

Effectiveness of Integrated Nutrition Interventions on Childhood Stunting: A Quasi-Experimental Evaluation Design

Ester Elisaria (✉ eelisaria@ihi.or.tz)

Ifakara Health Institute

Jackline Mrema

Ifakara Health Institute

Tariki Bogale

Children's Investment Fund Foundation

Giulia Segafredo

Doctors with Africa Cuamm

Charles Festo

Ifakara Health Institute

Research Article

Keywords: Integrated, intervention, stunting, children, Tanzania

Posted Date: December 2nd, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-112591/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Version of Record: A version of this preprint was published at BMC Nutrition on May 13th, 2021. See the published version at <https://doi.org/10.1186/s40795-021-00421-7>.

Abstract

Background: Although malnutrition particularly stunting is recognized as multi-causal, there has been limited integrated nutrition interventions to reduce its burden in children under-fives and those existing are not well evaluated. This study tested the effectiveness of provision of health and nutrition education and promotion of home gardening in child stunting.

Methods: A quasi-experimental evaluation design with repeated cross-sectional surveys was used to assess changes in behaviors (uptake of Antenatal Care services and child feeding practices) and stunting among children under-five years. Household surveys were done at the baseline, and end-line in both controls (Tabora, Lindi and coast regions) and interventions (Simiyu and Ruvuma regions) sites. The sample size was calculated to detect a 10% percent absolute baseline-to-end-line change in stunting as a key indicator. A two-stage stratified sampling process was employed to select study participants. A total of 840 and 1,680 households was need at each round of data collection in the intervention and control districts respectively. Mothers delivered in the past 24 months preceding the survey and all children under-five years residing in selected households were eligible. The difference in difference (DID) analysis was used to estimate effect of the interventions. All ethical clearances were obtained from relevant authorities prior to data collection.

Results: A total of 3,467 and 4,145 children under five years were recruited at baseline and endline respectively. The proportional of stunted children decreases from 35.9% to 34.2% in intervention and from 29.3% to 26.8 % in the control sites. Overall, no statistically significant stunting reduction was observed between intervention and control sites. However, a significant effect were observed in intermediate outcomes; Uptake of iron folic acid (DID: 5.2%, (95% CI: 1.7-8.7), $p=0.003$), health facility delivery (DID: 6.5%, (95% CI: 1.8-11.2), $p=0.006$), pre-lacteal feeding (DID: -5.9%, (95%CI: -9.2, -2.5), $p=0.001$), breast feeding within one hour after birth (DID: 7.8 %, (95%CI: 2.2-13.4), $p=0.006$) and exclusive breast feeding in children under six months (DID:20.3%, (95% CI: 10.5-30.1), $p=0.001$).

Conclusion: The three years program did not result in significant evidence of stunting reduction, but the observed effect on health and nutrition behavioural indicators were substantial. These are intermediate indicators that are in the causal pathways to improved child nutritional outcomes in the long run. Implementation of these integrated packages over a longer duration is needed to witness significant reduction the prevalence of stunting.

Background

Undernutrition particularly stunting is a major public health problem affecting hundreds of millions of children globally. In 2018, 149 million children under-five were stunted (1). Africa continent is by far the hardest hit by stunting with 30 countries out of 41 ranked worldwide with highest number of people experiencing more than one form malnutrition (childhood stunting, anaemia in women of reproductive age and overweight among women)(2). The consequences of stunting are profound including increased

susceptibility to infections, mortality, reduced cognitive development, diminished educational attainment, less economic productivity in the later stage of life and lower birth weight of offspring(3). There is also a close link between deprivation of food in early life and increased chances of adulthood chronic diseases(3). The collective consequences of stunting cost up to 12% of the country Gross Domestic Product of developing countries(4).

Nearly 45% of all under-five deaths were attributed to malnutrition which translates to nearly 3.1 million deaths per year. Sub-optimal infant feeding alone contributes to 800,000 deaths per year and the prevalence of deaths was much higher in South Asia and sub-Saharan Africa than in other parts of the world(5). Tanzania has made huge progress in reducing stunting in under-five children, from 43% in 1991 to 34% in 2015(6). However, disparities exist between regions with six regions (Ruvuma, Iringa, Rukwa, Kigoma, Njombe and Songwe) out of 26 having over 40% of stunted children(6). This is unacceptably high by the WHO standards (7). Several studies have linked poor nutritional status among pregnant women and women of reproductive age with adverse birth and nutritional outcomes among newborns and children (8,9). Evidence in Tanzania suggests that the prevalence of underweight (BMI < 18.5) among women of reproductive age has remained low and unchanged over the past 20 years. However, overweight and obesity (BMI > 18.5) has increased substantially. The 2015/2016 Demographic and Health Survey indicates, one in ten women aged 15- 49 years were either underweight or obese and 18% were overweight(6). Further, 45% of women of reproductive age and 57% of pregnant women were anemic(6).

The government of Tanzania aims to eliminate stunting as a significant public health problem by 2030 (10). As part of several initiatives, an integrated intervention involving nutrition education and promotion of use of health services was implemented by Doctors with Africa CUAMM. The program uses trained community health care workers to provide health education to pregnant and lactating mothers on areas of infant and young child feeding, handwashing, waste management, birth preparedness, and healthy eating during pregnancy and lactation through a village health day. The program also facilitated formation of peer support groups and home gardening to ensure financial stability and availability of different food diversities. This paper generates evidence from an evaluation work of these program activities.

Methods And Design

The evaluation employed a quasi-experimental design to test the hypothesis that health and nutrition education and promotion of use of antenatal care (ANC) services in the first 1,000 days of life will reduce stunting in children under five years of age. Repeated data collection surveys were done at baseline in June - September 2016, and endline in July- September 2019 in both control and intervention sites.

Setting

The study was conducted in five regions of Tanzania mainland. Simiyu and Ruvuma regions were purposively selected as intervention sites by the implementers as they had a high prevalence of stunting, 33 and 44% respectively(6). Simiyu is located in the Northern part of Tanzania and the South East of Lake Victoria while the Ruvuma is located in the Southern part of Tanzania. Four districts matched on

health services availability, population, nutritional and mortality indicators were purposeful selected as controls. Uyui and Nzega districts located in Tabora region were paired with Simiyu region while Rufiji and Ruangwa districts in Coast and Lindi region respectively were paired with Ruvuma region. Districts with ongoing or planned similar nutrition program at the beginning of program activities were excluded from the controls sampling frame.

Sample size and sampling

The sample size was calculated to detect a 10% percent absolute baseline-to-end-line change in stunting as a key indicator, using a baseline rate of stunting in the intervention and control districts of 40% and 26 % respectively. Assuming a 15% and 5% absolute drop in stunting in intervention and control districts respectively over the 4-year period, a 5% type I error and 80% power, and an intervention to control ratio of 1:2, a total of 840 households in intervention districts and 1,680 in control districts was deemed sufficiently after accounting for the 10% non-response. A two-stage cluster sampling process was used, with the first stage involving sampling of 56 villages, 28 from each site proportional to the district population size. This was followed by random sampling of 30 and 60 households from each village located in the intervention and control site respectively. All households with children under two years in the selected villages form part of a sampling frame for the second stage sampling.

Study Participants and Eligibility

Mothers who delivered within the 24 months preceding the survey and all children under-five years residing in the selected households were eligible. The 24 months were selected because child nutrition deteriorates in the period 6-24 months and after that age, the growth stagnates(11). Infant feeding information was collected for all children under 24 months, as longer duration will introduce feeding pattern misclassification due to recall bias (12). In household with two or more women with children less than 24 months of age, the one with the youngest child was interviewed to reduce recall bias.

Measurement

Anthropometric measurements

Anthropometric measurements (weight and height) were taken from all under-five children who slept in the selected household a night preceding the survey and also to the blood parents of the children under-fives. Weight was assessed using the calibrated United Nations Children Funds (UNICEF) Electronic Scales(13). The scale was placed on a flat surface, and children aged 2 years and above weighed while standing on a scale while those aged less than 2 years had their weight taken as a difference of weight of mother or caretakers with the child combined to that of the mothers alone. Weight was recorded to the nearest 0.1kg. Height was measured using a height board. Children less than two years were measured lying on the length board while those aged two years and above were measured standing upright on the board. Height was recorded to the nearest 0.1cm. Measurement procedures adhered to standardized protocols for anthropometry used in the construction of the international growth reference (13).

Study Questionnaires

A modified version of the validated Demographic and Health Survey (DHS) questionnaire was used during the interviews(6). The tools captured i) mother's demographic and reproductive history; ii) alcohol consumption and cigarette smoking history iii) history of health service utilization during ANC and the postnatal period, including Iron and Folic Acid supplementation, presumptive treatment for malaria and use of insecticide-treated bed nets during pregnancy and the postnatal period; iv) sources of breastfeeding information and a series of questions testing maternal knowledge on breastfeeding, complementary feeding and healthy eating during pregnancy and lactation; and v) infant feeding practices.

Data Management and Analysis:

Data was analyzed using STATA version 13 software. Descriptive statistics were done to establish the markers of household-level characteristics, health and nutrition indicators at each round of data collection. The anthropometry Z-scores were calculated using the WHO 2006 growth references(14). The impact of a program was calculated using the difference in difference estimates with a p-value less than 0.05 at 95% level considered as significant. Principal components analysis was used to create a wealth index for each household based on the asset's availability at household level.

Quality Assessment and Control

All study tools were reviewed by relevant experts prior to data collection. Questionnaires were translated to Kiswahili and back-translated to English to ensure meaning was maintained. Field workers were trained for four days prior to each round of data collection to reduce within and between inter and intra-data variability. The training was followed by a day of field-testing of data tools. Weight and height/length measurements were standardized using FANTA guidelines (15). All weighing scales were calibrated using an object of known weight prior to use. Data collection was done using electronic devices and uploaded to a central data server on daily basis allowing instant review and feedback to the field team.

ETHICAL CONSIDERATION

Ethical clearance from institutional (IHI/IRB/No:09-2016) and national (NIMR/HQ/R.8a/Vol.IX /2208) Research Ethics Committee were obtained. The study team pay courtesy to regional and district authority prior to beginning data collection activities. Permission letters were obtained and presented to village leaders during data collection activities. Before interviews, RA's informed all study participants about the study objectives, risk and benefit of participating and study procedures. Only respondent who provided written consent were interviewed.

Results

Overall, 2,533 households were interviewed at baseline, and 2,559 at end-line. Baseline and end-line population was characterized by a large family size (>5). Closer to two third (>64%) of the population had 5 or more family members. Teenage pregnancy ranged from 11.9% to 17.5% between baseline and end-line. Majority (>79.1%) of the women interviewed were married. Most (>63%) of the women had at least primary level education in both surveys. Generally, control sites had higher proportion of mothers with no education and poor socio-economic status compared to intervention sites at baseline and education continued to vary at end-line. Less than 7.4% of the mothers had BMI of <18.5. **(Table 1)**.

Table 1: Household and Socio-demographic characteristic of *respondents the intervention and control sites, 2016 and 2019*

	Baseline		End-line	
Indicator	Intervention. N (%)	Control N (%)	Intervention N (%)	Control N (%)
Number of Household	853	1680	871	1,688
Household size				
Median household size (range)	6 (2-30)	5 (2-30)	6 (2-28)	5 (2-27)
Family size				
2-4	277 (32.5)	604 (36.0)	267 (30.8)	564 (33.4)
5-7	344 (40.4)	663 (39.5)	369 (42.5)	686 (40.6)
8+	232 (27.1)	413 (24.6)	235 (27.0)	438 (26.0)
Household wealth				
1 (Poorest)	229 (26.9)	424 (25.3)	184 (21.1)	472 (28.0)
2 (Poor)	170 (19.9)	458 (27.3)	227 (26.1)	405 (24.0)
3 (Medium)	214 (25.1)	419 (25.0)	196 (22.5)	437 (25.9)
4 (Better off)	240 (28.1)	379 (22.6)	264 (30.3)	374 (22.2)
Mother's age (years)				
15-19	149 (17.5)	252 (15.0)	104 (11.9)	240 (14.2)
20-29	453 (53.1)	911 (54.3)	491 (56.4)	883 (52.3)
30-39	208 (24.3)	446 (26.6)	237 (27.2)	472 (28.0)
40-49	43 (5.0)	70 (4.2)	39 (4.5)	93 (5.5)
Marital status				
Married	724 (84.9)	1,328 (79.1)	760 (87.3)	1,418 (84.0)
Single	81 (9.5)	226 (12.1)	65 (7.5)	174 (10.3)
Widow	8 (0.9)	12 (0.7)	7 (0.8)	4 (0.2)
Divorce	40 (4.7)	114 (6.8)	36 (4.1)	89 (5.3)
Mother's education				
No schooling	135 (15.8)	432 (25.7)	114 (13.1)	439 (26.0)
Primary	588 (68.9)	1092 (65.0)	598 (68.7)	1,062 (62.9)
Secondary +	130 (15.2)	155 (9.2)	159 (18.3)	187 (11.1)

¹Mother's BMI				
Thinness BMI <18.5	52 (6.3)	103 (6.4)	40 (4.7)	121 (7.4)
Normal 18.5<BMI<25.0	624 (75.5)	1189 (73.3)	626 (74.1)	1,132 (69.5)
Overweight ≥25.0	125 (15.1)	256 (15.8)	133 (15.7)	282 (17.3)
Obese ≥ 30.0	26 (3.1)	74 (4.6)	46 (5.4)	93 (5.7)
¹ Pregnant women were excluded from the BMI calculations. The numbers in brackets are row percent unless stated.				

Nutritional Outcomes of Children

A total of 3,467 and 4,145 children under five years were recruited at baseline and endline respectively. Overall, there was no statistically significant difference in prevalence of stunting three years post the program implementation (DID: 0.8 %, 95%CI: -3.4-5.1 and p=0.704. However, the percentage of stunted children declined slightly from 35.9 % (95% CI: 33.3-38.5) at baseline to 34.2% (95% CI: 31.9-36.6) at end-line in the intervention and from 29.3% (95% CI: 27.5-31.2) at baseline to 26.8% (95% CI: 25.2-28.6) at end-line in the control sites (**Table 2**).

Table 2: Nutritional indicators for children under-five years between 2016 and 2019

Nutritional outcomes	Intervention		Control		Program effect (DID estimates)	
	Baseline	Endline	Baseline	Endline	% DID (95% CI)	P value
	Prev (%). (CI)	Prev (%). (CI)	Prev (%). (CI)	Prev (%). (CI)		
	N= 1,334	N= 1,540	N=2,333	N= 2,605		
<i>Stunting</i>						
Overall	35.9 (33.3-38.5)	34.2 (31.9-36.6)	29.3 (27.5-31.2)	26.8 (25.2-28.6)	0.8 (-3.4-5.1)	0.704
Severe	11.3 (9.7-13.1)	11.6 (10.2-13.4)	7.7 (6.7-9.9)	7.1 (6.2-8.2)	1.0 (-1.6-3.6)	0.442

Uptake of Maternity Care

Almost all women (98 %) interviewed received antenatal care during their most recent pregnant from a skilled attendant at least once. There was no statistically evidence of the change of the number of ANC visits and timing of first ANC visit as a result of the intervention. However, a significant increases was observed in uptake of iron and folic acid (DID: 5.2%, 95%CI: 1.7-8.7, p=0.003), delivery at health facility (DID: 6.5%, 95%CI: 1.8-11.2, p=0.006), pre-lacteal feeding (DID:-5.9%, 95% CI: -9.2- -2.5, p=0.001), breastfeeding within one hour (DID: 7.8%, 95% CI: 2.2-13.4, p=0.006) and exclusive breast feeding from birth to six months (DID:20.3%, 95%CI: 10.5-30.1, p=0.001) (**Table 3**).

Table 3: Maternity care uptake and breastfeeding practice among mothers 2016 and 2019

Indicator of interest	Intervention		Control		Program effect (DID estimates)	
	Baseline	Endline	Baseline	Endline	% diff (95% CI)	P-value
	Prev (%). (CI)	Prev (%). (CI)	Prev (%). (CI)	Prev (%). (CI)		
	N=853	N= 871	N=1680	N= 1688		
Number of ANC visit						
Ever attended	98.6 (97.5-99.2)	98.0 (96.9-98.8)	98.0 (97.2-98.6)	97.5 (96.6-98.2)	-0.1 (-1.7-1.6)	0.924
At least 4 visits	48.2 (44.8-51.5)	69.0 (65.8-72.0)	51.8(49.4-54.1)	71.0 (68.8-73.1)	1.5 (-4.0-7.1)	0.593
Gestation age at First ANC (Months)						
0-3	21.7 (19.0-24.6)	42.2 (39.0-45.6)	23.4 (21.4-25.5)	43.0 (40.7-45.4)	0.9 (-4.4-6.3)	0.728
4-6	68.0 (64.8-71.0)	50.9 (47.5-54.2)	64.3 (61.9-66.5)	48.5 (46.1-50.9)	-1.4 (-7.0-4.3)	0.636
7-9	9.6 97.8-11.8)	6.2 (4.8-8.0)	11.2 (9.8-12.9)	7.4 (6.3-8.8)	0.4 (-2.9-3.7)	0.825
Uses of Iron and folic acid						
Ever took	87.6 (85.2-89.6)	95.2 (93.5-96.4)	87.9 (86.2-89.3)	90.2 (88.7-91.6)	5.2 (1.7-8.7)	0.003
Took for 90+	17.9 (15.3-20.9)	40.6 (37.3-44.0)	29.1 (26.9-31.5)	47.4 (44.8-49.9)	4.5 (-1.2-10.2)	0.118
Delivered at HF	70.1 (66.9-73.1)	81.7 (79.0-84.2)	78.6 (76.5-80.5)	83.7 (81.9-85.4)	6.5 (1.8-11.2)	0.006
Given pre-lacteal feeds	14.2 (11.2-16.7)	7.1 (5.6-9.0)	9.3 (8.0-10.8)	8.2 (7.0-9.6)	-5.9 (-9.2- -2.5)	0.001

Ever breastfed	98.7 (97.7-99.3)	99.7 (98.9-99.9)	99.0 (98.4-99.4)	99.8 (99.4-99.9)	0.2 (-0.8-1.1)	0.728
Breastfeeding within 1 hr	59.1 (55.8-62.4)	66.2 (63.0-69.3)	66.3 (63.9-68.5)	65.6 (63.3-67.8)	7.8 (2.2-13.4)	0.006
EBF per age (months)						
0-1	91.9 (83.7-97.1)	94.6 (87.4-97.8)	95.1 (89.9-97.7)	88.6 (82.5-92.7)	9.2 (0.8 -19.1)	0.070
2-3	75.0 (65.0-82.9)	84.3 (74.6-90.8)	68.5 (60.4-75.6)	53.1 (44.9-61.2)	24.7 (7.6-41.9)	0.005
4-5	47.6 (38.1-57.3)	61.5 (51.2-70.8)	43.9 (36.9-51.1)	28.7 (22.3-36.0)	29.1 (12.3-45.9)	0.277
0-5	70.0 (64.3-75.1)	79.7 (74.5-84.1)	66.7 (62.3-70.8)	56.1 (51.6-60.5)	20.3 (10.5-30.1)	<0.001
EBF=Exclusive breastfeeding, hr =hour, ANC =Antenatal clinic						

Discussion

This study investigated the effectiveness of integrated intervention (nutrition education and promotion of use of health services) in the first 1000 days of a child's life on child stunting. The findings show a slight reduction in stunting three years post program implementation in both intervention and control sites, though not statistically significant. However, some of health and nutrition behaviours were positively impacted by the program.

The observed none significant reduction of stunting could be explained by the shorter duration of program implementation as stunting is a chronic condition that requires a longer period to change. Results from similar integrated interventions implemented in Ethiopia and Mozambique (16,17) also found no improvement in child stunting. A systematic review by Goudet et al in 2019 exploring the effect of these similar intervention reported no or moderate effect of the interventions on stunting(19). The literature shows high mobility, lack of social services, and high loss to follow-up as possible explanation for this kind of findings (19).

Despite the program showing no impact on child stunting, a significant improvement was observed in the uptake of iron and folic acid, health facility delivery, pre-lacteal feeding, initiation of breastfeeding within one hour of birth, and exclusive breastfeeding in children aged below six months. These results are in the

intermediate or distal causal pathways for children's stunting (20) and may guarantee stunting reduction in the long run.

Further, these behavioural indicators have been defined by WHO as essentials nutrition action and recommended in early child life for optimum health, growth, and neurodevelopment (11).

Supplementation of iron during pregnancy, initiation of breastfeeding, exclusive breastfeeding, and appropriate complementary feeding practices during 1000 days were found to have a significant effect with child stunting (21). In-depth analysis of demographic and health surveys in many sub-Saharan African countries has indicated an improvements in uptake of maternity care reduces the prevalence of stunting (22). Based on these pieces of evidence from other studies, there is an indication that, the observed significant changes in pregnant women using health services as well as infant and changes in child feeding practises impacted by program in intervention communities could contribute to the reduction of child stunting in the future.

Conclusion

Even though the program did not show a significant effect in reducing the prevalence of stunting, a significant effect was observed in nutrition behaviours, ameliorating the uptake of iron and folic acid, health facility delivery, pre-lacteal feeding, and breastfeeding practices. These are in the causal pathway in reducing child undernutrition. More intensive and longer duration of the intervention might be needed to see the effect of these interventions.

Abbreviations

BMI: Body Mass Index

CI: Confidence interval

DID: Difference in difference

HAZ: Height-for-Age Z-score

TDHS: Tanzania Demographic and Health Survey

WHO: World Health Organization

Declarations

Ethics approval and consent to participate

The study protocol was approved by Ifakara Health Institute review board with reference IHI/IRB/No:09-2016 and the National Health Research Ethics Committee at the National Institute of Medical Research,

Tanzania (NIMR/HQ/R.8a/Vol.IX/2208). Written informed consent was obtained from all mothers/caretakers of eligible children selected households

Consent for publication

All authors consented to publication of this manuscript.

Availability of data and materials

The study datasets are available from the corresponding author on request.

Competing interests

The authors declare that they have no competing interests.

Funding

The study was funded by Child Investment Fund Foundation (CIFF)

Authors' contributions

E.E and C.F conceptualised, designed the study and reviewed manuscript; J.M supervised data collection, drafted manuscript and respond to comments from co-authors; C.F and T.B managed data, analysed data. G.S reviewed and edited manuscript. All the authors interpreted the results, critically reviewed the manuscript for important intellectual content and read and approved the final version of the manuscript.

Acknowledgments

We acknowledge the financial support from the Child International Fund Foundation for funding this study “The Next Generation Programme” We also appreciate the support we received from Bariadi, Simiyu, Tabora, Lindi and Coast Region authorities. Finally, we thank the study participants and community health workers, whose cooperation and voluntary participation made this study successful.

Authors' information (optional)

Ifakara Health Institute (IHI)

Mikocheni, Keko Avenue

Dar es Salaam Branch

Children Investment Fund Foundation (CIFF)

ABC Place, 3rd floor Waiyaki Way,

Westlands, Nairobi, Kenya

References

1. UNICEF. The State of the World's Children: Children, food and nutrition,. 2019.
2. Fanzo J, Hawkes C, Udomkesmalee E, Afshin A, Allemandi L, Assery O, et al. 2018 Global Nutrition Report: Shining a light to spur action on nutrition. 2018;
3. Victora CG, Adair L, Fall C, Hallal PC, Martorell R, Richter L, et al. Maternal and child undernutrition: consequences for adult health and human capital. *Lancet*. 2008;371(9609):340–57.
4. Horton S, Steckel RH. Malnutrition: global economic losses attributable to malnutrition 1900–2000 and projections to 2050. *How Much Have Glob Probl Cost Earth? A Scorec from 1900 to. 2013;2050:247–72.*
5. Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, De Onis M, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. *Lancet*. 2013;382(9890):427–51.
6. MoHCDGEC, MoH, NBS, OCGS, ICF. Tanzania Demographic and Health Survey and Malaria Indicator Survey (TDHS-MIS) 2015-16. Dar es Salaam, Tanzania, and Rockville, Maryland, USA; 2016.
7. World Health Organization. Nutrition Landscape Information System (NLIS) country profile indicators: interpretation guide. 2019;
8. Valente A, Borges A, Almeida F, Neves E, Afonso C. Relationship between the mothers ' nutritional status with that of a child population from São Tomé Príncipe , " Africa ." *RevBrasSAude Matern Matern*. 2017;17(2):327–35.
9. Dessie ZB, Fentie M, Abebe Z, Ayele TA, Muchie KF. Maternal characteristics and nutritional status among 6 – 59 months of children in Ethiopia : further analysis of demographic and health survey. *BMC Pediatr*. 2019;19(83):1–10.
10. Kavishe F. Towards Eliminating Malnutrition in Tanzania : Vision 2025 THE UNITED REPUBLIC OF TANZANIA. 2015.
11. World Health Organization. Essential Nutrition Actions: improving maternal, newborn, infant and young child health and nutrition. Geneva, Switzerland; 2013.
12. Li R, Scanlon KS, Serdula MK. The Validity and Reliability of Maternal Recall of Breasfeeding Practice. *Nutr Rev*. 2005;63(4):103–10.
13. de Onis M, Onyango AW, Van den Broeck J, Chumlea WC, Martorell R. Measurement and standardization protocols for anthropometry used in the construction of a new international growth reference. *Food Nutr Bull*. 2004;25(1_suppl_1):S27–36.
14. WHO. WHO Child Growth Standards. 2006.

15. Cashin K, Oot L. GUIDE TO ANTHROPOMETRY A Practical Tool for Program Planners , Managers , and Implementers. 2018.
16. Fenn B, Bulti AT, Nduna T, Duffield A, Watson F. An evaluation of an operations research project to reduce childhood stunting in a food-insecure area in Ethiopia. *Public Health Nutr.* 2012;15(9):1746–54.
17. Martinez S, Naudeau S, Pereira V. The promise of preschool in Africa: A randomized impact evaluation of early childhood development in rural Mozambique. 2012;
18. Vazir S, Engle P, Balakrishna N, Griffiths PL, Johnson SL, Creed-Kanashiro H, et al. Cluster-randomized trial on complementary and responsive feeding education to caregivers found improved dietary intake, growth and development among rural Indian toddlers. *Matern Child Nutr.* 2013;9(1):99–117.
19. Goudet SM, Bogin BA, Madise NJ, Griffiths PL. Nutritional interventions for preventing stunting in children (birth to 59 months) living in urban slums in low-and middle-income countries (LMIC). *Cochrane Database Syst Rev.* 2019;(6).
20. Hien N, Hoa N. Nutritional Status and Determinants of Malnutrition in Children under Three Years of Age in Nghean, Vietnam. *Pakistan J Nutr.* 2009 Jul 1;8.
21. Nur, Ramadhan; Teuku, Tahlil; dan Kartini H. Specific Interventions During the First 1000 Days of Life Program And Toddlers' Nutritional Status. In: *Proceedings of the 7th AIC-ICMR on Health and Life Sciences.* Banda Aceh, Indonesia: ReseachGate; 2017. p. 10.
22. Buisman LR, Van de Poel E, O'Donnell O, van Doorslaer EKA. What explains the fall in child stunting in Sub-Saharan Africa? *SSM-population Heal.* 2019;8:100384.