Factors Associated with Diet Quality of Mothers and Birth Weight of Infants at Lodwar Referral Hospital in Turkana County, Kenya

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Abstract

Maternal factors have been shown to affect maternal outcomes over the years. Low birth weight and preterm birth have been linked to maternal dietary intake during gestation. The prevalence of low birth weight at Lodwar Referral Hospital is 14%. The main objective was to determine the factors associated with maternal diet quality and infants' birth weight in Turkana County. The study used a longitudinal design to collect data from 2023 to 2024 at Lodwar Referral Hospital among mothers aged 18 years and above. The researcher recruited 540 mothers, of whom 500 completed enrollments using a systematic random technique. After pregnancies, 38 defaulted from follow-up, and 2 had stillbirths, resulting in an overall response rate of 93% among mothers. Data were collected using pretested structured questionnaires. SPSS version 29 was used for analysis. A log-binomial model was used to estimate the adjusted risk ratio and its 95% CI for the risk factors for low birth weight. Multi-collinearity was assessed using the variance inflation factor (VIF) with a cut-off of 8; no multicollinearity was found. The overall incidence of low birth weight was 14% (95% CI: 11.1, 17.4%). The difference in low-birth-weight incidence was statistically significant (p-value = 0.006). The risk factors for low birth weight were maternal illiteracy (ARR: 1.8, 95% CI: 1.01, 3.3) and low monthly family income <5000 Ksh. (ARR:1.6,95%CI:1.07,2.2), food taboos during pregnancy (ARR:0.47,95%CI:0.28,0.78), and diet meal number<5 (ARR:1.9,95%CI:1.05,2.61). The prevalence of low birth weight was 14% (70). Low birth weight significantly affected children of mothers with poor diet quality, illiteracy, and poverty. The study recommended that MOH nutritionists promote knowledge of recommended diet quality and exclusive breastfeeding among pregnant mothers. Further research should be conducted to determine the cause of the high prevalence of low-birth-weight cases at Lodwar hospital.

Keywords: *Maternal nutrition, Infant birth Weight, Diet quality of mothers, Turkana County*

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1.0 Introduction

Regardless of gestational age, infants weighing less than 2.5 kg at birth are classified as low birth weight (LBW) by the World Health Organization. Approximately 15-20 percent of births globally result in LBW infants. In low- and middle-income countries, over 95 percent of newborns fall into this category, bearing a disproportionate burden of LBW (Cutland et al., 2020). Given limited resources in certain settings, LBW is a significant public health concern because of its association with increased risks of infant morbidity, mortality, and disability. In addition to the infant's nutritional and health status, growth and development are important factors to consider, on both the physical and psychosocial levels, as they affect the infant's chances of survival. As of 2009, the LBW rate in Mexico was reported to be 8.5 percent (Buekens et al., 2013). Canfield, Padilla, Lara Lona, and Lozano conducted a study that identified variables linked to low-birth-weight babies worldwide. These variables included the child's gender at birth, the mother's age and the fetus's age at birth, the mother's nutrition, smoking, the interval between pregnancies, and malnutrition. The prevalence of LBW shows minimal variation across regions, with sub-Saharan Africa reporting a range of 13-15%. East Africa specifically has a prevalence of 13.5%. Additionally, UNICEF estimated that between 2006 and 2010, Kenya had a prevalence of 8% for LBW births according to Abu-Saad and Fraser (2010), Dimasuay et al. (2016) Morrison and Regnault (2016), and this is believed to be partially influenced by alterations in the metabolism and hormone levels of mothers. The outcomes of this research have the potential to enhance current understanding of nutrition during the crucial initial 1,000 days of life, commonly referred to as the "window of opportunity." Moreover, the findings regarding diet quality are congruent, as four studies have identified a link between higher diet quality during pregnancy and a decreased likelihood of low birth weight (LBW) (Chatzietal., 2012; Gilbert-Diamondetal., 2018). According to the study, the age bracket with the greatest risk of stillbirths was ≤ 14 years, followed by a decline in risk at ages 22 to 29 and a steady increase in risk at ≥ 44 years old. According to the study, the risk was highest for adolescents aged ≤ 14 years. Individuals aged 27 and below had the highest risk among the LBW group with ages ≤ 14 years. Those aged 31-32 had a lower risk than those aged 32 and above, who were at higher risk (Weng et al., 2014). According to KDHS (2014), women who get pregnant for the first time at ages 15 or 39 were more prone to experiencing stillbirth than women in other age groups.

Statement of the problem

Low birth weight is a significant public health concern because it is strongly linked to infant and child morbidity and contributes to the overall burden of infant and child mortality. Infants with low birth weight are at higher risk of severe health issues, long-term disabilities, and even death. In Kenya, low birth weight is the 15th leading cause of death WHO (2011), and studies have shown that 14.2% of infant deaths in the country are attributed to extremely low birth weight. Turkana County, known for its high prevalence of low-birth-weight children, is particularly affected by malnutrition, especially among women of

childbearing age, due to factors such as drought, poverty, and illiteracy.

General objective

To determine factors associated with maternal diet quality and infant birth weights at Lodwar Referral Hospital in Turkana County.

Research Hypothesis

H_0: There was no significant association between the prevalence of low birth weight and maternal diet quality at Lodwar Referral Hospital in Turkana County.

"The overall prevalence of low birth weight at Lodwar Referral Hospital in Turkana County was 14% (95% CI: 11.1, 17.4%), and was higher among undernourished mothers"

Theoretical Review

According to the Barker hypothesis, proposed by physician Barker in 2008, the fetus's body mass is physiologically and anatomically programmed to adapt to a life of undernutrition. This causes the fetus to be born as a low-birth-weight baby and later develop health problems. In developing countries, many babies are poorly nourished during pregnancy because their mothers eat diets that are unbalanced in macro- and micronutrients, leading to multiple nutrient deficiencies.

Empirical Review

Low birth weight is an important public health problem because it is associated with neonatal mortality. A systematic review of the literature up to 2011 and a meta-analysis reported an odds ratio of 8.5 for neonatal mortality in full-term newborns (≥37 gestational weeks) with a birth weight <2.5 kg (Malin et al., 2014).

Therefore, efforts have been made to identify the factors associated with LBW. In an investigation using SINASC data from 1996 to 2011, improvements in maternal schooling levels and prenatal care coverage were associated with a reduction in the risk of LBW across all regions of Brazil (Souza et al., 2016).

2.0 Materials and Methods

The study used a longitudinal design, which was deemed appropriate for collecting data at Lodwar Hospital in Turkana County. This design enabled the researcher to collect useful information about the phenomenon under study. The target population included mothers 18 years and older with live-born infants of both low and normal birth weight. A sample of 540 mothers with live births was targeted for the study. During the study period, 38 defaulters and 2 stillbirths were identified. The researcher obtained a total sample size of 500 mothers of both low- and normal-birth-weight infants during and after birth. Systematic random sampling was also used, with a sampling interval (R) of 4, to recruit members until the required sample size was obtained. Data were collected at the maternity ward as mothers delivered. The researcher used digital baby scales and mothers' weighing scales to measure birth weight and determine whether respondents had low birth weight. A 24-hour recall table was used to assess diet quality. Once collected, the data were sorted, cleaned, coded, and entered into

SPSS version 29 for analysis. Chi-square p-values, percentages, pie charts, figures, and tables were used to present the data (Louie et al., 2015). The data were also validated and reliability tested to identify factors associated with mothers' diet quality and infants' birth weights. The Ethical Review Committee (ERC) at KEMU granted ethical approval for the study, with registration number KeMu/SEC/HND/P/3/2021. Prior permission was obtained from the Turkana County government to collect data at Lodwar referral hospital. Additionally, an exploration permit was obtained from the National Commission for Science, Technology, and Innovation, bearing license number NACOSTI/P/21/8851. Participation in the study was voluntary, and informed consent was obtained after the purpose of the research was explained. Participants provided written or thumbprint consent, guaranteeing the protection of their privacy. The privacy of respondents was protected by not recording their names.

3.0 Result and Discussion

The study achieved a response rate of 93% among both under- and well-nourished mothers aged 18 years and older.

Socio-demographic factors

The study sought to determine the ages of mothers with low-birth-weight babies, as shown in Table 1. The report showed that most respondents were between 19 and 35 years old, with the largest percentage being mothers aged 30 to 35 at 32. 2% undernourished and 42. 7% nourished. Mothers aged 35 and above were the least recorded, with only 15—5%. Studies in Kenya have shown that mothers <20 years of age and those >35 years of age had a higher chance of having low-birth-weight babies than those between 20 and 35 (Aboderin et al., 2015). Mothers aged 35 and above were the least recorded, with 15. 5%, and 9. 8% of both undernourished and normally nourished mothers (Patel R. et al., 2019). This study shows the same results, with a high incidence of low birth weight among mothers over 35 years and those under 20 years. Looking at the levels of education in Table 1, the study revealed that 60. 2% of the mothers were illiterate. Maternal illiteracy was directly linked to incidences of low- birth- weight babies. Studies have shown that maternal illiteracy is directly linked to low birth weight and preterm births. Most mothers had secondary education, and among this group, 23. 23.3% were undernourished, 27. 8% were normal, and 18% were undernourished. Their husbands, on the other hand, had a large number with tertiary education at 36. 9%, with only 19. 7% being in the illiterate group. The spouse's education level has been associated with support for the mother during pregnancy complications and childbirth. A low husband's education showed a significant association with poor birth outcomes, including low birth weight (Agushybana, 2016). The mother's education level in this study was found to affect children's birth weight; this is consistent with other studies showing a significant relationship between the mother's education level and birth weight. A study in the United States showed that the mean birth weight increased with higher maternal education by 27-108 grams. There was also a correlation between maternal education and infant mortality, with infant

mortality rates decreasing with higher maternal education (Gage et al., 2013), as shown in Table 1.

Table 1

Socio-demographic factors of the Respondents

Variables		Under-nourished mothers, *N*=245(%	Normal nourished mothers N=255(%)	Chi-square test,	*P*-value
Mothers, ages	19–24years	71(29%)	53 (20.8%)		0.13
	25–29years	56 (22.9%)	68 (26.7%)		
	30–35years	80 (32.7%)	109 (42.7%)		
	Above35years	38 (15.5%)	25(9.8%)		
Education Levels of Mothers	Illiterate	84 (34.3%)	43 (16.9%)		0.001
	Primary (1–8 Class)	60 (24.5%)	65 (25.5%)		
	Secondary (9–10 Form)	57(23.3%)	71 (27.8%)		
	Tertiary (1-4Year)	44(18%)	76 (29.8%)		
Educational levels of Husbands	Primary (1-8 Class)	46 (19.7%)	26 (11.2%)		0.11
	Secondary (1–4 Year)	86 (36.9%)	57 (24.5%)		
	College(1–3grades) 51	(21.9%	66 (28.3%)		
	University (1-4Year)	50 (21.5%)	84 (36.1%)		
Marital Status	Single	15 (6.1%)	94 (38.5%)		0.09
	Divorced	39(15.9)	11(4.5%)		
	Widowed	65 (26.5%)	13(5.3%)		
	Marriage	126 (51.4%)	126 (51.6%)		
House Size	1-2 members	72(29.4%)	119 (51.1%)		0.21
	3-4 members	135 (55.1%)	92 (39.5%)		
	5> members	38(15.5%)	22(9.4%)		
Numbers of Children	3-4 Children	78 (31.8%)	44 (17.3%)		0.001
	2-3 Children	75 (30.6%)	106 (41.6%)		
	1-2 Children	92(37.6%)	105 (41.2%)		
Religious Affiliation	Christians	165(67.3%)	245(96.1%)		0.14
	Muslims	80(32.7%)	10 (3.9%)		

Similar research also found that higher maternal education significantly reduces the likelihood of having low-birth-weight infants (Godah et al., 2020). A large percentage of respondents were married (51.4%), while those who were single were 6.1%, and the divorced group was the least at 4.5%, as seen in Table 1. Several studies have shown that the marital status of mothers significantly affects the birth weight of the baby, with a strong association with low-birth-weight infants. However, in this study, there was no significant association between low birth weight and the mother's marital status. Among the total respondents, 29.4% had 1-2 children, while the lowest percentage was among those who had 2-3 children, at 30.6%.

Social-economic characteristics among the respondents

The monthly income assessment in Table 2 showed that most mothers and their families had monthly incomes of more than 10000 Kenyan shillings (37.6%), followed by those

with incomes of 5000 (31.8%). The lowest percentage had incomes of less than 5000-1000, at 0.6% of respondents. This indicates a low-income population unable to afford certain food varieties. We also assessed the husbands' occupations in Table 2 and found that the largest percentage was civil servants at 29.4%, and the least common occupation was daily casual work at 2.4%. Monthly income was directly linked to birth weight outcomes, as it affected the types and frequency of meals the mother consumed during pregnancy. As shown in Table 2, working in strenuous conditions, both at home and at the workplace, was strongly associated with low birth weight. .67.3% of the mothers in this research worked under strenuous conditions, while only 32.7% did not.

Table 2

Social-economic characteristics among the respondents

Variables		Under nourished mothers *N*=245(%)	Normal nourished mothers N=255(%)	Chi-square test, *P*-value
Sources of Income	Friends' donation	71(29%)	53 (20.8%)	0.13
	Casual jobs	56 (22.9%)	68 (26.7%)	
	Farming	80 (32.7%)	109 (42.7%)	
	Family contribution	38 (15.5%)	25(9.8%)	
Sources of Fuel Energy	Electricity	84 (34.3%)	43 (16.9%)	0.001
	Firewood's	60 (24.5%)	65 (25.5%)	
	Cooking gases	57 (23.3%)	71 (27.8%)	
	Cooking charcoal	44(18%)	76 (29.8%)	
Types of Housing	Traditional House	46 (19.7%)	26 (11.2%)	0.11
	Permanent house	86 (36.9%)	57 (24.5%)	
	Semi-permanent house	51(21.9%	66 (28.3%)	
	No house, but rent	50 (21.5%)	84 (36.1%)	
Occupation of Mothers	Civil servant	15 (6.1%)	94 (36.9%)	0.09
	Daily worker	39(15.9%)	11(4.3%)	
	Farmers	91(37.1%)	50(19.6%)	
	Own business	100 (40.8%)	100(39.2%)	
	Housewife	126 (51.4%)	126 (49.4%)	
Occupation of Husbands	Civil servant	72(29.4%)	119 (46.6%)	0.21
	Own business	12 (4.9%)	5 (2.0%)	
	Daily worker/waitress/	30(2.4%)	5(2.0%)	
	Farmer	5(12.4%)	0(0.0%)	
Monthly Income	< Ksh.5000	78 (31.8%)	44 (17.3%)	0.001
	Ksh.5000-10000	75 (30.6%)	106 (41.6%)	
	>Ksh.10000	92(37.6%)	105 (41.2%)	0.14
Work Environments	Strenuous	165(67.3%)	245(96.1%)	
	Not strenuous	80(32.7%)	10(3.9%)	

Dietary Habits of Respondents

The 24-hour recall was used to assess patients' dietary habits. The results indicated that 82.9% of mothers consumed fewer than 3 meals per day, while 17.1% consumed more than 4 meals per day (Table 3). This was lower than the recommended meal frequency during pregnancy and lactation (Aburto et al., 2016). Mothers who had fewer than 3 meals in this study were more likely to have low-birth-weight infants. These results were consistent

with other studies reporting a significant association between meal frequency per day and pregnancy outcomes (Alebel et al., 2019). Research among pregnant mothers showed that the frequency of food consumption significantly affected infants' birth weight at the $p < 0.05$ significance level. This frequency also affected the mother's gestational weight gain, which affected the baby's growth, leading to Small for Gestational Age (SGA) and LBW babies Zra et al. (2023), as shown in the table below.

Table 3

Dietary-related factors

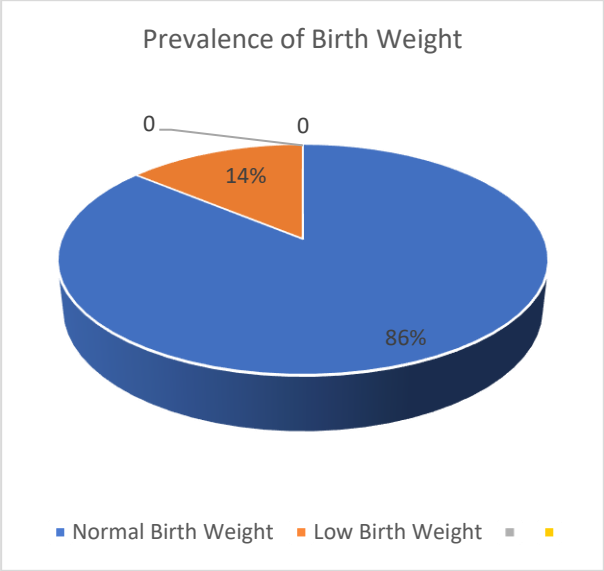
Variables		Under-nourished mothers, N=245(%	Normal nourished mothers N=255(%)	Chi-square test, *P*-value
Number of meals per day	≤3times	203 (82.9%)	171(67.1%)	0.001
	≥4times	42 (17.1%)	84 (32.9%)	
Additional meal per day	No additional meals (as usual)	35(14.3%)	78 (30.6%)	0.001
	Once	81 (33.1%)	46(18%)	
	Twice	94 (38.4%)	72 (28.2%)	
	Three times and above	35(14.3%)	59 (23.1%)	
Drinking coffee/tea shortly after meals	No drinking of coffee/tea	58 (23.7%)	94 (36.9%)	0.005
	1–2cups	99 (40.4%)	80 (31.4%)	
	≥3cups	88(35.9%)	81 (31.8%)	
Food security level	Mildly food insecure with hunger	17(6.9%)	10(3.9%)	0.14
	Mild food insecure without hunger	80(32.7%)	72 (28.2%)	
	Food secured	148(60.4%)	173(67.8%)	

Prevalence of low-birth-weight Infants

The prevalence of low birth weight was 14%, and that of normal birth weight was 86%, as shown in Fig. 1. Studies in Turkana have reported similar results, with a high prevalence of low birth weight. These have often been associated with maternal illiteracy, low family income, and rural residence (Achar, 2019). This prevalence needs to be reduced to avoid the high infant mortality rate in the Turkana region, which is related to low birth weight (Thapa et al., 2022).

Figure 1

Prevalence of low-birth-weight Infant



Factors associated with low-birth-weight Infants.

Table 3 shows the factors associated with low-birth-weight infants. The overall cumulative prevalence of low birth weight was 14% (95% CI: 11.1, 17.4%). This study assessed maternal, socioeconomic, environmental, and nutritional factors associated with low birth weight (LBW) among the study population. Key factors examined included maternal height, education, occupation, family income and size, sanitation, fasting practices, pregnancy-related disease, and dietary diversity. Maternal height showed a clear association with LBW. Although most mothers (87.2%) had a height ≥1.45 m, a smaller proportion (8.6%) had a height <1.45 m, which was significantly linked to an increased risk of LBW. This finding is consistent with evidence that short maternal stature is associated with preterm delivery and restricted fetal growth (Han et al., 2012). Maternal education emerged as an important determinant. Over half of the mothers (50.4%) had low educational attainment (no formal education or only primary education). Lower educational levels were associated with limited maternal knowledge of nutrition, particularly regarding meal frequency and dietary variety, increasing the risk of LBW. This aligns with previous studies demonstrating a strong relationship between maternal education, nutritional practices, and infant birth weight (Muula et al., 2011; Godah et al., 2020).

Table 4

Factors associated with low-birth-weight Infants

Variables		Low birth weight		CRR (95%CI)	ARR (95%CI)
		Yes (%)	No (%)		
Maternal height	≤1.45m	3(4.3)	41(9.5)	0.15(0.12,1.8)	0.56(0.19,1.64)
	>1.45m(ref.)	67(95.7)	389(90.5)	1	1
Maternal educational status*	Illiterate	18(25.7)	109(25.3)	0.06(0.57,1.99)	1.8(1.01,3.3) *
	Primary school	16(22.9)	109(25.3)	0.96(0.5,1.8)	1.89(0.89,4.04)
	Secondary High School	20(28.6)	108(25.1)	1.17(0.64,2.5)	1.86(0.98,3.44)
	Tertiary/University(ref.)	16(22.9)	104(24.2)	1	1
Maternal occupational status	Civil servant	25(35.7)	84(20)	2.63(1.55,4.45)	2.69(1.56,4.68)
	Farmer/daily worker	5(7.1)	45(10.7)	1.15(0.46,2.88)	1.08(0.43,2.69)
	Own business	18(25.7)	60(14.3)	2.64(1.49,4.67)	1.75(0.98,2.32)
	Housewife(ref.)	22(31.4)	230(54.9)	1	1
Monthly family income**	< Ks.5000	23(32.9)	99(23)	1.09(0.68,1.76)	1.6(1.07,2.2) **
	Ks. 5000-10000	13(18.6)	168(39.1)	0.42(0.23,0.76)	0.47(0.28,0.78)
	>10000(ref.)	34(48.6)	163(37.9)	1	1
Family size	≤4	50(71.4)	267(62.1)	1.44(0.89,2.35)	1.44(0.88,2.34)
	>4(ref.)	20(28.6)	163(37.9)	1	1
Fats *	None	34(48.6)	319(75.6)	0.37(0.24,0.57)	0.47(0.28,0.78) *
	1-2 times(ref.)	36(51.4)	103(24.4)	1	1
Sugar	1-2 times	27(38.6)	195(45.3)	0.79(0.5,1.23)	1.12(0.71,1.75)
	>3 times(ref.)	43(61.4)	235(54.7)	1	1
Food taboos during pregnancy	Death	2(2.9%)	58(13.5)	0.22(0.05,0.86)	0.25(0.06,0.98)
	Infantile colic(ref.)	68(97.1)	372(86.5)	1	1
DDS*	Low(<5)	35(50)	226(52.6)	0.92(0.59,1.4)	1.9(1.05,2.61) *

	Adequate(≥5)(ref.)	35(50)	204(47.4)	1	1
Numbers of meals	≤3times	6(8.6)	84(19.5)	0.43(0.19,0.96)	0.42(0.18,0.95)
	No(ref.)	64(91.4)	346(80.5)	1	1
Total gestational weight gain	Low	51(72.9)	262(60.9)	1.6(0.98,2.6)	1.45(0.9,2.32)
	Adequate(ref.)	19(27.1)	168(39.1)	1	1

Socioeconomic factors also played a critical role, as shown in Table 3. The majority of mothers were housewives (50.4%), while only a small proportion was formally employed. Lower occupational status and limited income were associated with poorer pregnancy outcomes. Families earning <5,000 KES per month (24.0%) were more vulnerable to food insecurity, limiting access to adequate, diverse foods required during pregnancy. Similar findings have been reported in other studies, linking low household income to maternal undernutrition and increased risk of LBW (Harper et al., 2023; Tessema et al., 2021). Family size showed a weaker association. Although most households had fewer than four members (63.4%), larger family size (>4 members) has been reported elsewhere to increase competition for food, potentially affecting maternal intake. However, in this study, family size was a less significant determinant of LBW, consistent with previous findings (Mallick, 2021). Environmental and health-related factors were also considered. While most mothers used latrines (70.6%), poor sanitation among the remaining households may increase infection risk. Additionally, 12.0% of mothers reported illness during pregnancy, and maternal infections have been strongly linked to LBW and preterm birth in other studies (Moradi et al., 2017). Fasting during pregnancy was reported by 44.4% of mothers, which may further compromise maternal nutrient intake during critical periods of fetal growth. Dietary diversity was a major nutritional factor. Over half of the mothers (52.2%) had a low dietary diversity score, indicating limited consumption of nutrient-rich foods. Low dietary diversity was directly associated with LBW in this study, supporting evidence that monotonous, plant-based diets common in low- and middle-income settings increase the risk of micronutrient deficiencies and poor birth outcomes (Zerfu et al., 2016).

4.0 Conclusion

The overall prevalence of low birth weight at Lodwar Referral Hospital in Turkana County was 14% (95% CI: 11.1, 17.4%), which was significantly higher among undernourished mothers and needed to be reduced further to avoid many deaths linked to infants' birth weight. Maternal illiteracy, low monthly family income, food taboos, and a low diet diversity score were risk factors for low birth weight. It is important to strengthen nutritional assessment and interventions during pregnancy, with special attention to illiterate and low-income mothers. There also needs to be promotion of proper knowledge about food taboos, latrine use, and consumption of diversified diets.

5.0 Recommendation

Recommendation to the Turkana government to ensure that mothers in Turkana County are economically empowered by providing more employment opportunities and starting community income-generating activities for women. The Ministry of Health staff and nutritionists should ensure that nutrition education and counseling are provided to mothers at the antenatal clinic every week to help reduce low-birth-weight cases at Lodwar Referral Hospital in Turkana County. Further research should be conducted in Turkana County on maternal nutrition knowledge, attitudes, and practices among mothers of childbearing age.

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