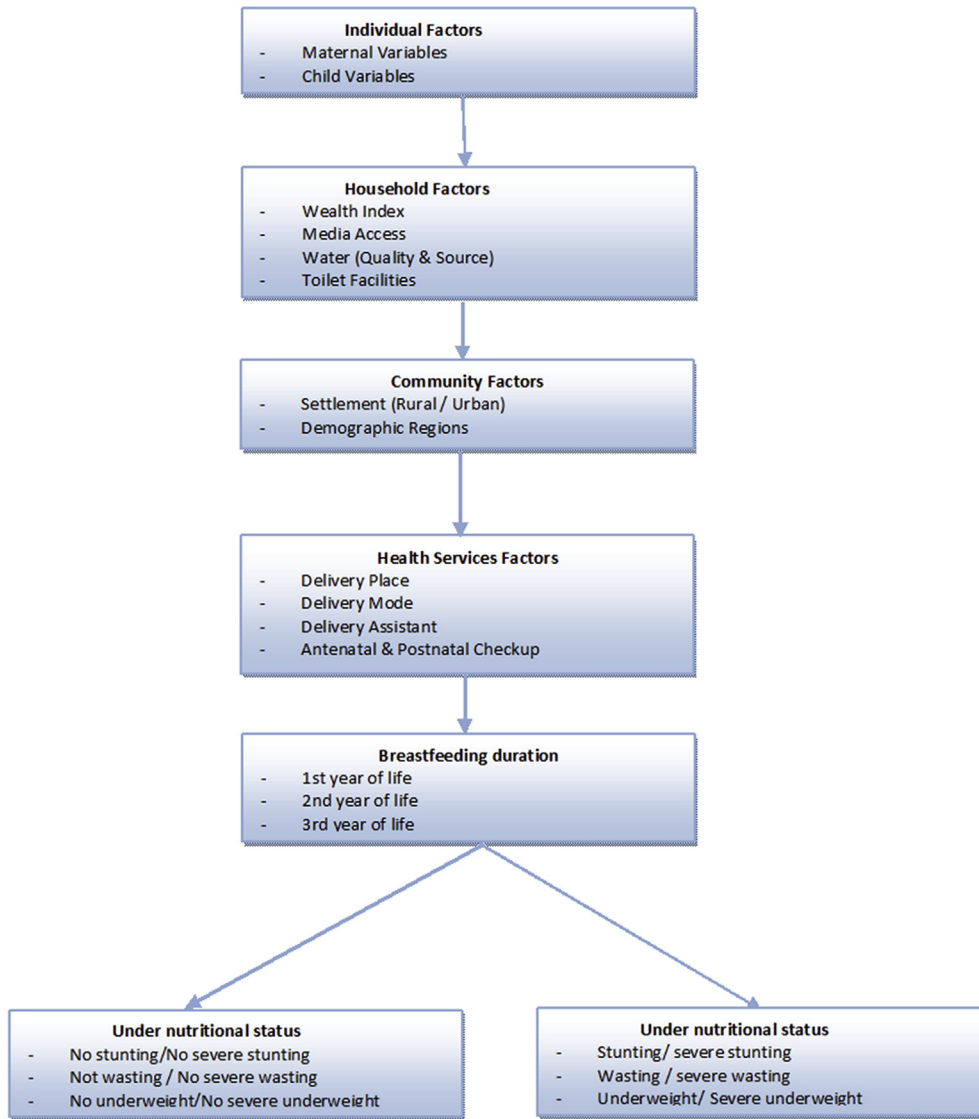
Household wealth index was developed by assessing variables such as source of drinking water and possession of land or automobile. Household wealth was estimated by principal components analysis [22] which was used to classify households into five quintiles (richest, rich, middle, poor, poorest). Settlement area (either urban or rural) and geopolitical region were also included in analysis.

2.5. Statistical analysis

The analysis was performed using Stata version 14.1 survey commands [23] and was adjusted to control for sampling design, weights and standard error. In the first stages, frequency counts and percentages were assessed for designated variables, after which undernutrition status was calculated i.e. stunting wasting and underweight prevalence in children (0–3 years). Ninety-five percent confidence intervals were projected using Taylor series linearization method.

Logistic regression analysis, adjusted for design and weights, was used to examine any relationship between duration of breastfeeding and undernutrition in children less than three years. First, univariate logistic regression analysis was carried out to investigate unadjusted odds ratio followed by multinomial logistic regression analyses using a five-step model as explained in Fig. 1.

Initially, multiple logistic regression was performed on individual characteristic variables to assess their relationship with outcome variables. Subsequently, a stepwise manual backward deletion analysis was performed and only variables with p value of less than 0.05 were kept. Afterwards, household variables were incorporated into these significant variables followed by healthcare and community level factors. Finally, the independent variable – breastfeeding duration, was added into the analyses and only variables of significance were retained. Association between duration of breastfeeding and undernutrition status in children 0–3 years was calculated using odds ratios (OR) and confidence intervals (CI) obtained through the multiple regression model.



5-step Logistic Regression Model

Figure 1. 5-step logistic regression model.

3. Results

3.1. Characteristics of the sample

Demographic characteristics are summarized in Table 1.

Regarding paternal characteristics, fifty percent of fathers had secondary or higher qualification while 85% had non-farming occupations. Nearly all women (99.2%) were presently married, 3/4th were unemployed and more than half were illiterate. More than 80% of women had a BMI in or above normal range. Seventy-four percent of children were apparently of normal size when born. Most children had no fever or diarrhoea 24 h preceding the survey.

3.2. Prevalence of undernutrition

Our study revealed that severely stunted and severely wasted forms of undernutrition were not as prevalent as stunting and wasting (Fig. 2).

Forty percent children were stunted, around 16% were wasted and almost 34% were underweight. Twenty-four percent, 4% and 14% had severe forms of stunting, wasting and underweight respectively. Fig. 2 shows statistical differences between stunting, wasting, underweight and their severe forms.

3.3. Relationship between breastfeeding duration and undernutrition

Breastfeeding duration had significant association with stunting [AOR: 2.43, CI 95% = (1.55, 3.79) for children in their 2nd year of life and AOR: 4.35, CI 95% = (2.01, 9.33) for children in their 3rd year] (Fig. 3).

Children breastfeeding in their third year of life had higher odds of developing severe stunting [AOR: 6.19, CI 95% = (3.31, 11.56)] in comparison to children in their second year [AOR: 2.84, CI 95% = (1.81, 4.46)] (Fig. 4).

Our study did not find any association between duration of

Table 1
Characteristics of children aged 0–3 years in Pakistan, 2013–14 (n = 1072).

Characteristic	N	%
Maternal variables		
Employment		
Unemployed	829	77.4
Employed (past year)	243	22.6
Qualification		
None	584	54.5
Basic (grade 5)	194	18.1
Secondary or higher	295	27.5
Literacy		
Illiterate	587	54.8
Literate	485	45.2
Husband's job		
Non farming	916	85.4
Farming	156	14.6
Husband's qualification		
None	338	31.5
Basic (grade 5)	195	18.2
Secondary or higher	538	50.3
Maternal age		
16–25 years	342	31.9
26–35 years	550	51.3
36–50 years	180	16.8
Marriage status		
Presently married	1063	99.2
Previously married	9	0.8
BMI, kg/m²		
Less or equal to 18.5	198	18.5
Greater than 18.5	873	81.5
Birth number		
1st	209	19.5
2 to 4	567	52.8
5 or above	296	27.6
Birth spacing		
No prior birth	209	19.6
<2 years	301	28.1
>2 years	559	52.3
Child variables		
Gender		
Boy	544	50.8
Girl	528	49.2
Perceived birth size		
Small	216	20.2
Regular	792	73.9
Large	64	5.9
Recent diarrhoea history		
Negative	749	69.8
Positive	323	30.2
Fever history (2 weeks)		
Negative	616	57.4
Positive	456	42.6
Household factors		
Wealth index		
Poorest/poor	456	42.6
Middle	449	41.8
Richest/rich	167	15.6
Mother's weekly TV use		
Positive	711	66.4
Negative	361	33.6
Mother's weekly radio use		
Positive	199	18.6
Negative	873	81.4
Mother's newspaper reading		
Positive	254	23.7
Negative	818	76.3
Water source		
Not protected	614	57.3
Protected	458	42.8
Toilet facilities		
Uncovered	467	43.6
Covered	605	56.4
Community variables		
Settlement		
Urban	316	29.5
Rural	756	70.5

Table 1 (continued)

Characteristic	N	%
Demographic region		
Punjab	660	61.6
Sindh	275	25.6
KPK	117	10.9
Balochistan	20	1.9
Health services factors		
Delivery site		
House	506	47.2
Healthcare facility	566	52.8
Delivery mode		
Normal delivery	907	84.6
C-Section	165	15.4
Delivery assistance		
Healthcare professional	575	55.5
Dai (TBA)	454	43.8
Unskilled person	8	0.8
Number of antenatal check ups		
None	232	21.6
1 to 3	425	39.6
4 or more	416	38.8
Postnatal visit history		
Positive	664	61.9
Negative	408	38.1

breastfeeding and wasting/severe wasting, neither could we establish any relationship between breastfeeding duration and underweight/severe underweight. Only severe stunting and stunting had significant association with duration of breastfeeding. They also had significant association with perceived birth size of baby, maternal education and frequency of antenatal check-ups the mother had during pregnancy. Children who were perceived as large at the time of birth were less susceptible to stunting in later life than their counterparts [AOR: 0.20, CI 95% = (0.07, 0.51)]. Children perceived as having average size at birth were also less prone to develop severe stunting in comparison to children perceived as small at birth [AOR: 0.54, CI 95% = (0.32, 0.90)]. Mothers with secondary or higher qualification had decreased odds of having stunted children as opposed to uneducated mothers [AOR: 0.43, CI 95% = (0.25, 0.77)]. On other hand, stunting was also uncommon in children whose mothers had ≥ 4 antenatal check-ups during pregnancy, [AOR: 0.44, CI 95% = (0.23, 0.85)] or severe stunting [AOR: 0.45, CI 95% = (0.27, 0.81)] in comparison to mothers who had no antenatal checkups.

4. Discussion

Our study observed the relationship between breastfeeding duration and undernutrition status among children up to 3 years of age in Pakistan. In addition, we also observed other sociodemographic factors with any known association to undernutrition. This study confirms that breastfeeding duration has a significant association with stunting and severe stunting but does not seem to have any significant relationship with wasting and severe wasting and undernutrition/severe undernutrition. Comparable study in Botswana also had a similar conclusion [24]. Perceived birth size of child, maternal education and antenatal checkup history were also found to have significant association with stunting and severe stunting.

Other research studies have also established that breastfeeding, if continued for more than 18 months, leads to an increased susceptibility to malnutrition [25,26] further supporting our conclusion that breastfeeding duration has a positive association with stunting, and also that this association increases with age i.e. the longer a child is breastfed, the more susceptible it is to stunting. Children aged 2–3 years were more likely to stunted as well as

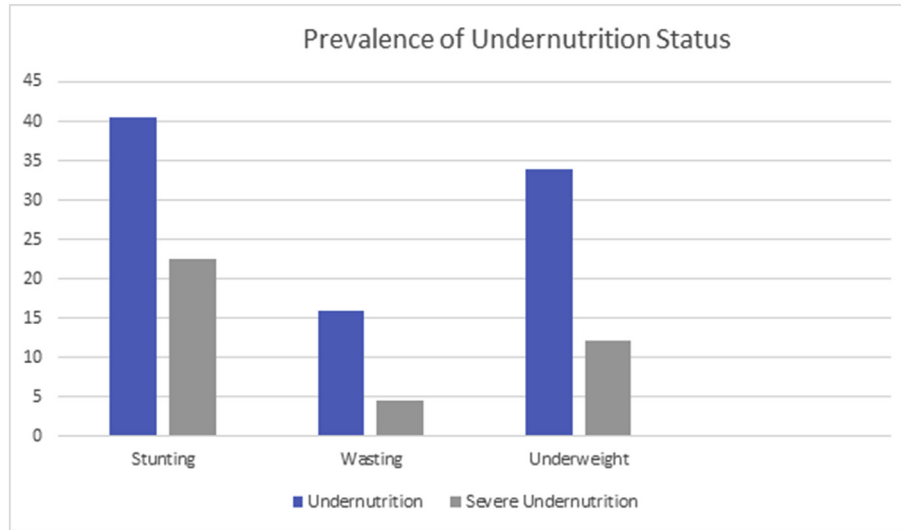


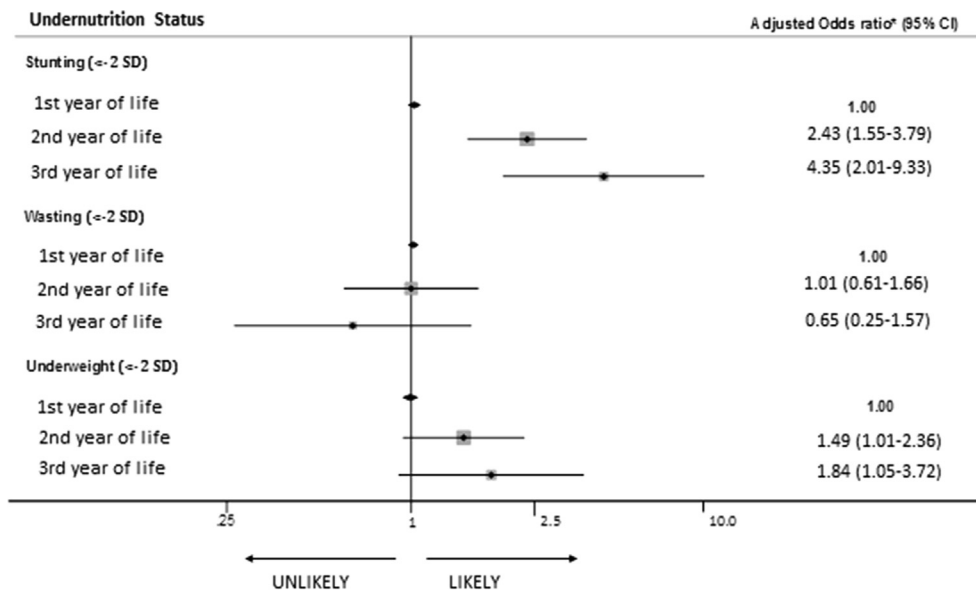
Fig. 2. Prevalence of undernutrition status.

severely stunted with increased duration of breastfeeding in comparison to breastfeeding during infancy [18]. These findings are also in line with another study which proves that children being breastfed in older ages were shorter than their counterparts who were weaned off early [20].

The correlation between duration of breastfeeding and stunting may be because of delay in the introduction of supplementary foods to the baby's diet either due to unawareness on the mother's part, or due to lack of resources in the household to provide complementary foods for the baby. This could also be because introduction of supplementary foods into the child's diet was delayed and as a consequence, the child could never develop a healthy appetite towards complementary feeding. This makes the child over dependent on breast milk and may also bring about chewing

difficulties both of which may lead to a weak immune system and impaired growth and development [17, 27]. Contrary to the above evidence, a few studies have also found prolonged breastfeeding to be protective against various forms of undernutrition [28,29] while another found no association between breastfeeding and any form of undernutrition [30].

A study in Senegal revealed that prolonged breastfeeding enhanced linear growth however it had no observed effect on being underweight in children [31]. In contrast, our study observed that children aged two or three years, who were subjected to longer durations of breastfeeding had decreased linear height and better weight for age scores. Furthermore, our study establishes that the correlation between stunting and breastfeeding duration originates from the fact that children being breastfed longer had initial low



Impact of breastfeeding duration on Stunting, Wasting and Underweight in children aged 0-3 years in Pakistan (Exposure variables adjusted for Individual, Community, Household and Healthcare services factors).

Fig. 3. Impact of breastfeeding duration on Stunting, Wasting and Underweight in children aged 0–3 years in Pakistan (Exposure variables adjusted for individual, Community, Household and Healthcare services factors).

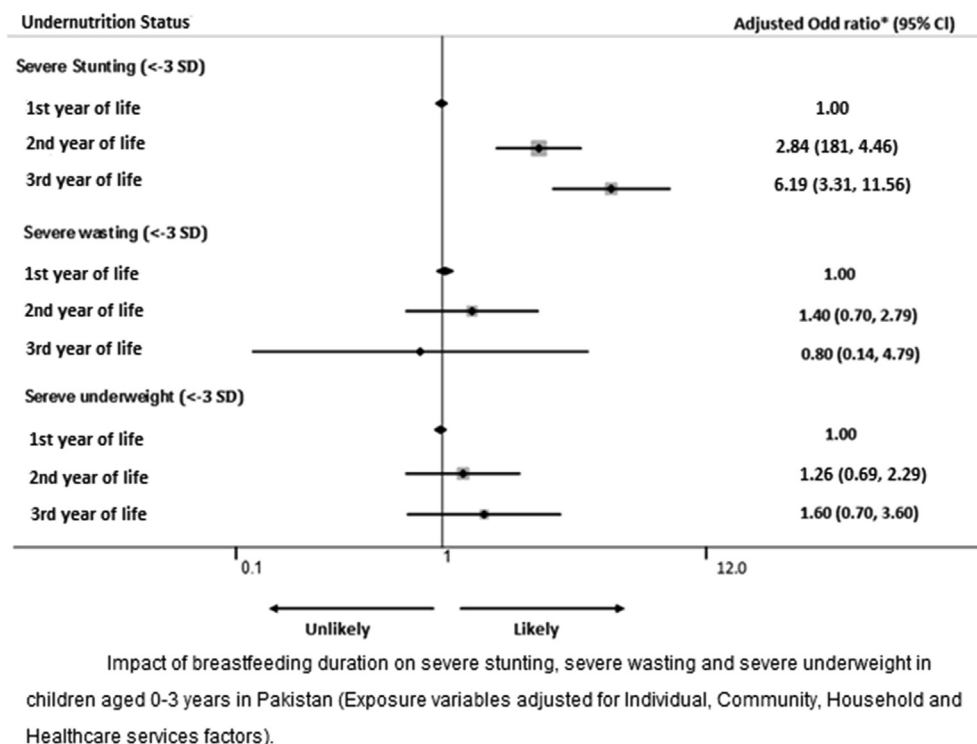


Fig. 4. Impact of breastfeeding duration on severe stunting, severe wasting and severe underweight in children aged 0–3 years in Pakistan (Exposure variables adjusted for individual, Community, Household and Healthcare services factors).

stunting score which concludes that children did not develop stunting because they were breastfed longer, rather it was the child's sub optimal growth which forced the mother to continue breastfeeding for longer than usual. Our study did not find any relationship between breastfeeding duration and wasting/severe wasting. This is understandable as wasting is an acute malnutrition condition and manifests only when there is absolute shortage of food. Children breastfeeding during their 3rd year of life had lower odds of developing wasting and severe wasting but the association was insignificant. The lack of association between underweight/severe underweight can be explained by fact that milk, although has high nutritive value but has low caloric value, and is not a suitable as a standalone meal after a certain age. It can also be due to the fact that weight change in 0–3 year children is greatly influenced by illness and other behaviour and environmental factors not explored by this study.

Our study further concludes that undernutrition status has significant association with perceived birth size, mother's qualification and regularity of antenatal visits at the time of pregnancy. Other studies have also found that mothers with secondary or higher qualification had lower odds of having stunted children as opposed to uneducated or minimally educated mothers [32,33]. This might be explained by the fact that uneducated mothers do not have awareness about proper childhood nutrition and are also more likely to believe in myths surrounding complementary feeding [34] which can be unsafe for the health of their children. They also may not have resources to provide sufficient quantity and quality of supplementary food because of ignorance or poverty. Our study also found a significant relationship between perceived birth size of baby and stunting. Children perceived as "large" at the time of their birth were less likely to develop undernutrition conditions later in life in comparison to children perceived as "small" at birth. This is in agreement with other studies conducted in Pakistan [35],

Cambodia and Kenya [36] which also conclude that birth size is a valid predictor of successive growth in children. Mothers perception of birth size is prone to bias as small size at birth is a sign of nutrition deprivation in the period of pregnancy which, if continued, will ultimately lead to stunting in children.

Our study results also found that there is a significant role of proper antenatal care in warranting healthy growth of the child. Children whose mothers frequented antenatal clinics during pregnancy had decreased likelihood of being stunted and severely stunted later in life. This finding backed by studies in Ethiopia [37], Nigeria [38] and also a systemic review of 69 less economically developed countries [39]. This is probably because women who visit antenatal clinics gain valuable health education regarding proper child nutrition from medical professionals which equips them to make healthy food choices for their children. Furthermore, women who do not seek antenatal care may generally have bad health seeking behavior or they might not be cared for by their families enough to seek antenatal care for herself.

Strengths of our study include; 1) Data analyzed in the study was drawn from nationally representative Pakistan demographic and Health survey 2012–13, which has large sample size, moreover, standardized methods were employed to obtain high response rate and correct measurements and 2) suitable adjustment measure were taken in investigating the complex sampling design of the PDHS 2012 - 13. However, the study has some possible limitations which should be considered when comprehending our results. Due to its cross-sectional nature, the study is limited in its ability to establish a causal relationship between the variables. Residual confounding because of unmeasured variable like food insecurity, micronutrient consumption cannot be ruled out. Furthermore, a few variables including breastfeeding duration information was dependent on a mother's memory of events which increases the possibility of recall bias and social desirability bias.

5. Policy implications and conclusions

Although breastfeeding is healthy for the child and the mother, health care providers need to educate mothers and raise awareness regarding the consequences of prolonged breastfeeding and facilitate them to prevent any harmful outcomes. Any strategy which enhance mothers' knowledge and awareness to practice breastfeeding should be adopted. Additionally, commercial projects which focus on raising the socio-economic status of people needs to be developed to reduce the burden of malnutrition in children. More research needs to be directed to investigate the effect of breastfeeding duration on health of mother and her nutrition status to make certain that prolonged breastfeeding has no negative impact on the health of mother.

Summing up, our study established that the prolonged duration of breastfeeding in children up to three years of age had significant association with stunting but not with wasting & underweight. It also revealed that birth size perception, infrequent antenatal clinic visits and low literacy level of the mother were considerable factors associated stunting, wasting and underweight. Utilization of study results may help in reducing the prevalence of stunting, wasting and underweight and also put Pakistan back on track to accomplish WHO global nutrition targets by 2025.

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Author statement

Dr. Batool Syeda: Substantial contribution to conception and design, substantial contribution to acquisition of data, substantial contribution to analysis and interpretation of data, drafting the article, critically revising the article for important intellectual content, final approval of the version to be published; Dr. Kingsley Agho (Supervisor): Substantial contribution to conception and design, substantial contribution to analysis and interpretation of data, final approval of the version to be published; Dr. Leigh Wilson (Co-Supervisor): Substantial contribution to analysis and interpretation of data, drafting the article, final approval of the version to be published; Dr. Greesh Kumar Maheshwari: Drafting the article, critically revising the article for important intellectual content, final approval of the version to be published; Dr. Muhammad Qasim Raza: Drafting the article, critically revising the article for important intellectual content, final approval of the version to be published.

Declaration of competing interest

None.

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References

- [1] De Onis M, Branca F. Childhood stunting: a global perspective. *Matern Child Nutr* 2016;12:12–26.
- [2] UNICEF Malnutrition. UNICEF; 2019 [online] Available from: <https://data.unicef.org/topic/nutrition/malnutrition/>. [Accessed 15 June 2019].
- [3] WORLD HEALTH ORGANIZATION Malnutrition. World Health Organization; 2018 [online] Available from: <https://www.who.int/news-room/fact-sheets/detail/malnutrition>. [Accessed 15 June 2019].
- [4] World Health Organisation. Nutrition Landscape Information System (NLIS) country profile indicators: interpretation guide. 2010.
- [5] UNICEF/WHO/WorldBank. Joint child malnutrition estimates: levels and trends in child malnutrition. 2019.
- [6] Krishna A, Mejia-Guevara I, McGovern M, Aguayo VM, Subramanian S. Trends in inequalities in child stunting in South Asia. *Matern Child Nutr* 2018;14:e12517.
- [7] National Institute of Population Studies - NIPS/Pakistan, ICF International. Pakistan demographic and health survey 2012–13. Islamabad, Pakistan: NIPS/Pakistan and ICF International; 2013.
- [8] Global Nutrition Report. Pakistan nutrition profile. globalnutritionreport.org; 2018.
- [9] Bryce J, Coitinho D, Darnton-Hill I, Pelletier D, Pinstrip-Andersen P, Maternal, et al. Maternal and child undernutrition: effective action at national level. *Lancet* 2008;371(9611):510–26.
- [10] Leroy JL, Ruel M, Habicht J-P, Frongillo EA. Linear growth deficit continues to accumulate beyond the first 1000 days in low-and middle-income countries: global evidence from 51 national surveys. *J Nutr* 2014;144(9):1460–6.
- [11] Prado EL, Dewey KG. Nutrition and brain development in early life. *Nutr Rev* 2014;72(4):267–84.
- [12] Stuebe A. The risks of not breastfeeding for mothers and infants. *Rev Obstet Gynecol* 2009;2(4):222–31.
- [13] Saadeh RJ, Labbok MH, Cooney KA, Koniz-Booher P, Organization WH. Breastfeeding: the technical basis and recommendations for action. 1993.
- [14] Scherbaum V, Srouf ML. The role of breastfeeding in the prevention of childhood malnutrition. hidden hunger, vol. 115. Karger Publishers; 2016. p. 82–97.
- [15] Bhutta ZA, Ahmed T, Black RE, Cousens S, Dewey K, Giugliani E, et al. What works? Interventions for maternal and child undernutrition and survival. *Lancet* 2008;371(9610):417–40.
- [16] Rao S, Kanade A. Prolonged breast-feeding and malnutrition among rural Indian children below 3 years of age. *Eur J Clin Nutr* 1992;46(3):187–95.
- [17] Brakohiapa L, Bille A, Quansah E, Kishi K, Yartey J, Harrison E, et al. Does prolonged breastfeeding adversely affect a child's nutritional status? *Lancet* 1988;332(8608):416–8.
- [18] Fawzi WW, Herrera MG, Nestel P, Amin AE, Mohamed KA. A longitudinal study of prolonged breastfeeding in relation to child undernutrition. *Int J Epidemiol* 1998;27(2):255–60.
- [19] Kramer MS, Moodie EE, Dahhou M, Platt RW. Breastfeeding and infant size: evidence of reverse causality. *Am J Epidemiol* 2011;173(9):978–83.
- [20] Caulfield LE, Bentley ME, Ahmed S. Is prolonged breastfeeding associated with malnutrition? Evidence from nineteen demographic and health surveys. *Int J Epidemiol* 1996;25(4):693–703.
- [21] Marquis GS, Habicht J-P, Lanata CF, Black RE, Rasmussen KM. Association of breastfeeding and stunting in Peruvian toddlers: an example of reverse causality. *Int J Epidemiol* 1997;26(2):349–56.
- [22] Filmer D, Pritchett LH. Estimating wealth effects without expenditure data—or tears: an application to educational enrollments in states of India. *Demography* 2001;38(1):115–32.
- [23] vol. 14 StataCorp. Stata statistical software: release. College Station, TX: StataCorp LP; 2015.
- [24] Nnyepi M, Bandeke T, Mahgoub S. Factors affecting prevalence of malnutrition among children under three years of age in Botswana. 2006.
- [25] Sawudatu Z. Does prolonged breast-feeding enhance nutritional status; evidence from Ghana. University of Ghana; 2001.
- [26] Nube M, Asenso-Okyere W. Large differences in nutritional status between fully weaned and partially breast fed children beyond the age of 12 months. *Eur J Clin Nutr* 1996;50(3):171–7.
- [27] Przyrembel H. Timing of introduction of complementary food: short- and long-term health consequences. *Ann Nutr Metabol* 2012;60(Suppl. 2):8–20.
- [28] Muchina E, Waitthaka P. Relationship between breastfeeding practices and nutritional status of children aged 0–24 months in Nairobi, Kenya. *Afr J Food Nutr Sci* 2010;10(4).
- [29] Mgongo M, Chotta N, Hashim T, Uriyo J, Damian D, Stray-Pedersen B, et al. Underweight, stunting and wasting among children in Kilimanjaro Region, Tanzania; a population-based cross-sectional study. *Int J Environ Res Publ Health* 2017;14(5):509.
- [30] Qadri S, Hubaira H, Singh D. A study of inter-relationship between prolonged breast feeding and nutritional status in children aged 15 months to 3 years: an observational, case-control study. *Sri Lanka J Child Health* 2017;46(4):362–5.
- [31] Simondon KB, Simondon F, Costes R, Delaunay V, Diallo A. Breast-feeding is associated with improved growth in length, but not weight, in rural Senegalese toddlers. *Am J Clin Nutr* 2001;73(5):959–67.
- [32] Emina J, Kandala N-B, Inungu J, Ye Y. The effect of maternal education on child nutritional status in the Democratic Republic of Congo. Nairobi, Kenya: African Population and Health Research Center; 2009.
- [33] Makoka D, Masibo PK. Is there a threshold level of maternal education sufficient to reduce child undernutrition? Evidence from Malawi, Tanzania and Zimbabwe. *BMC Pediatr* 2015;15(1):96.
- [34] Sabharwal V. Myths and beliefs surrounding complementary feeding practices of infants in India. *J Community Nutr Health* 2014;3(1):34.
- [35] Hasnain S, Hashmi S. Consanguinity among the risk factors for underweight in children under five: a study from rural Sindh. *J Ayub Med Coll Abbottabad* 2009;21(3):111–6.
- [36] ETTYANG G, SAWE CJ. Factors associated with stunting in children under age 2 in

- the Cambodia and Kenya 2014 Demographic and Health Surveys. 2016.
- [37] Abeway S, Gebremichael B, Murugan R, Assefa M, Adinew YM. Stunting and its determinants among children aged 6–59 months in northern Ethiopia: a cross-sectional study. *J Nutr Metabol* 2018;2018.
- [38] Hamel C, Enne J, Omer K, Ayara N, Yarima Y, Cockcroft A, et al. Childhood malnutrition is associated with maternal care during pregnancy and childbirth: a cross-sectional study in Bauchi and Cross River States, Nigeria. *J Publ Health Res* 2015;4(1).
- [39] Kuhnt J, Vollmer S. Antenatal care services and its implications for vital and health outcomes of children: evidence from 193 surveys in 69 low-income and middle-income countries. *BMJ Open* 2017;7(11):e017122.