Under Nutrition and its Associated Factors among Lactating Mothers in Rural Ambo District, West Shewa Zone, Oromia Region, Ethiopia

Eshetu Zerihun[1*,] Gudina Egata[2], Firehiwot Mesfin[3]

[1] Department of Nursing, College of Health and Medical Sciences, Arbaminch University, P.O.BOX: 21, Arbaminch, Ethiopia
[2] Department of Public Health, College of Health and Medical Sciences, Haramaya University, Ethiopia
[3] School of Nursing and Midwifery, College of Health and Medical Sciences, Haramaya University, Ethiopia

Abstract

Background: Lactation has different effects on maternal nutritional status. Even though, growing number of studies reported the existence of maternal under nutrition, very few studies in Ethiopia highlighted under nutrition among lactating mothers.

Objective: To assess the prevalence of under nutrition and associated factors among lactating mothers in rural areas of Ambo district, West Shewa zone, Oromia region, Ethiopia, 2016.

Methods: A community based cross-sectional study was conducted among randomly selected 619 lactating mothers. A pretested and structured questionnaire was used to collect socio-demographic data. Weight, height and Mid Upper Arm Circumference were measured. Body Mass Index was measured to assess the nutritional status. Descriptive statistics was used to describe the data. Binary logistic regression was performed to assess the association between each independent and dependent variable. Adjusted Odds Ratios with its 95% confidence interval were estimated to identify factors associated with the outcome variable in multivariable logistic regression.

Results: The overall prevalence of under nutrition (BMI < 18.5 kg/m2) was 21.5%. Lactating mothers within the age group of 17-25 were more likely to be undernourished than those mothers in the age group of 36-49 (AOR=6.82, 95%CI: 1.84, 25.27). Mothers who were unable to read and write (AOR=2.45, 95%CI: 1.22, 4.94) and from poor wealth index (AOR=1.76, 95% CI: 1.05, 2.95) were also more likely to be undernourished than those who had formal education and rich mothers, respectively.

Conclusion: One fifth of lactating mothers were undernourished. Thus, strengthening health education on proper maternal and child dietary practices and the need of adequate dietary intake during lactation should be emphasized. Additionally, strong multi-sectorial collaboration targeted at improving women's status in the community is very essential in order to improve health and nutritional outcomes of lactating women.

Keywords: *under nutrition, lactating mother, Ambo, Ethiopia*

Introduction

In 2015, about 795 million people, of whom 780 million were from the developing regions, were undernourished globally. This means that nearly one in nine individuals did not have enough to eat. In sub-Saharan Africa, the projected rate of undernourishment for the 2014–2016 period was almost 23 percent. Though the hunger rate has fallen, the number of undernourished people has increased by 44 million since 1990 (UN, 2015).

Lactation has different effects on maternal nutritional status depending on its duration, intensity, as well as cultural diversity. Lactating mothers from low-income settings are considered as nutritionally vulnerable group (Kiday *et al.*, 2013). Lactation puts high demands on maternal stores of energy and protein than in any other stage of a woman's reproductive life. To support lactation and maintain maternal reserves, most mothers in developing countries need to eat about 500 additional

*Corresponding author; Email: eshetamu@gmail.com

kilocalories every day. Extra food, therefore, must be made available to the mother to meet the additional demands of pregnancy and lactation (LINKAGES, 2004).

Maternal under nutrition, including chronic energy and micronutrient deficiencies, accounts for 11% of the global burden of disease (Cuziat and Mattinen, 2011). It is highly prevalent in low-income and middle-income countries, resulting in substantial increases in mortality and overall disease burden. The problem ranges from 10% to 19% in most countries. Its seriousness is evident in most countries in sub-Saharan Africa, south-central and southeastern Asia, and in Yemen, where more than 20% of women have a body-mass index of less than 18·5 kg/m² (Black *et al.*, 2008). In Ethiopia 27% of women aged 15-49 years were undernourished (BMI of less than 18.5 kg/m²) which remained relatively constant since the year of 2005 (CSA, 2012). Improvements in nutrition still represent a massive unfinished global agenda (Cuziat and Mattinen, 2011).

Even though a growing number of studies reported the existence of maternal under nutrition, very few studies in Ethiopia highlighted the issue of under nutrition among lactating mothers. The objective of this study was to assess the prevalence of under nutrition and its associated factors among the lactating mothers in rural areas of Ambo district, West Shewa zone, Oromia Region, Ethiopia.

Materials and Methods

Study Area and Period

The study was conducted in rural areas of Ambo district, West Shewa Zone, Ethiopia, from February 15-30, 2016. The population size was 138,612, of whom 94% were rural residents who were living in 29,102 households. During the study, there were 4,223 lactating mothers in the rural area.

Study Design and Study Participants

A community-based cross-sectional study was conducted on 638 lactating mothers, who were between 15 and 49 years of age, from five randomly selected kebeles (clusters). The lactating mothers who were seriously ill during the data collection, pregnant, and with physical deformities during anthropometric measurement were excluded from the study to allow consistent record of the measurement.

Data Collection Instruments and Procedure

The data were collected using a structured and pretested questionnaire. It was initially developed in English, and then translated into the local language, Afan Oromo; then back translated into English. The households' food insecurity level was measured using Household Food Insecurity Access Scale (HFIAS), which is a structured, standardized, and validated tool developed by FANTA (Coates *et al.*, 2007; Deitchle *et al.*, 2010). The scale is a valid tool to measure a household's food insecurity in rural and urban areas of Ethiopia (Seifu *et al.*, 2015). The mothers' dietary intake pattern was measured by a qualitative recall of all the foods they consumed in the 24 hours before the interview. The foods were grouped to calculate the Women's Dietary Diversity Score (WDDS) of the respondents, and the mean score was used to classify their food intake as adequate or not (Kennedy *et al.*, 2013). To measure the outcome variable, the weight, height, and Mid-Upper Arm Circumference (MUAC) of the lactating mothers were measured. Ten students who completed high school and who were living in the study area collected the data via home to home visits and all the anthropometric measurements were taken based on the standard procedure (Rockville, 1988; NHANES, 2007).

Data Quality Control

To assure the quality of the data, a structured and pretested questionnaire was used. The data collectors and the supervisors were given a two-day intensive training. Relative Technical Error of Measurement (%TEM) was calculated to minimize a random anthropometric measurement error. The data collectors' accuracy of the measurements was standardized with their trainer during training and pretesting. A respondent's weight and height were measured at least twice and more times when the difference between the two weight measures was greater than 0.1kg and when the difference between the two height measures was greater than 0.1 cm. The functionality of the digital weight scale was checked before use. It was checked using a known weight and assuring it read exactly at zero (NHANES, 2007). Intensive supervision was done and the data were double entered.

Data Processing and Analysis

After the data had been checked for completeness and internal consistency, the data were coded and double entered into EpiData 3.1 computer software package and cleaned for inconsistency. For further analysis, data

were exported to Statistical Package for Social Science (SPSS) Version 22 software. The descriptive statistics was used to describe the data. The Women's Dietary Diversity Score (WDDS) was calculated and the mean score was used to describe their nutrient intake status (Kennedy *et al.*, 2013; FAO, 2008). Based on the data obtained from HFIAS, the households were categorized as food secured or not secured (Coates *et al.*, 2007). By considering the locally available household assets and using Principal Component Analysis (PCA) method, the families' wealth index was constructed. The outcome variable was re-coded to dichotomous outcomes: undernourished or not undernourished. The co-linearity effect was checked using Variance Inflation Factor (VIF) and non-collinear covariates were included in the independent binary logistic regression model. All the covariates that were significant at p<0.2 in the bivariate analysis were considered for further multivariate analysis. Using a multivariable logistic regression, Odd Ratios, along with 95% Confidence interval, were estimated to identify the factors associated with the outcome variable. The level of statistical significance was declared at p<0.05. The model was tested by Hosmer- Lemeshow goodness of fit test.

Ethical Consideration

Ethical clearance was obtained from Institutional Health Research Ethical Review Committee (IHRERC) of Haramaya University College of Health and Medical Sciences. Iindividual Informed written consent was obtained from each study participant. The respondents were assured of the confidentiality by excluding their names during the data collection. They were informed well that they had full right to totally refuse to participate and/or with draw from the study at any time without any precondition.

Results

Socio-demographic Characteristics of the Study Participants

Among the assumed 638 lactating mothers aged 15-49 years, 619 (97%) participated in the study. More than half of the respondents, 344 (55.4%), were in the age group of 26-35 years with a mean age value of 28.1years (SD±5.3 years). Of the total, 395 (63.8 %) of the women were unable to read and write, and only 178 (31.3%) of their husbands were able to read and write. Regarding the family wealth index, 247 (39.9%), 124 (20%) and 248 (40.1%) of the households were in the poor, medium and rich wealth terciles, respectively. Among the households, 238(38.4%) were food insecured whereas the remaining 381(61.6%) were food secured (Table 1)

Maternal Health Care and Feeding Practices

Among the respondents, 287 (46.4%) had been pregnant once or twice, 311 (50.2%) visited ANC 4 or more times during their last pregnancy, 483 (78%)) were using family planning methods, and only 90 (14.5%) had experienced diarrhea in the two weeks before the study, which was probably because 428 (69.1%) of the households had their own latrine, and pipe water was the major source of drinking water for 488 (78.8%) study participants.

The mean Dietary Diversity Score (DDS) of the lactating mothers was 4 ±1.5 and many of them, 446 (72.1%), had DDS of ≥4. Of the babies whom the mothers breast feeding, 238 (38.4%) were in the age group of 12-24 months and nearly one fourth of them, 147 (23.7%), started additional food at 6 month (Table 2).

Table 1. Socio-demographic characteristics of lactating mothers in Ambo district, West Shewa zone, Oromia region, Ethiopia, 2016

Variables	Category	Frequency	%
Age of mother (in years)	17-25	216	34.9
	26-35	344	55.6
	36-49	59	9.5
Religion of mother	Orthodox	404	65.3
	Protestant	184	29.7
	Muslim	4	0.6
	Others	27	4.4
Ethnicity of mother	Oromo	581	93.9
	Amhara	34	5.5
	Others	4	0.6
Current marital status of mother	Married	561	90.6
	Divorced	24	3.9
	Widowed	12	1.9
	Single	22	3.6
Educational status of mother	Unable to read and write	224	36.2
	Able to read and write	146	23.6
	Primary level	144	23.3
	Secondary level	73	11.8
	College diploma and above	32	5.2
Educational status of husband	Unable to read and write	120	21.1
	Able to read and write	178	31.3
	Primary level	126	22.1
	Secondary level	101	17.8
	College diploma and above	44	7.7
Occupation of mother	Farmer	343	55.4
	Housewife	122	19.7
	Daily laborer	74	12.0
	Private employee	14	2.3
	Merchant	30	4.8
	Government employee	24	3.9
	Not working	11	1.8
	Others	1	0.2
Family size	1-3	148	23.9
	4-6	339	54.8
	>6	132	21.3
Number of children < 2 years	1	605	97.7
	≥2	14	2.3
Household head	Male	575	92.9
	Female	44	7.1
Family wealth index	Poor	247	39.9
	Medium	124	20.0
	Rich	248	40.1
Household food security	Food secure	381	61.6
	Mildly insecure	65	10.5
	Moderately insecure	64	10.3
	Severely insecure	109	17.6

Nutritional Status of Lactating Mothers

The overall prevalence of under nutrition (BMI<18.5 kg/m²) among the lactating mothers was 21.5% (95%CI: 18.3, 24.9), whereas 78.5% (95%CI: 75.1, 81.7) of the mothers were not undernourished. Among the total lactating mothers included in the study, 68.5%; (95%CI: 64.6, 72.2) and 10% (95%CI: 7.6, 12.3) of them were

normal (BMI=18.5-24.99kg/m²) and overweight (BMI 25.5-29.99kg/m²), respectively, and there was no case of obesity. Using MUAC, 79(12.8%) (95%CI: 10.0, 15.5) of lactating mothers were undernourished (MUAC<21cm) while the remaining 540(87.2%) (95%CI: 84.5, 90.0) had MUAC ≥21cm.

Table 2. Maternal health care and feeding practice of the study participants in Ambo district, West Shewa zone, Oromiya region, Ethiopia, 2016

Variables	Category	Frequency	%
Age of breast feeding child (in months)	<6	189	30.5
	6-11	145	23.4
	12-24	238	38.4
	>24	47	7.6
Number of pregnancy	≤2	287	46.4
	3-4	216	34.9
	5-6	93	15
	>6	23	3.7
Birth interval for the index child	First birth	148	23.9
	1-2 years	151	24.4
	>2 years	320	51.7
Number of ANC visit	No ANC visit	68	11
	< 4 times	240	38.8
	≥ 4 times	311	50.2
Family planning utilization	Do not use FP method	136	22
	Pills	32	5.2
	Injectable	264	42.6
	Norplant	145	23.4
	IUCD	25	4
	Condom	2	0.3
	Breast feeding	15	2.4
Last menstruation seen	Within the last 30 days	234	37.8
	More than 30 days ago	229	37
	Did not remember	156	25.2
Duration of breast feeding	< 6 months	185	29.9
	6-11 months	168	27.1
	12-24 months	216	34.9
	>24 months	46	7.4
	Did not remember	4	0.6
Introduction of complementary feeding	Yes	457	73.8
	No	162	26.2
Age of introduction of complementary feeding	< 6 months	50	8.1
	At 6 month	147	23.7
	>6 month	246	39.7
	Do not remember	14	2.3
Diarrhea in the past two weeks	Yes	90	14.5
	No	529	85.5
Nutrition education	Yes	415	67
	No	204	33
Latrine availability	Yes	428	69.1
	No	191	30.9
Women dietary diversity score	<4	173	27.9
	≥4	446	72.1

Factors Associated with Under Nutrition among Lactating Mothers

In the multivariable logistic regression analysis, the mother's age, education, and family wealth index were statistically significant at 5% level and were found to be the predictors of under nutrition among the lactating. The mothers within the age group of 17-25 years were 6.8 times more likely to be undernourished compared with those mothers in the age group of 36-49 years (AOR=6.82, 95% CI: 1.84, 25.27). Mothers who were unable to read and write were 2.45 times more likely to be undernourished than those mothers who had formal education (AOR=2.45, 95%CI: 1.22, 4.94). Mothers from poor households were 1.76 times more likely to be undernourished than their counterparts (AOR=1.76, 95%CI: 1.05, 2.95) (Table 3).

Table 3. Factors associated with under nutrition among lactating mothers mothers in Ambo district, West Shewa zone, Oromia region, Ethiopia, 2016

Covariates	Category	Under nutrition (BMI<18.5)			
		Yes	No	COR (95% CI)	AOR (95%CI)*
Age of mother (in years)	17-25	56	160	2.60(1.12, 6.05)	6.82(1.84, 25.27)*
	26-35	70	274	1.89(0.83, 4.36)	3.49(1.00, 12.14)
	36-49	7	52	1	1
Educational status of mother	Unable to read and write	60	164	2.10(1.33, 3.31)	2.45(1.22, 4.94)*
	Able to read and write	36	110	1.88(1.12, 3.13)	1.45(0.70, 3.00)
	Have formal education	37	212	1	1
Educational status of husband	Unable to read and write	25	95	1.43(0.83, 2.49)	0.85(0.40, 1.80)
	Able to read and write	54	124	2.38(1.50, 3.76)	1.50(0.78, 2.89)
	Have formal education	42	229	1	1
	Poor	66	181	1.90(1.22, 2.95)	1.76(1.05, 2.95)*
Family wealth index	Medium	27	97	1.46(0.84, 2.50)	1.49(0.79, 2.80)
	Rich	40	208	1	1
	Food secure	88	293		
Household food security	Mildly food insecure	9	56	0.54(0.26, 1.13)	0.44(0.17, 1.13)
	Moderately food insecure	16	48	1.11(0.60, 2.05)	1.37(0.68, 2.78)
	Severely food insecure	20	89	0.75(0.44, 1.28)	0.66(0.33, 1.31)
Age of breast feeding child (in months)	≤12	87	270	1.51(1.02, 2.26)	1.21(0.72, 2.03)
	>12	46	216	1	1
	First birth	30	118	1.13(0.69, 1.84)	0.75(0.38, 1.47)
Birth interval for the index child	1-2 years	44	107	1.82(1.16, 2.86)	1.44(0.82, 2.52)
	>2 years	59	261	1	1
Frequency of ANC visit	< 4 times	65	175	1.73(1.15, 2.60)	1.51(0.91, 2.50)
	≥ 4 times	55	256	1	1
Introduction of CF	Yes	92	365	1	1
	No	41	121	1.34(0.88, 2.05)	1.26(0.72, 2.20)

*Note: AOR, Adjusted Odd Ratio; CF, Complementary Food; CI, Confidence Interval, COR, Crude Odd Ratio; *, p-value <0.05*

Discussion

This study revealed that the prevalence of under nutrition (BMI<18.5kg/m²) among the lactating mothers was 21.5%. Mothers who were between 17 and 25 years of age, not able to read and write, and whose family wealth index was poor were found more likely to be undernourished. This finding is closer to the one reported from Nekemte (20.5%) (Temesgen *et al.*, 2015), but a bit less than the finding in Tigray (25%) (Kiday *et al.*, 2013). When compared with the result from Babile (41.7% during post-harvest and 54.7% during pre-harvest season) (Kedir *et al.*, 2015), the prevalence in this research is much lower. The difference could be attributed to the interventions on maternal health, nutrition and other women empowering programs by the government and other non-governmental

organizations in the study area and the time of survey as well.

However, the prevalence we found is much higher than the ones reported from India (16%) (Ghosh-Jerath *et al.*, 2015), Guatemala (5%) (Oyesiku *et al.*, 2013), Nigeria (<5%) (Sanusi and Falana, 2009), and Kenya (10%) (Gewa *et al.*, 2012). The difference might be related to a seasonal variation of the study period, the difference in socio-economic and demographic factors like educational status of mothers and family income. As per MUAC measurement, the proportion of the undernourished lactating mothers (MUAC< 21cm) was 12.8%, which is comparable with the finding from Tigray (13%) (Kiday *et al.*, 2013).

The present study has showed that the age of the lactating mothers was significantly associated with their nutritional status. The mothers within the age group of 17-25 were 6.8 times more likely to be undernourished compared with those mothers in the age group of 36-49. This is in line with a result from Bangladesh, in which, younger women in the age group 15–24 were more likely to be malnourished (Rahman *et al.*, 2015). This might be related with an increased nutritional requirement during adolescent age for normal growth and development of the mother and lack of sufficient food intake to meet this requirement.

Educational status of the mothers was also another factor that predicted their nutritional status in this study. The respondents who can't read and write were 2.45 times more likely to be undernourished than those mothers who had formal education. Similar studies from Sri Lanka (Jayawardena, 2014) and Congo Democratic Republic (Adebowale *et al.*, 2015) also reported that undernourished women were more common among those with no formal education. This could be related with an increased awareness of self care, health service utilization, and acknowledging the importance of increasing meal frequency during lactation among educated mothers.

In this study, statistically significant association was found between the covariate family wealth index (poverty level) and the nutritional status of the lactating mothers. The mothers from poor terciles family wealth were 1.76 times more likely to be undernourished than from the rich tercile. This is also supported by the study from Bangladesh (Rahman *et al.*, 2015) and Congo Democratic Republic (Adebowale *et al.*, 2015). This association could be due to the fact that the women from lower tercile family wealth were in difficulties of meeting their dietary requirement, engaged in strenuous works like daily laborer and have minimal health care practice.

Food insecurity affects the intake of adequate quantity and quality of diet that in-turn contributes to maternal under nutrition. In the present study, the lactating mothers from moderately food insecure households were 1.37 times more likely to be undernourished compared with those mothers from food secure households. The analysis did not identify statistically significant association between the households' food insecurity level and the nutritional status of the lactating mothers. However, other studies from Kenya (Gewa *et al.*, 2012) and Bangladesh (Rahman *et al.*, 2015) reported that food insecurity was significantly associated with maternal BMI. The absence of association in this study might be due to the differences in the measurement tools, the season of the study and the relatively low prevalence of food insecurity in the study area.

In this study, even if the association is not statistically significant, the odd of being undernourished were 1.26 times more likely among the mothers who did not introduce complementary feeding for their child than their counterparts. But, when we see the age of the introduction of complementary feeding, only 23.7% started additional food at the recommended age (at 6 months) whereas the 39.9% started at >6 months of age. This increases the burden of the lactating mothers to meet the nutritional demand of their child in the cost of their own nutritional status (nutrition depletion).

Recall bias is one of the limitations of this study since some of the questions were asked the event that occurred 4 weeks back. This was minimized by probing the respondents about the event. Anthropometric measurement error is also another limitation. To minimize this; data collectors were well trained, standardization of anthropometric measurers were done and the instrument was calibrated.

Conclusion and Recommendations

The result of this study revealed substantial proportion of under nutrition among the lactating mothers. The predictors of the under nutrition were the mothers' age (17-25 years of age), education (unable to read and write), and poor family wealth. Thus, strengthening health education programs on proper maternal and child dietary practices and the need of adequate dietary intake during lactation should be necessary. Additionally, strong multi-sectorial collaboration targeted at improving women's educational status in the community is very essential in order to improve health and nutritional outcomes of lactating women.

Acknowledgments

Conflict of Interests

The authors declare that there is no any conflict of interest.

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1. Instructions to Authors

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    - All authors have approved the manuscript.
    - The contribution of the paper to the body of knowledge
    - The paper is not published or submitted anywhere else for publication.
    - The declaration that the manuscript is submitted on behalf of all the authors.
- Accepted papers are subject to editorial revision without any prior notice.
- After the successful submission of manuscript, all authors will be acknowledged automatically and will be asked for potential complaint about the manuscript.
- Any query regarding the preparation and submission of manuscript to the journal should be addressed through online tracking system or email by the corresponding author.
- English is the official language of the journal.
- Copyright belongs to the publisher upon acceptance of the manuscript.
- Submission of a manuscript signifies acceptance of journal's guidelines for authors.

1.2. Manuscript Preparation

I. Original Research Paper

Papers should be in English and be prepared in A4 (8.27" X 11.69") page size, using standard fonts with size of 12, with double-spacing, and margins of at least 1" (2.5cm) all around. The recommended length for original manuscript is 2000 to 4000 words (8 to 16 typed, double-spaced pages), not including references, tables or figures. All pages numbered starting from the title page. Lines should be numbered in the margins with a continuous numbering from the start of the manuscript. Times New Roman fonts must be used and remain uniform throughout the text. The authors must strictly adhere to the proper format of the journal for all sections of the manuscript. For authors whose native language is not English, *EAJHBS* strongly recommends brushing up the English of the manuscript by consulting an English language editor before submission to avoid delays in receiving and processing of the manuscript.

Format of the Manuscript

1. ***Title page***
   - First page should include the complete title of the manuscript. Title should be font size of 14 (Bold) and the first character in each word in the title has to be capitalized (title should be centered).
   - Under the title of the manuscript write the full names of all authors (Family name of the authors should be mentioned followed by first name or given name), their affiliations and addresses, and the name and E-mail address of the corresponding author.

2. ***Abstract and Keywords***
   - Abstract (not more than 300 words) presented in a concise form and including the introduction, objective, methods, results, and conclusion of the research described in the paper.
   - A list of 3 to 5 keywords or short phrases suitable for indexing should be typed at the bottom of the abstract.
   - Avoid vague or overly general terms.

3. ***Introduction***
   - Provide sufficient background information such that a scientifically literate reader can understand and appreciate the research
   - Description of the research area, pertinent background information, and the hypotheses tested in the study should be included
   - Provide brief information about the specific aims identified along with a rationale for the specific researches and other work performed
   - State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results.
   - Introduction must include in-text citations including references to pertinent reviews and primary scientific literature.

4. ***Material and Methods***
   - Provide sufficient detail to allow the work to be reproduced.

- It should include explicit, concise descriptions of all methods or procedures employed.
- Commonly used methods require only a citation of the original source. The description should be such that the reader can judge the accuracy, reproducibility, reliability, etc. of the work.
- The statistical tool used to analyze the data should be mentioned. In case of the involvement of human participants, this section must accompany with statement on necessary ethical approval from appropriate ethical committee.

5. Results
- It should be clear and concise.
- It should include research data but not extended discussions of its relative significance.
- It is more easily grasped by readers if they are presented in graphic or tabular form rather than discursively. Written result should not be repeated in the text, tables, and figures.

6. Discussion
- This should explore the significance of the results of the work, not repeat them.
- Avoid use of irrelevant citations and discussion of published literature.
- This section should relate the results section to current understanding of the scientific problems being investigated in the field.
- Description other work/s in the field should be included here.
- This section also allows you to discuss the significance of your results.
- This section should end with new answers/ questions that arise as a result of your work.
- Speculation is to be based on data only; be concise and clear.
- Lengthy discussions will necessarily mean a delay in accepting manuscripts for publication.
- The text should be written with a logical connection between the introduction and major findings.

7. Conclusion and recomendations
- The main conclusion of the study may be presented in the main findings of the research its implications.
- The recommendations should emanate from the findings of the study.

8. Acknowledgements
- This is a brief section crediting the people/ institutions who have helped make your manuscript possible and who aided you in your work but are mention all applicable grants and other funding sources that supported your work.
- Collate acknowledgements in a separate section at the end of the article before the references and do not, therefore, include them on the title page, as a footnote to the title or otherwise.
- List here those individuals/institutions who provided help during the study.

9. Conflict of Interests
- Authors are responsible for declaring any conflict of interest related to the submitted research work.

10. Contribution of Authors (Authorship)
- Authorship be based on the following criteria:
  1. Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work;
  2. Drafting the work or revising it critically for important intellectual content;
  3. Final approval of the version to be published;
- Conditions 1, 2, and 3 must all be met.
- Participation solely in the acquisition of funding or the collection of data does not justify authorship. General supervision of the research group is also not sufficient.

11. References
- All materials (literature) referred to must be cited. References must be cited and listed in the following forms.

References in the Text
- *Smith and Charles (2008),* or if more than two authors*, Samuel et al. (2009).*
- Put references in chronological order of publications when references are more than one (William and Michael, 2007; James, 2009; Belay *et al.*, 2010) and alphabetically for references published in same year.
- The letters a, b, c, etc., should be used to distinguish citations of different works by the same author(s) in the same year.
  Example, Asfaw (2008a; b) or Asfaw et al. (2008a; b)

References in the List
- References should be listed in alphabetical order and shall have the following form:

a. Journal Articles
- Cooper, G. R., Myer, G. L., Smith, S. J., Schlant, R. C. 1992. Blood lipid measurements, variations and practical utility. *JAMA,* 267 (12): 1652 -1660.
- Kelemu, T., Mengistu, A., and Mamo, Y. 2005. Assessment of distribution of risk factors for chronic complication of diabetes among patients

attending Jimma Hospital Diabetic Clinic. *Ethiop J Health Sci,* 15(2): 187-196.

b. Books

- Siegel, S. 1956. Nonparametric Statistics for the Behavioral Sciences, 2nd edition. McGraw-Hill Book Co., New York, USA.

c. Contributions in Books (Book Chapters)

- Henderson, P. J. F. 1992. Statistical analysis of enzyme kinetic data. pp. 277-316, In: Eisenthal, R. and Danson, M. J. (Eds.), Enzyme assays: a practical approach. Oxford University Press, Oxford.

d. Unpublished Thesis

- Tadelle, K. 1988. Epidemiology and zoonotic importance of bovine tuberculosis in selected sites of Eastern Shoa, Ethiopia. Master's Thesis. Addis Ababa University, Debre Zeit.

e. Contributions in Proceedings

- Green, P. N., Hood, D., Dow, C. S. 1984. Taxonomic status of some methylotrophic bacteria. pp. 251-254. In Crawford, R. L., Hanson, R. S. (eds). Microbial growth on C_1 compounds. Proceedings of the 4th International Symposium. American Society for Microbiology, Washington, DC.

f. Publications of Organizations

- NIH (National Institutes of Health). 2002. Third report of the National Cholesterol Education Program (NCEP) Expert Panel on detection, evaluation, and treatment of high blood cholesterol in adults: Final Report. Circulation 106: 3143-3421.

g. Publications from Website

- South African National AIDS Council (SANAC). 2011. The HIV epidemic in South Africa: What do we know and how has it changed? South Africa. (http://www.hsrc.ac.za.) (Accessed August 2011).

12. Tables, Figures and Others

- Tables should bear Arabic numerals followed by the title and be referred to in the text by their numbers.
- Footnotes in tables should be indicated by superscript letters or symbols. Descriptive material not designated as a footnote may be placed under the table as a Note.
- Tables should have only 3 horizontal lines separating top and bottom of columns heading, and bottom of a table plus additional line separating mean and/or total values from the main data set in the table.
- All illustrations should be given separately, not stuck on pages and not folded. They should be numbered as figures in sequence in Arabic numerals.
- High quality, clear black and white photographs (100 x 70 mm) can be submitted to the journal; major findings should be marked clearly.
- Appropriate title to each illustration should be given at the bottom.

II. Review Articles

These consist of critical assessment of literature and data pertaining to health and biomedical topics. In these review articles, emphasis should be placed on cause, diagnosis, therapy, prognosis, and prevention. Information concerning the type of study or analysis, population, intervention, and outcome should be included for all data used. The selection process used for all data should be described. Meta-analyses will be considered as review papers. The recommended length of review articles is 2000 to 3000 words (8 to 12 typed, double-spaced pages).

III. Brief Reports

These should be short reports of original studies or evaluations. They should contain a short, structured abstract and no more than 10 references and 1 to 2 figures or tables. Brief Reports should be no more than 1500 words (6 typed, double-spaced pages).

IV. Case Reports

Case reports should be approximately 1000 to 2000 words (up to 8 typed, double-spaced pages). They must include a structured abstract. The number of references, tables, and figures should be appropriate for the overall length of the paper. In general, no more than 2 tables or 2 figures are necessary.

V. Letters to the Editor.

Letters to the Editor are encouraged. Letters must specifically address a recent article published in *East African Journal of Health and Biomedical Sciences (EAJHBS)* and may not report any new, un-reviewed data. They should be no more than 500 words (2 typed, double-spaced pages) with 5 references.

VI. Invited Editorial

These represent commentaries addressing newly published articles in the journal and are by invitation only. Invited editorials should be no more than 1200 words (5 typed double-spaced pages) with a maximum of 15 references and a maximum of 2 Figures and/or Tables.

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