

Magnitude and Determinants of Undernutrition among Pregnant Women Attending a Public Hospital in Kenya

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Abstract

Background: Undernutrition during pregnancy in the developing countries is a major public health problem due to its strong association with maternal and child morbidity and mortality. The available data on the extent and determinants of under-nutrition among pregnant women in Kenya is scant. This main objective of the study is to establish the extent and determinants of undernutrition in pregnant women attending a public hospital in Kenya. **Methods:** A cross-sectional study was conducted among 162 randomly selected pregnant women who attended antenatal clinic at Pumwani Maternity Hospital, a well-known public health facility in Nairobi. A semi-structured questionnaire was used to collect the data. Nutritional status of the pregnant mothers was determined using mid-upper arm circumference measurement. Hemoglobin level was extracted from the maternal antenatal card to determine their anemic status. Descriptive and inferential analyses were done using SPSS Software (version 22.0). Frequencies and proportions were generated for categorical variables. While mean and standard deviation were computed for continuous variables. The chi-square test of independence was employed to establish the relationship between the independent variables and dependent variable. Multivariable logistic regression analysis was used to identify the variables independently linked to maternal undernutrition. **Results:** The overall prevalence of undernutrition and anemia among the pregnant women was 27% and 39.7%, respectively. Multivariable logistic analysis showed that being single [AOR = 4.27; 95% CI = 2.21 - 8.32, P = 0.001], divorced/separated [AOR = 2.25; 95% CI = 1.13 - 4.87; P = 0.021], self-employed [AOR = 4.27; 95% CI = 2.21 - 8.32; P = 0.022], illiterate [AOR = 4.31; 95% CI = 2.55 - 8.20; P = 0.007], having short birth interval (<24 months) [AOR = 2.54; 95% CI = 1.43 - 5.53; P = 0.042] and being anemic [AOR = 2.7; 95% CI = 1.66 -

4.97; $P = 0.037$] were the variables significantly and independently associated with undernutrition among the pregnant women. **Conclusions:** Our findings show that the burden of undernutrition during pregnancy is still high in Kenya which requires urgent attention. Pregnant women who were never married, divorced/separated, self-employed, illiterate, and those with short birth interval were at increased risk of undernutrition. Nutrition intervention targeting social determinants of maternal undernutrition may result in positive outcomes. This will significantly help achieve the SDGs by reducing maternal child mortality.

Keywords

Anemia, Determinants, Kenya, Prevalence, Pregnant Women, Undernutrition

1. Introduction

Maternal nutrition during pregnancy has a substantial effect on the mother's health, pregnancy outcome, and overall maternal and child survival [1] [2] [3]. Undernutrition during pregnancy is a significant public health problem in developing countries [3] [4] [5]. Specifically, pregnant women in Sub-Saharan Africa (SSA) are disproportionately burdened with undernutrition [6] [7] [8]. A systematic review of SSA reported a high prevalence (23.5%) of undernutrition in pregnant women [9]. In Kenya, despite the provision of free maternal care, the burden of undernutrition among pregnant women remains high at 19.3% [10]. Undernutrition during pregnancy in the low and middle-income countries (LMICs) contributes to 3.5 million maternal deaths [1] [3] [11].

The risks for maternal undernutrition in developing countries are multifactorial. Maternal sociodemographic factors namely: age, marital status, level of education and income status are identified as major determinants of undernutrition during pregnancy [12] [13]. Family size, birth space, and the number of meals per day are also recognized as important determinants of maternal undernutrition in developing countries [13] [14] [15]. Undernutrition is the leading cause of maternal mortality in developing countries [16] [17]. Malnourished pregnant women are at markedly increased risk of death due to complicated delivery, anemia, and bleeding [18] [19] [20]. Furthermore, maternal undernutrition is a significant risk for miscarriages, premature delivery, low birth weight, several congenital defects, and overall neonatal and child mortality [5] [21] [22] [23]. Additionally, studies have revealed that babies born of malnourished mothers are at increased risk of developing cardiovascular diseases (CVDs) later in their adult life [3] [24] [25].

Globally, a maternal mortality rate of 152 deaths per 100,000 live births was reported in 2020, of which 94% was from developing countries [26]. According to the WHO [27], the maternal mortality rate in SSA is extremely high, 533 per

100,000 live births. In Kenya, in 2017, the maternal mortality rate was 342 per 100,000 live births [28]. The maternal mortality in the SSA is still unacceptably high, depicts lack or inadequate availability of maternal services in these countries.

According to the Sustainable Development Goals, the global maternal mortality rate is to reduce to less than 70 per 100,000 live births between 2016 and 2030 [29]. Furthermore, the WHO has planned to reduce maternal anemia by 50% by 2025 [29]. This calls specifically for the SSA countries to develop and implement effective and sustainable interventions aiming at maternal mortality reduction. To achieve these goals, updated data regarding the extent and determinants of undernutrition during pregnancy is required, which is essential to prioritize and design targeted interventions to prevent maternal undernutrition and therefore reduce maternal death. However, in Kenya, the available data on the magnitude and contributing factors of undernutrition during pregnancy is limited. The study, therefore, sought to determine the magnitude and contributing factors of undernutrition during pregnancy among mothers attending a public hospital, in Nairobi, Kenya.

2. Methods and Materials

2.1. Study Setting

This study was conducted at the antenatal clinic of Pumwani Maternity Hospital, a famous public health facility in Nairobi. It provides an affordable maternal services to the low-income people from the informal settlements of Nairobi (Eastleigh, Mathare, Muthurwa and Majengo). The hospital is the largest maternity hospital in the SSA region. It offers a wide range of maternal-related outpatient and inpatient services namely: emergency obstetric care, antenatal care, newborn unit, Prevention of Mother to Child Transmission (PMTCT) and comprehensive post-natal clinic services including family planning services. It conducts normal and caesarean deliveries. Furthermore, it serves as a practical teaching hospital for medical and nursing students.

2.2. Study Design and Participants

A health facility-based, cross-sectional study design was carried out from 21st February to 20th March 2021. The target population included all pregnant women who visited the antenatal clinic of Pumwani maternity hospital.

2.3. Sample Size and Sampling Method Determination

The Fisher's formula ($n = Z^2 pq/d^2$) was used to determine sample size by considering 95% CI. The proportion of malnutrition during pregnancy was taken from the study carried out by Mustafa *et al.* 2012 at 9%. Therefore $n = (1.96)^2 (0.09) (1 - 0.09)/(0.05)^2 = (1.96)^2 (0.09) (0.91)/(0.0025) = 126$ women. A systematic random sampling method was used to select the study participants. According to the hospital records, around 800 pregnant women attend the an-

tenatal clinic (ANC) in one month. Thus, a sampling interval of 6 was determined to select study participants. Therefore, every 6th pregnant women attending the ANC of the hospital was selected until the desired sample size was achieved.

2.4. Data Collection Tools and Procedures

A semi-structured questionnaire was used to collect data. Participants' socio-demographics, medical history, obstetric history, ANC visits and iron-folic supplementation, dietary practice and anthropometric measurements (MUAC) were obtained. Nutritional status of the pregnant mothers was determined using mid-upper arm circumference (MUAC) measurement. MUAC is the ideal anthropometric parameter to determine nutritional status during pregnancy [15]. The measurement was taken by putting a tape measure at the midpoint between the tip of the elbow of the left arm and the tip of the shoulder.

In this study, MUAC < 23 cm was considered as acute malnutrition [7] [30]. Hemoglobin level was extracted from the maternal antenatal card and anemia was defined as hemoglobin level of less than 11 g/dl [31]. Recommended meal frequency during pregnancy was considered when the mother take an additional meal (>3 meals per day) because of the current pregnancy [32].

2.5. Validity and Reliability of the Study Tool

The validity of the tools in terms of content was revised by experts in the field of nutrition and their recommendations were included in the questionnaire. To measure the reliability of the questionnaire, a test-re-test technique was carried out after two weeks. The Cohen's kappa coefficient was calculated to determine the degree of agreement between the two results. The repeated questions produced a 0.81 kappa value which was considered reliable. Furthermore a pilot study was carried out on 5% (n = 8) of the sample size to assess the clarity and objectivity of the tools.

2.6. Ethical Considerations

The study was ethically and scientifically reviewed and approved by the University of Nairobi/Kenyatta National Hospital, Ethics and Research Committee (Approval No. UP706/12/2020). Further permission to collect the data was granted from the hospital administration. Verbal and written consent was obtained from all the study participants.

2.7. Data Analyses

Data was analyzed using Statistical Package for Social Scientists (SPSS) Software (version 22.0). Frequencies and proportions were generated for categorical data. To establish the relationship between the independent and dependent variables, the chi-square test of independence was employed. Multivariable logistic regression analysis was employed to identify the factors independently associated with maternal under-nutrition. P-value of less than 0.05 was considered statistically

significant.

3. Results of the Study

3.1. Socio-Demographic and Obstetric Characteristics of the Study Population

Table 1 presents the socio-demographic and obstetric information of the study participants. The study involved 126 pregnant women who attended antenatal clinic at a public hospital in Nairobi, Kenya. Majority of the mothers were married (64.3%) with mean age of 26.39 ± 7.63 (Mean \pm SD) years. A higher proportion were belonged to Protestants (37.3%), possessed secondary level of education (43.7%) and self-employed (43.7%). The mean age at first pregnancy was 21.26 (± 4.78). Approximately one-third (35.7%) of them had one child and half (50%) were in their third trimester of pregnancy. Approximately, one-fifth (19%) had less than the recommended 24 months birth intervals.

3.2. Maternal Health Profile during Pregnancy

Most of the pregnant mothers reported they did not have any illness during the current pregnancy. A small proportion, 7.9% and 10.3% reported that they had history of aborting and preterm birth, respectively. History of bleeding and urinary tract infection during the current pregnancy was reported by 6.3% and 7.9%, respectively. Of the pregnant women, 13.5% were HIV positive. Furthermore, approximately one-third (31%), reported having illnesses during the current pregnancy, of which a higher proportion were suffered from High blood pressure (28.2%) and anemia (20.5%) (**Table 2**).

3.3. Nutritional Profiles of the Pregnant Mothers

Most, 73% and 60.3% of the pregnant mothers had normal mid upper arm circumference (MUAC) and hemoglobin level, respectively. While, 27% of the pregnant women were undernourished (MUAC < 23 cm), and 39.7% were anemic (hemoglobin level < 11 g/dl) (**Figure 1**).

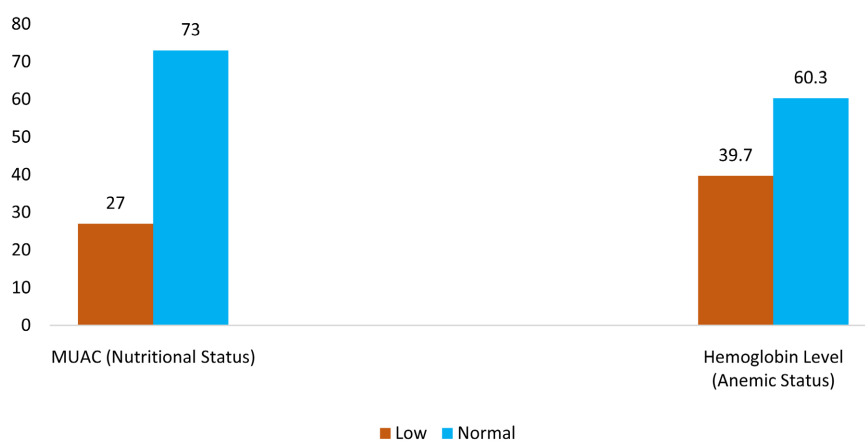


Figure 1. Nutritional and anemic status of the pregnant women (%).

Table 1. Socio-demographic and obstetric characteristics of the study population.

Characteristic	Frequency	Percent
Age in years (Mean \pm SD)	26.39	7.63
Marital Status		
Married	81	64.3
Single	42	33.3
Divorced/Separated	3	2.4
Total	126	100.0
Religion		
Protestants	47	37.3
Catholics	37	29.4
Muslims	42	33.3
Total	126	100.0
Education		
None-Primary	48	38.1
Secondary	55	43.7
Tertiary	23	18.3
Total	126	100.0
Occupation		
Government employee	38	30.2
Self-employed	55	43.7
Unemployed	33	26.2
Total	126	100.0
Residence		
Nairobi	126	100.0
Age at first pregnancy (mean \pm SD in years)	21.26	4.78
Number of live children		
None	40	31.7
One	45	35.7
2 - 3	28	22.2
Above 3	13	10.3
Total	126	100.0
Birth interval		
<24 months	24	19.0
\geq 24 months	62	49.2

Continued

First pregnancy	40	31.7
Total	126	100.0
126	100.0	
First Trimester	13	10.3
Second Trimester	50	39.7
Third Trimester	63	50.0
Total	126	100.0

Table 2. Maternal health profiles during pregnancy.

Characteristic	Frequency	Percent
History of abortion		
No	116	92.1
Yes	10	7.9
Total	126	100.0
History of preterm birth		
No	113	89.7
Yes	13	10.3
Total	126	100.0
History of bleeding during the current pregnancy		
No	118	93.7
Yes	8	6.3
Total	126	100.0
History of UTI during the current pregnancy		
No	116	92.1
Yes	10	7.9
Total	126	100.0
HIV status		
Seronegative	109	86.5
Seropositive	17	13.5
Total	126	100.0
Any other illness during the current pregnancy		
No	87	69.0
Yes	39	31.0
Total	126	100.0

Continued

If yes to the above, which one (n = 39)		
High blood pressure	11	28.2
Anaemia	8	20.5
Oligohydramnios	6	15.4
Placenta abruption	6	15.4
Polyhydramnios	6	15.4
Malaria	2	5.1
Total	39	100.0

UTI: Urinary Tract Infection.

3.4. Determinants of Undernutrition Using Unadjusted and Adjusted Logistic Regression Model

In a bivariate analysis, maternal age, marital status, occupation, level of education, gestational age, birth interval and anemic status were substantially linked to nutritional status among the pregnant women. After subjecting all these variables into multivariate analysis, marital status, occupation, level of education, birth interval and anemic status remained as independent predictors of undernutrition during pregnancy.

Single [AOR = 4.27; 95% CI = 2.21 - 8.32, P = 0.001] and divorced/separated [AOR = 2.25; 95% CI = 1.13 - 4.87; P = 0.021] pregnant women were 4 and 2 times more likely to suffer from undernutrition compared to married mothers. Self-employed pregnant women were about 4-fold [AOR = 4.27; 95% CI = 2.21 - 8.32; P = 0.022] at increased risk of undernutrition relative to government employed respondents. The odds of undernutrition was approximately 5 times [AOR = 4.31; 95% CI = 2.55 - 8.20; P = 0.007] higher among illiterate pregnant women as compared to those who attained tertiary level of education. Pregnant women who had short birth interval (<24 months) were at increased risk of undernutrition [AOR = 2.54; 95% CI = 1.43 - 5.53; P = 0.042] relative to those who had the recommended birth interval of ≥ 24 months. Pregnant women who had anemia were about 3-fold [AOR = 2.7; 95% CI = 1.66 - 4.97; P = 0.037] increased risk of undernutrition relative to non-anemic mothers (**Table 3**).

4. Discussion

The study aimed to establish the magnitude and determinants of maternal undernutrition in Nairobi, Kenya. Our findings showed that approximately one in four women was undernutrition and slightly above one-third (39.7%) were anemic. Despite several nutrition intervention programs that have been put in place such as the Kenya Nutrition Action Plan (2018-2022), Kenya vision 2030, and the Agriculture Sector Development Strategy 2010-2020 [33], the magnitude of maternal undernutrition in the current study is still of serious public health

Table 3. Factors associated with undernutrition using unadjusted and adjusted logistic regression (n, %).

Variables	Under-nourished	well-nourished	COR (95% CI)	p-value	AOR (95% CI)	p-value
Age in years						
Below 20	12 (38.7)	19 (61.3)	2.12 (1.12 - 4.75)	0.043	1.81 (0.24 - 3.76)	0.064
20 - 30	17 (26.6)	47 (73.4)	1.29 (0.94 - 3.16)	0.058	1.01 (0.67 - 2.82)	0.072
Above 30	5 (16.1)	26 (83.9)	Reference		Reference	
Religion						
Protestants	13 (27.7)	34 (72.3)	1.04 (0.45 - 2.48)	0.106		
Catholics	14 (37.8)	23 (62.2)	1.22 (0.56 - 1.95)	0.086		
Muslims	7 (16.7)	35 (83.3)	Reference			
Marital status						
Single	20 (47.6)	22 (52.4)	3.34 (1.98 - 7.65)	0.002	4.27 (2.21 - 8.32)	0.001
Divorced/separated	1 (33.3)	2 (66.7)	2.41 (1.21 - 5.14)	0.023	2.25 (1.13 - 4.87)	0.021
Married	13 (16.0)	68 (84.0)	Reference		Reference	
Occupation						
Self-employed	22 (40.0)	33 (60.0)	4.29 (1.98 - 7.65)	0.012	4.27 (2.21 - 8.32)	0.022
Unemployed	9 (27.3)	24 (72.7)	2.41 (1.21 - 5.14)	0.041	2.25 (1.13 - 4.87)	0.061
Got employee	3 (7.9)	35 (92.1)	Reference		Reference	
Education						
None-primary	19 (39.6)	29 (60.4)	3.97 (1.67 - 6.74)	0.025	5.31 (2.55 - 8.20)	0.007
Secondary	12 (21.8)	43 (78.2)	1.41 (0.65 - 2.94)	0.081	1.25 (0.58 - 2.79)	0.091
Tertiary	3 (13.0)	20 (87.0)	Reference		Reference	
Trimester						
Third Trimester	24 (38.1%)	39 (61.9)	2.68 (1.08 - 6.54)	0.037	2.05 (0.71 - 4.96)	0.057
Second Trimester	8 (16.0)	42 (84.0)	1.02 (0.41 - 2.19)	0.876	1.01 (0.38 - 1.92)	0.905
First Trimester	2 (15.4)	11 (84.6)	Reference		Reference	
Birth interval						
Firs pregnancy	11 (27.5)	29 (72.5)	1.52 (0.86 - 2.47)	0.062	1.32 (0.66 - 2.27)	0.077
<24 months	12 (50.0)	12 (50.0)	2.88 (1.66 - 6.12)	0.026	2.54 (1.43 - 5.53)	0.042
≥24 months	11 (17.7)	51 (82.3)	Reference		Reference	
HIV status						
Seropositive	7 (41.2)	10 (58.8)	1.37 (0.72 - 2.71)	0.081		
Seronegative	27 (24.8)	82 (75.2)	Reference			
History of bleeding						
Yes	2 (25.0)	6 (75.0)	1.02 (0.41 - 2.19)	0.876		
No	32 (27.1)	86 (72.9)	Reference			

Continued

History of UTI						
Yes	2 (20.0)	8 (80.0)	0.73 (0.44 - 1.59)	0.209		
No	32 (27.6)	84 (72.4)	Reference			
Anemia						
Yes	20 (40.0)	30 (60.0)	3.12 (1.86 - 5.28)	0.021	2.7 (1.66 - 4.97)	0.037
No	14 (18.4)	62 (81.6)	Reference			
Number of meals per day						
<3	19 (48.7)	20 (51.3)	0.78 (0.39 - 1.42)	0.129		
≥3	57 (65.5)	30 (34.5)	Reference			

concern. The findings further showed that pregnant women who were single, illiterate, self-employed, anemic, and those who had short birth intervals (<24 months) were significantly at increased risk of undernutrition. Nutrition intervention focusing on specific social determinants of health in pregnant mothers is urgently required to tackle the burden of maternal undernutrition in Kenya.

The current study found a 27% prevalence of maternal undernutrition, which is higher than previous reports in Kenya at 19.3% [10] and in the Sub-Saharan Africa region at 23.5% [9]. It is similar to a Ghanaian finding of 28.8% [34]. However, it is much lower than several findings in Ethiopian at 38% [35], 41.2% [36], 43.1% [37], and 52.9% [38] using the same criteria (MUAC < 23 cm). It is also lower than Bangladesh's report at 32% [39]. Differences in socioeconomic status, culture, ethnicity, geographical location, and sample population might be attributed to the difference in the prevalence of maternal undernutrition.

Our findings indicate that pregnant women who had never married were more likely to be undernourished relative to those who were currently married. Similar findings were reported in Ethiopia [40] [41], Tanzania [42], and Bangladesh [43]. Relative to married women, single mothers are more likely to suffer from food insecurity and lack of adequate psychosocial support system during pregnancy, which might negatively affect their nutritional status [44]. Hence, nutrition intervention targeting single women is highly recommended. In the current study, undernutrition was significantly more prevalent among illiterate pregnant women relative to those who attained a higher level of education. Consistent findings have been reported in Kenya [45] and Ethiopia [40] [41] [46] [47]. The likely explanation for this association is that illiterate women are less likely to be knowledgeable regarding the importance of nutrition during pregnancy, which may influence their nutritional status [48]. Additionally, illiterate women are more likely to suffer from food insecurity and are unable to take a balanced diet [49]. Furthermore, women with a low level of education are more likely to have short birth intervals, a major risk factor for maternal undernutrition [50] [51]. Self-employed pregnant women were more likely to be malnourished.

rished as compared to government-employed mothers, in line with other previous reports [52] [53].

In the current study, pregnant women who had short birth intervals (<24 months) were at higher risk of undernutrition relative to those who had the WHO recommended intervals of ≥ 24 months [54]. This finding is consistent with a study carried out in Bangladesh [55]. This can be explained by the fact that short birth interval may deplete micronutrient reserves and increases the risk of undernutrition [50] [51]. Furthermore, the current study found a 39.7% prevalence of anemia, which is higher than Ethiopian finding of 32.8% [47]. Anemia during pregnancy is considered a severe public health problem if the prevalence is $\geq 40\%$ [31]. In the current study, undernutrition was significantly more common among anemic women compared to non-anemic women. This is in line with several reports in Kenya [56], Ethiopia [47] [57] [58], and Sudan [59]. Anemic pregnant women suffer from micronutrients and are therefore more likely to be malnourished [60] [61].

Limitations of the Study

Firstly, being as a cross-sectional design, it may not establish the cause-effect relationship. Secondly, this study was conducted in one hospital which is located in the capital city of Kenya, Nairobi, therefore, generalizability to other rural hospitals in the country may not be possible.

5. Conclusion

A significant number of pregnant mothers are suffering from undernutrition associated with the social determinants of health. The magnitude of maternal undernutrition and anemia is still a serious public health concern. The single, self-employed, those with a low level of education and those who had short birth intervals are disproportionately burdened with undernutrition. These findings underscore the need to implement targeted interventions focusing on the social determinant of health to significantly decrease the burden of undernutrition among pregnant women. This requires a multi-sectoral collaboration between the community, government, and non-governmental sectors to improve nutritional status during pregnancy.

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Authors' Contribution

Tekeste and Margaret were involved in proposal writing. Margaret collected the data. Tekeste carried out data analysis and interpreted the results. Tekeste drafted the paper and Weldemichael critically reviewed it.

Availability of Data and Materials

The dataset analyzed for the current study is available from the corresponding author on a reasonable request.

Ethics Approval and Consent to Participate

The study was ethically and scientifically reviewed and approved by the University of Nairobi/Kenyatta National Hospital, Ethics and Research Committee (Approval No. UP706/12/2020). Further permission to collect the data was granted from the hospital administration. Verbal and written consent was obtained from all the study participants.

Conflicts of Interest

The authors declare that they have no any competing interests.

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Questionnaire

PART 1: Demographic information of the participants

- 1) Age in years: _____
- 2) Current marital status: [1] Married [2] Single [3] Divorced [4] Separated [5] Widowed [6] Cohabiting
- 3) Ethnic group?
- 4) Religion affiliation: [1] Protestant [2] Catholic [3] Muslim Others (specify)
- 5) What is your highest level of education [1] No formal education [2] Primary [3] Secondary [4] Tertiary/University
- 6) Where do you live?
- 7) What is your occupation: [1] Government employee [2] Non-government employee [3] Self-employed [4] Unemployed [5] House wife
- 8) What is your family net monthly income?
- 9) Availability of psycho-social support system [1] Yes [2] No

PART 2: Obstetric history of the participant

S. No.	QUESTION	RESPONSE
1.	Age at first pregnancies (years):	
2.	Number of pregnancies (gravid):	
3.	Parity:	
4.	Number of living children:	
5.	Age of the youngest child:	
6.	Birth interval in months (between the current pregnancy and the previous child)	
7.	History of abortion:	[1] Yes [2] No
8.	History of bleeding during the current pregnancy:	[1] Yes [2] No
9.	History of preterm birth:	[1] Yes [2] No
10.	Gestational in weeks:	

PART 3: Health conditions during the current prregnancy

S. No.	QUESTIONS.	RESPONSE.
1.	Do you have any chronic illness such as diabetes, cancer, kidney or heart disease	[1] Yes [2] No
1.1	If yes, which one?	
2.	History of any illness during the current pregnancy:	[1] Yes [2] No
2.1	If yes, what type of disease/s?	

Continued

3.0	History of urinary tract infection during pregnancy:	[1] Yes [2] No
3.1	If yes, did you take any antibiotic/s	[1] Yes [2] No
3.2	If yes, what type/s of antibiotic/s did you take? And for how long?	
4.0	Did you have any pregnancy related problem?	[1] Yes [2] No
4.1	If yes, state the health problem/s:	
5.0	HIV status(refer to the ANC booklet for this question)	[1] Seropositive [2] Seronegative
6.0	History of any drug/s use during pregnancy:	[1] Yes [2] No
6.1	If yes, specify the drug/s	
6.2	Duration:	

PART 4: Dietary intake of the participant

S. No.	QUESTION.	ANSWER.
1.	In a typical day how many meals do you take?	[1] 1 meal [2] 2 meals [3] 3 meals [4] ≥4
2.	How often do you take a home cooked meal?	[1] Always [2] Sometimes [3] Rarely
3.	How often do you eat out?	[1] Always [2] Sometimes [3] Rarely
4.	How often do you take fast foods ie pizza, burger	[1] Always [2] Sometimes [3] Rarely
5.	In a typical week, on how often do you eat a fruit?	[1] Always [2] Sometimes [3] Rarely
6.	In a typical week, on how often do you eat vegetables?	[1] Always [2] Sometimes [3] Rarely
7.	How often do you add salt to your food right before you eat or as you are eating?	[1] Always [2] Sometimes [3] Rarely
8.	How often is salt added in cooking or preparing food?	[1] Always [2] Sometimes [3] Rarely

Continued

9.	How much salt do you think you consume?	[1] Too much [2] Just the right amount [3] Too little [4] Don't know
10.	How important to you is lowering the salt in your diet?	[1] Far too much [2] Just the right amount [3] Too little [4] I don't know
11.	Do you think that too much salt in your diet could cause a health problem.	[1] Yes [2] No

PART 5: Do you do any of the following on a regular basis to control your salt intake?

S. No.	QUESTION.	ANSWER.
1.	Limit consumption of processed food	[1] Yes [2] No
2.	Look at the salt or sodium content on food labels.	[1] Yes [2] No
3.	Buy low salt/sodium alternatives	[1] Yes [2] No
4.	Use spices other than salt when cooking	[1] Yes [2] No
5.	Avoid eating foods prepared outside home	[1] Yes [2] No
6.	Do other things specifically to control your salt intake?	[1] Yes [2] No
7.	Other{please specify}	
8.	Do you take sugar?	[1] Yes [2] No
9.	How often do you take sugar?	[1] Too much [2] Just the right amount [3] Too little [4] Don't know
10.	Approximately how many teaspoons of sugar do you take?	Number of teaspoons:
11.	How often do you take sugary foods <i>i.e.</i> cakes, biscuits in a week?	Number of days:
12.	How important to you is lowering the sugar in your diet?	[1] Far too much [2] Just the right amount [3] Too little [4] I don't know

Continued

13.	Do you think that too much sugar or sugary foods and drinks in your diet could cause a health problem?	[1] Yes [2] No
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PART 6: Behavioural and lifestyle habits of participants

S. No.	QUESTION.	ANSWER.
1.	Do you take any alcoholic beverage?	[1] Yes [2] No
2.	If yes, please specify:	
3.	Do you take alcohol:	[1] Yes [2] No
4.	If yes, which type of alcohol/s do you take?	
5.	If yes, how many standard drinks do you take in one drinking session?	
6.	If yes, For how long have you take alcohol?	
7.	Do you smoke cigarettes?	[1] Yes [2] No
8.	If yes, how many cigarettes do you take in one day?	
9.	If yes, how long have you taken cigarette?	
10.	Do you take any other type of drug?	[1] Yes [2] No
11.	If yes, please specify:	

PART 7: Presence of co-morbidities

Do you have any of these diseases?

S. No.	QUESTION.	ANSWER.
1.	Diabetes	[1] Yes [2] No
2.	Obesity	[1] Yes [2] No
3.	Cardiovascular disease	[1] Yes [2] No
4.	Kidney disease	[1] Yes [2] No
5.	Thyroid problem	[1] Yes [2] No
6.	Cancer	[1] Yes [2] No
7.	Stroke	[1] Yes [2] No

PART 8: Antenatal profile of the participants

Antenatal profile done (to obtain details from MCH card)

Hemoglobin (Hb) level(mg/dl):					
Parameter.	Positive.	Negative.	Indeterminate.		
HIV					
VDRL					
Urinalysis report.					
Clinic visit	Protein	Sugar	Bacteriuria	MCH card seen	MCH card not seen.
1.					
2.					
3.					
4.					
5.					

PART 9: Anthropometric and haemoglobin measurements of the participants

Refer to the mother's antenatal clinic card and record for the previous weight and Hb level.

1. Current weight (Kgs)
2. Current Height (cm)
3. Body mass index
4. Current MUAC (cm)
5. Previous hemoglobin level (mg/dl)
6. Current hemoglobin level (mg/dl)