

Research Article

Knowledge, Attitudes, and Practices Regarding Dietary Diversity Among Pregnant Women in Mbulu District, Tanzania

Paul Hudson^{*} , Happiness Muhimbula , Theobald Mosha 

Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture, Chuo Kikuu, Morogoro, Tanzania

Abstract

Background: Dietary diversity is crucial for maternal and fetal health. However, little is known about pregnant women's knowledge, attitudes and practices (KAP) regarding dietary diversity. This study aimed to evaluate the KAP status on dietary diversity among pregnant women in Mbulu district, Tanzania. **Methods:** A cross-sectional study was conducted among 384 pregnant women were selected by using a systematic random sampling. Eight health facilities were selected using a purposive sampling method. Data were collected through face-to-face interviews conducted by trained enumerators using a structured, pretested and interviewer-administered questionnaire. Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 25. **Results:** Among the 384 participants, 219 (57%) were aged 25–40 years. Overall, 295 (76.8%) lacked adequate knowledge, 273 (71.1%) had negative attitudes, and 233 (60.7%) demonstrated poor practices regarding dietary diversity. Pregnant women residing in urban areas were nearly twice as likely to be knowledgeable as those in rural areas (AOR = 1.96, 95% CI: 1.15 - 3.33). A higher household monthly income (> 500,000 TZS) was significantly associated with greater knowledge (AOR = 2.49, 95% CI: 1.21 - 5.13). Similarly, those earning between 250 000–500 000 TZS were 1.89 times more likely to be knowledgeable than those earning < 250 000 TZS (AOR = 1.89, 95% CI: 1.05 - 3.41). Urban residents were also 1.81 times more likely to have a positive attitude compared to rural residents (AOR = 1.81, 95% CI: 1.11 - 2.94). **Conclusion:** Knowledge, attitudes, and practices regarding dietary diversity among pregnant women were generally low. Urban residence and higher household income were significantly associated with better dietary diversity knowledge, while urban residence was also linked to more positive attitudes. No significant factors were identified associated with dietary diversity practices.

Keywords

Pregnant Women, Knowledge, Attitudes, Practices, Dietary Diversity, Mbulu District, Tanzania

^{*}Corresponding author: paulmbonile@gmail.com (Paul Hudson)

Received: 19 May 2025; **Accepted:** 26 August 2025; **Published:** 15 September 2025



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1. Introduction

Globally, it is well recognized that the key to achieving the best pregnancy outcomes is maternal nutrition, dietary diversity directly impacts the health of pregnant women and their developing fetuses [1, 2]. Dietary diversity, defined as the consumption of a variety of food groups over a given period, provides essential macronutrients, and micronutrients that are required during pregnancy to prevent pregnancy complications [3, 4]. Unfavorable pregnancy outcomes, including low birth weight, preterm birth, and increased rates of maternal morbidity and mortality, have been associated in multiple studies with inadequate dietary diversification [5, 6]. Dietary iron deficiency was the leading cause of anemia, affecting about 37% (32 million) of pregnant women aged 15–49 [7]. Overall, 28% of pregnant women achieved minimum dietary diversity by consuming foods from at least five of out ten food groups that are possible [2, 8]. Pregnant women's poor practices, unfavorable attitudes, and lack of awareness about nutritional diversity all contribute to this insufficient dietary diversity [9, 10].

Investigation from Tanzania, Ethiopia, and India demonstrates that a large number of expectant mothers follow monotonous diets high in starchy staple foods and low in fruits, vegetables, legumes and meals derived from animals [2, 11, 12]. This lack of nutritional diversity is frequently linked to inadequate knowledge, unfavorable attitudes, and suboptimal practices (KAP) regarding dietary diversity among pregnant women [2, 13]. Similarly, in many low and middle income countries (LMICs), cultural taboos and beliefs further limit food choices, such as avoiding fish or eggs during pregnancy [14, 15]. There is still a significant knowledge, attitude and practice (KAP) gap among pregnant women regarding dietary diversity across different locations, especially in low- and middle-income countries (LMICs) including Tanzania, despite the recognized importance of maternal nutrition for good outcomes [2, 16]. Lack of dietary diversity results in insufficient consumption of vital nutrients, which harm maternal health and fetal development. Socio-economic obstacles, cultural norms, and low dietary diversity knowledge contribute to this problem [10, 17]. According to recent study, there has been considerable improvement in maternal nutrition, but there are still major obstacles to overcome, many pregnant women eat monotonous diets controlled by staple foods with restricted inclusion of fruits, vegetables and animal source foods, especially in low and middle income countries (LMICs) [18, 19]. This inadequate dietary diversity is often connected to poor knowledge, negative attitudes and unfortunate practices (KAP) related to dietary diversity [2, 20].

Although maternal health outcomes have improved significantly in Tanzania, dietary diversity among pregnant women remains a challenge [2, 21]. Studies from various regions indicate that while many pregnant women are aware of the benefits of consuming a variety of foods [2, 22], tradi-

tional gender dynamics within households often influence their dietary choices. In particular, male partners, especially husbands, play a major role in determining what pregnant women eat [23, 24]. Adequate nutritional knowledge, including an understanding of balanced meals, essential nutrients, and dietary diversity, is crucial for achieving optimal pregnancy outcomes [25].

Despite the recognized importance of dietary diversity during pregnancy, many pregnant women in Tanzania still lack adequate knowledge, positive attitudes, and appropriate practices [2, 21]. This gap contributes to various maternal and fetal health complications, including anemia and preterm birth. Most existing studies focus broadly on maternal health without addressing dietary diversity in depth [26, 27]. To bridge this gap and provide insights that can guide policymakers and healthcare providers in designing targeted nutritional interventions, this study examines pregnant women's knowledge, attitudes, and practices regarding dietary diversity [17, 20]. Mbulu District was selected because it represents both rural and urban settings, where socio-economic and cultural factors strongly influence maternal nutrition. Understanding dietary diversity in this context can provide valuable evidence for similar regions in Tanzania. Specifically, the study aimed to: assess pregnant women's knowledge of dietary diversity, explore their attitudes toward dietary diversity, and evaluate their dietary diversity practices in Mbulu District, Tanzania.

2. Materials and Methods

2.1. Description of the Study Area

The study was conducted in Mbulu district, Manyara region, Tanzania. Mbulu has a total population of 376,865 (Male 193,494; Female 183,371) according to the National Census [28]. It was selected for this study because of high levels of nutritional vulnerability [29] and socio-economic challenges- low income and high unemployment rates [30]. The district has fifty-nine health facilities as follows; 2 hospitals, 6 health Centers, 47 dispensaries and 4 private other health facilities [31].

2.2. Study Design, Sampling Procedures and Sample Size

This health-based cross-sectional study was conducted between March and April 2024 among 384 pregnant women attending reproductive and child health (RCH) clinics in Mbulu District. Purposive sampling was used to select eight health facilities with high antenatal clinic attendance: two hospitals (Mbulu Hospital and Hydrom Lutheran Hospital), two health centers (Dongobesh and Daudi), and four dispen-

saries (Labay, Bargish, Gehandu and Muslur). The study involved all pregnant women aged 15-49 years who were permanent residents of the district. Women with known physical and mental disabilities, chronic illnesses such as diabetes, or those who were non-residents were excluded from the study. The study participants were selected using systematic random sampling techniques.

A total sample size of 384 participants was obtained using a formula [32] $N = z^2 P (1-P) / d^2$ whereby; n = desired sample size, z = standard normal deviation, set at 1.96 corresponding to a 95% confidence interval, p = prevalence of inadequate dietary diversity among pregnant women estimated 50%, d = the margin of error set at 5%, therefore $n = (1.96)^2 \times 0.5 (1-0.5) / 0.05^2$ $n = 384$. A total of 384 pregnant women were randomly selected to participate in the study.

2.3. Data Collection

The structured questionnaire was pretested on ten pregnant women attending prenatal clinic at Morogoro Regional Hospital outside the study area, before data collection. The questionnaire was modified as needed in light of the pretest results. For this study, four enumerators received specialized training on the goals, methods for gathering data and significance of protecting the privacy of information.

Quantitative data were collected using a structured, pre-tested and interviewer- administered questionnaire which existed of questions on pregnant mothers' Knowledge, Attitudes, and Practices (KAP) regarding dietary diversity [9, 10]. It was adapted after reviewing similar literature [10, 33, 34] and administered through face-to-face interviews with pregnant women. The questionnaire comprised four sections: socio-demographic and obstetric characteristics; knowledge of dietary diversity during pregnancy; attitudes toward dietary diversity; and related practices. For each respondent, an average score was calculated and converted into a percentage. Scores were then categorized based on predetermined cut-off points to classify knowledge as knowledgeable or not knowledgeable, attitudes as positive or negative, and prac-

tices as good or poor.

The Homocue photometer was used to measure hemoglobin levels using a sterile lancet, a finger prick was used to capture capillary blood samples after the middle fingertip was cleansed with an alcohol swab. After adding the drop of whole blood to the microcuvette, the hemoglobin was analyzed by the Homocue photometer. Results were recorded from the digital display. Pregnant women who were expecting and had a hemoglobin level of less than 11g/dl were classified as anemic.

2.4. Data Analysis

Data were coded, cleaned and analyzed using Statistical Package for Social Sciences (SPSS) software, version 25. Descriptive statistics in the form of frequencies (n) and percentages (%) were used to summarize sociodemographic characteristics and knowledge, attitudes and practices (KAP) levels. KPA scores were computed and converted into percentages. A 70% cut-off score was used to categorize knowledge as knowledgeable ($\geq 70\%$) or not knowledgeable ($< 70\%$), attitudes as positive ($\geq 70\%$) or negative ($< 70\%$), and practices as good ($\geq 70\%$) or poor ($< 70\%$) [10]. Inferential statistics, including chi-square tests and logistic regression, were employed to assess associations between socio-demographic factors and KAP scores. The significance level was set at $p < 0.05$ with 95% confidence interval.

2.5. Ethical Considerations

Permission to conduct the study in Mbulu district was obtained from Mbulu district authorities and research approval from the Sokoine University of Agriculture with reference number SUA/DPRTC/MHN/D/2022/0004/15. Participants were informed about the study's objectives, procedures, potential benefits. Oral informed consent was obtained from all participants. Confidentiality and anonymity were maintained throughout the study by assigning unique codes to participants and securely storing data.

Table 1. Demographic characteristics of respondents.

Variable	Category	Number of respondents	Percent
Location	Rural	190	49.5
	Urban	194	50.5
Age (years)	18-24	158	41.1
	25-40	219	57.0
	≥ 41	7	1.8
Marital Status	Cohabiting	23	6.0
	Divorced	2	0.5
	Married	304	79.2

Variable	Category	Number of respondents	Percent
Education Level	Single	53	13.8
	Widowed	2	0.5
	No formal education	11	2.9
	Primary school	246	64.1
	Secondary school	109	28.4
	College or University	18	4.7
	Employed	10	2.6
Occupation	Farmers (Self-employed)	325	84.6
	Other Self-employed	42	10.9
	Unemployed	7	1.8
Family Size (members)	<2	57	14.8
	3-5	186	48.4
	>5	141	36.7
Monthly Household Income (TZS)	<250,000	152	39.6
	250,000-500,000	158	41.1
	>500,000	74	19.3
Religion	Christian	374	97.4
	Muslim	10	2.6
Partner Support	No	50	13.0
	Yes	334	87.0

3. Results

3.1. Socio-demographic Characteristics of the Respondents

Table 1 presents the socio-demographic characteristics of the pregnant women in Mbulu district. All 384 respondents participated, with n=194 (50.5%) from urban areas and n=190 (49.5%) from rural areas, showing an almost equal

distribution. A total of n=219 (57.0%) of the respondents were between ages of 25 and 40 years. More than three-quarters n=304 (79.2%) of the respondents were married. More than half n=246 (64.1%) of the respondents had a primary school education level, n=325 (84.6%) of the respondents were farmers by occupation. A total of n=186 (48.4%) of the respondents had a family size of 3-5 members, and n=152 (39.6%) had a household monthly income < 250,000 TZS and n=334 (87%) of husbands (male partners) supported their wives/female partners.

3.2. Maternal and Obstetric Characteristics of Pregnant Women in the Study Area

Table 2. Obstetric characteristics of respondents.

Variable	Category	Number of respondents	Percent
Parity (Number of births)	Nulliparous	97	25.3
	Primiparous	82	21.4
	Multiparous	205	53.4

Variable	Category	Number of respondents	Percent
Gravidity	Primigravida	102	26.6
	Multigravida	282	73.4
Interval between pregnancies (WHO, ≥ 24 months)	<24 months	137	35.7
	≥ 24 months	247	64.3
Gestational age	<37 weeks	367	95.6
	37-40 weeks	17	4.4
Maternal stages status	1st Trimester	51	13.3
	2nd Trimester	149	38.8
	3rd Trimester	184	47.9
Hemoglobin cut-off level (g/dl)	< 11	102	26.6
	≥ 11	282	73.4
Previous pregnancy complications	Yes	59	15.4
	No	325	84.6
Receiving nutritional counseling during pregnancy	Yes	225	58.6
	No	159	41.4

Table 2 shows that the more than half $n=205$ (53.4%) of pregnant women were multiparous, $n=367$ (95.6%) of respondents gave birth in less than 37 weeks, $n=137$ (35.7%) of respondents had pregnancy complications such as preterm birth and $n=184$ (47.9%) of respondents were in the third

trimester. Further, the HB cut-off level indicated that minority $n=102$ (26.6%) of respondents were anemic (<11g/dl). More than half $n=225$ (58.6%) of respondents received nutritional counseling on dietary diversity during pregnancy.

3.3. Pregnant Women's Knowledge Regarding Dietary Diversity During Pregnancy

Table 3. Pregnant women's knowledge regarding dietary diversity during pregnancy.

Variable	Category	Number of respondents	Percent	Score
You know the importance of dietary diversity	Yes	125	32.6	32.55 $\pm$ 2.39
	No	259	67.4	
You are aware of the specific nutritional needs during different stages of pregnancy	Yes	39	10.2	10.16 $\pm$ 1.54
	No	345	89.8	
You are familiar with the concept of eating a variety of foods from different food groups during pregnancy	Yes	167	43.5	43.49 $\pm$ 2.53
	No	217	56.5	
You have received any information or advice regarding dietary diversity during pregnancy	Yes	265	69.0	69.01 $\pm$ 2.36
	No	119	31.0	
Overall knowledge	Knowledgeable	89	23.2	23.18 $\pm$ 2.16
	Not knowledgeable	295	76.8	

Table 3 shows that knowledge assessment revealed that n=295 (76.8%) of the respondents were not knowledgeable while n=89 (23.2%) were knowledgeable with an overall mean score of 2.32 ± 0.22 out of 10 scores. Specifically, about n=259 (67.4%) of the respondents didn't know the

importance of dietary diversity n=345 (89.8%) were not aware of the specific nutritional needs during different stages of pregnancy and n=217 (56.5%) were not familiar with the concept of eating a variety of foods from different food groups during pregnancy.

3.4. Pregnant Women's Attitudes Regarding Dietary Diversity

Table 4. Pregnant women's attitudes regarding dietary diversity.

Variable	Category	Number of respondents	Percent	Score
To think if dietary diversity is important for the health of the pregnant woman and the unborn child	Agree	354	92.2	92.19 ± 1.37
	Disagree	30	7.8	
Cultural or personal preferences influence the food choices in your house	Agree	78	20.3	20.31 ± 2.06
	Disagree	306	79.7	
To believe that dietary diversity is for your health and the health of your child	Agree	306	79.69	79.69 ± 2.06
	Disagree	78		
To think if your current diet meets the nutritional needs of your pregnancy adequately	Agree	229	59.6	59.64 ± 2.51
	Disagree	155	40.4	
Cultural or traditional beliefs influence your dietary choices during pregnancy	Agree	65	16.9	16.93 ± 1.92
	Disagree	319	83.1	
To think if there are challenges in maintaining dietary diversity during pregnancy	Agree	163	42.4	42.45 ± 2.53
	Disagree	221	57.6	
Overall attitude	Positive	111	28.9	28.91 ± 0.23
	Negative	273	71.1	

Table 4 shows the attitude of pregnant women regarding dietary diversity. Overall, the attitudes assessment revealed that n=273 (71.1%) of the respondents had negative attitudes towards dietary diversity while others n=111 (28.9%) had positive attitudes. A total of 354 respondents (92.2%) agreed that dietary diversity is important for the health of both the

pregnant woman and the unborn child. About n=229 (59.6%) of the respondents agreed that their current diet adequately met the nutritional needs of their pregnancy. Only n=65 (16.9%) of the respondents thought that the cultural and traditional beliefs influenced their dietary choices during pregnancy.

3.5. Pregnant Women's Practices Regarding Dietary Diversity in Mbulu District

Table 5. Pregnant women's practices regarding dietary diversity.

Variable	Category	Number of respondents	Percent	Score
Having 4 or above 4 meals a day	Yes	10	2.6	2.60 ± 0.81
	No	374	97.4	
Having snacks between meals	Yes	214	55.7	55.73 ± 2.54
	No	170	44.3	

Variable	Category	Number of respondents	Percent	Score
Daily consumption of fruits last 7 days	Yes	62	16.1	16.15 ± 1.88
	No	322	83.9	
Daily consumption of vegetables last 7 days	Yes	267	69.5	69.53 ± 2.35
	No	117	30.5	
Daily consumption of dairy products last 7 days	Yes	186	48.4	48.44 ± 2.55
	No	198	51.6	
Daily consumption of lean proteins (poultry, fish, legumes) last 7 days	Yes	24	6.3	6.25 ± 1.24
	No	360	93.8	
Daily consumption of whole grains last 7 days	Yes	322	83.9	83.85 ± 1.88
	No	62	16.1	
Overall practices	Good	151	39.3	39.32 ± 2.50
	Poor	233	60.7	

Table 5 shows that overall nutritional practices of pregnant women were poor with a mean score of 3.70 ± 0.25 . Only $n=142$ (37.0%) of the respondents showed good practices while the remaining $n=242$ (63%) showed poor practices regarding dietary diversity. About $n=201$ (52.3%) of the respondents tried to include a variety of food in their daily meals, and $n=141$ (36.7%) actively discussed with their partners to plan for their diverse and balanced diet during

pregnancy. Minority $n=10$ (2.6%) of the respondents consumed 4 or more meals a day while only (97.4%) consumed less than 4 meals a day. Majority of the respondents reported daily consumption of whole grains $n=322$ (83.9%), vegetables $n=267$ (69.5%), and dairy products $n=186$ (48.4%), only a few respondents reported daily consumption of fruits $n=62$ (16.1%), and lean proteins $n=24$ (6.3%).

3.6. Factors Associated with Knowledge Regarding the Dietary Diversity Among Pregnant Women

Table 6. Bivariate and multivariate analysis of factors influencing knowledge regarding dietary diversity of pregnant women.

Variables		Dietary diversity knowledge		COR, 95% CI	AOR, 95% CI
		Not knowledgeable	Knowledgeable		
Location	Rural	157 (82.6%)	33 (17.4%)	1.93 (1.19, 3.14)	1.96 (1.15, 3.33) *
	Urban	138 (71.1%)	56 (28.9%)	I	I
Education	Primary school	195 (79.3%)	51 (20.7%)	2.62 (0.33, 20.91)	1.98 (0.24, 16.24)
	Secondary school	76 (69.7%)	33 (30.3%)	4.34 (0.53, 35.31)	2.66 (0.31, 22.95)
	High school / certificate / diploma	11 (100%)	0 (0.0%)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)
	University/postgraduate degree	3 (42.9%)	4 (57.1%)	13.33 (1.05, 169.6)	10.34 (0.69, 154.05)
	No formal education	10 (90.9%)	1 (9.1%)	I	I
Occupation	Farmer	257 (79.1%)	68 (20.9%)	1.59 (0.188, 13.41)	2.09 (0.20, 22.18)
	Self employed	27 (64.3%)	15 (35.7%)	3.33 (0.37, 30.36)	2.59 (0.24, 28.22)
	Employed	5 (50%)	5 (50%)	6.00 (0.52, 69.75)	7.26 (0.47, 111.10)

Variables		Dietary diversity knowledge		COR, 95% CI	AOR, 95% CI
		Not knowledgeable	Knowledgeable		
Monthly household income	Unemployed	6 (85.7%)	1 (14.3%)	I	I
	250 000 – 500 000 TZS	116 (73.4%)	42 (26.6%)	2.03 (1.15, 3.58)	1.89 (1.05, 3.41) *
	More than 500 000 TZS	50 (67.6%)	24 (32.4%)	2.692 (1.39, 5.20)	2.49 (1.21, 5.13) *
	Less than 250 000 TZS	129 (84.9%)	23 (15.1%)	I	I
Parity	Multiparous	160 (78.0%)	45 (22.0%)	0.86 (0.54, 1.39)	0.96 (0.57, 1.64)
	Primiparous	135 (75.4%)	44 (24.6%)	I	I

*Significant association at p -value<0.05.

Binary logistic regression (Table 6) showed the likelihood ratio of different factors (location, education, occupation, monthly income, and parity) to be associated with knowledge on dietary diversity among pregnant women. Results revealed that location of rural areas and monthly household income significantly influenced the knowledge regarding dietary diversity (p <0.05). The influence of location on the dietary diversity knowledge was 1.96 (AOR) = 1.96, 95% CI: 1.15, 3.33) times higher among urban re-

spondents than their rural counterparts. In terms of monthly income pregnant women who earned > 500 000 TZS were 2.49 (AOR = 2.49, 95% CI: 1.21 - 5.13) times higher likely to be knowledgeable than those who earn < 500 000 TZS. Further, pregnant women who earned between 250 000 – 500 000 TZS were 1.89 (AOR = 1.89, 95% CI: 1.05 - 3.41) times more likely to be knowledgeable than those who earned < 250 000 TZS.

3.7. Factors Associated with Attitudes Regarding Dietary Diversity Among Pregnant Women

Table 7. Bi-variate and multivariate analysis of factors influencing attitudes regarding dietary diversity of pregnant women.

Variables		Dietary diversity attitudes		COR, 95% CI	AOR, 95% CI
		Negative	Positive		
Location	Urban	134 (69.1%)	60 (30.9%)	1.58 (0.99, 2.50)	1.81 (1.11, 2.94)*
	Rural	148 (77.9%)	42 (22.1%)	I	I
Education	Primary school	182 (74.0%)	64 (26.0%)	0.42 (0.13, 1.43)	0.33 (0.10, 1.16)
	Secondary school	83 (76.1%)	26 (23.9%)	0.38 (0.11, 1.33)	0.27 (0.07, 0.98)
	High school/certificate/diploma	7 (63.6%)	4 (36.4%)	0.69 (0.12, 3.78)	0.51 (0.09, 2.88)
	University	4 (57.1%)	3 (42.9%)	0.90 (0.13, 6.08)	0.84 (0.12, 5.82)
	No formal education	6 (54.5%)	5 (45.5%)	I	I
Household income (Monthly)	250,000 – 500 000 TZS	112 (70.9%)	45 (29.1%)	1.48 (0.88, 2.48)	1.40 (0.83, 2.37)
	More than 500 000 TZS	51 (68.9%)	23 (31.1%)	1.63 (0.87, 3.04)	1.73 (0.91, 3.28)
	Less than 250 000 TZS	119 (78.3%)	33 (21.7%)	I	I

*Significant association at p -value<0.05.

Table 8. Bivariate and multivariate analysis of factors influencing practices regarding dietary diversity among pregnant women.

Variables		Dietary diversity practices		COR, 95% CI	AOR, 95% CI
		Poor	Good		
Education	Primary school	157 (63.8%)	89 (36.2%)	0.68 (0.20, 2.29)	0.71 (0.21, 2.41)
	Secondary school	69 (63.3%)	40 (36.7%)	0.70 (0.20, 2.426)	0.73 (0.21, 2.58)
	High school / certificate / diploma	7 (63.6%)	4 (36.4%)	0.69 (0.12, 3.78)	0.71 (0.13, 3.94)
	University	3 (42.9%)	4 (57.1%)	1.60 (0.24, 10.81)	1.81 (0.26, 12.41)
	No formal education	6 (54.5%)	5 (45.5%)	I	I
Household Income (Monthly)	250,000 – 500 000 TZS	97 (61.4%)	61 (38.6%)	1.02 (0.65, 1.61)	1.00 (0.63, 1.59)
	More than 500 000 TZS	51 (68.9%)	23 (31.1%)	0.73 (0.41, 1.32)	0.70 (0.39, 1.28)
	Less than 250 000 TZS	94 (61.8%)	58 (38.2%)	I	I
Attitude	Positive	63 (61.8%)	39 (38.2%)	1.08 (0.67, 1.72)	1.07 (0.67, 1.72)
	Negative	179 (63.5%)	103 (36.5%)	I	I

*Significant association at p -value <0.05

Factors associated with attitudes regarding the dietary diversity are shown in Table 7 the likelihood ratio of the factors (Urban and rural, education, and monthly income) associated with attitudes regarding dietary diversity among pregnant women during pregnancy. Only urban and rural showed a significant influence on the attitude of pregnant women whereby urban respondents were 1.81 (AOR = 1.81, 95% CI: 1.11, 2.94) times more likely to have a positive attitude than their rural counterparts.

3.8. Factors Associated with Practices Regarding Dietary Diversity Among Pregnant Women

Results in Table 8 show the binary logistic regression analysis of the factors associated with practices regarding dietary diversity among pregnant women. Education, monthly income, and attitude had no significant influence on the practices regarding dietary diversity among pregnant women despite controlling for the confounders.

4. Discussion

This study aimed to assess pregnant women's knowledge, attitudes, and practices regarding dietary diversity in Mbulu district, Tanzania. Overall, the findings revealed that more than three quarters of pregnant women were not knowledgeable, seventy one percent of pregnant women had negative attitudes and sixty percent of pregnant women had poor practices regarding dietary diversity.

4.1. Pregnant Women's Knowledge Regarding Dietary Diversity

Knowledge regarding dietary diversity among pregnant women in low- and middle-income countries (LMICs) including Tanzania is often limited, leading to poor nutritional outcomes for pregnant women and their unborn children. In LMICs, many pregnant women lack access to nutrition education due to inadequate healthcare infrastructure and insufficient emphasis on nutritional counseling during antenatal care (ANC) visits [2, 19, 21].

The results revealed that most of pregnant women had poor knowledge about the importance of consuming a variety of food groups [8] to meet specific essential nutrients such as folic acid, iron, calcium, iodine and protein during pregnancy which negatively affects their dietary diversity practices. Overall, 76.8% of the pregnant women in this study were not knowledgeable regarding dietary diversity. Because it directly affects the health of the pregnant mother and the development of the fetus, the large percentage of pregnant women who were ignorant of dietary diversity is concerning. Inadequate dietary diversity during pregnancy can have negative effects on the unborn child's growth over time, including low birth weight and premature birth. It is essential to increase nutritional literacy through education, better incorporate nutritional counseling into prenatal care, and implement culturally competent public health initiatives. This finding was consistent with studies from Coast region of Tanzania (82%), Addis Ababa Ethiopia (73%) and Western Ethiopia (66.7) [2, 20, 33], respectively showed that more

than half of pregnant women could not correctly identify the crucial food groups required during pregnancy, evaluate limited knowledge to poor nutrition education during antenatal care.

This current finding was greater than those reported in previous studies conducted in Ethiopia (39%) [10], Malaysia (48%) [35] and Yaounde 27% [36]. Also the result was less than the study conducted in Benin (88%) [37]. The variation could be due to the socio-demographic variations, nutrition education and low attention to counseling about dietary diversity during pregnancy. Result showed that there was knowledge gap about dietary diversity during pregnancy among pregnant women in Mbulu district.

Only, 23.2% of the pregnant women had knowledge about dietary diversity. A major weakness in maternal nutrition education is revealed by this research, which shows that many expectant mothers did not know enough about dietary diversity. Given that dietary diversity is crucial for providing important nutrients needed during pregnancy, this lack of awareness has serious implications for the health of both the pregnant mother and the fetus. This study is supported by the study conducted in Tanzania (18%) [2, 16].

This result was less than the study done in Ambo district, Ethiopia (33.3%) [20] and Southern Ethiopia (61.0%) [10] and Addis Ababa, Ethiopia (27% [38]. This might be due to the outcome variables and the study designs were different. Healthcare providers and planners should give due attention since more than two-thirds of pregnant women had poor knowledge regarding dietary diversity. Anemia, low birth weight, premature birth, and delayed fetal development were just a few of the negative effects that can result from malnutrition, which is made worse by pregnant women's limited knowledge of appropriate dietary diversity [10, 39]. This relative evidence is convincing as it shows that knowledge disparities are strongly influenced by contextual elements such as geographical location, education status and superior of antenatal care.

In this study, urban areas and household monthly income of pregnant women were found to be significantly associated with knowledge on dietary diversity (p -value < 0.05). Respondents who were located in urban areas were to be knowledgeable AOR = 1.96 (1.15-3.33) times more likely to diversified diets than those located in rural areas. This showed that pregnant women in urban areas often have better access to healthcare facilities, educational programs, and mass media that promote dietary diversity. In contrast, rural areas have challenges such as limited healthcare services, poor infrastructure, and low dietary diversity. Results of this study are similar to those reported from other studies conducted in Laikipia, Kenya [40] and South Central, Ethiopia [41]. The respondents who earned a monthly income were $> 500\,000$ TZS were 2.49 (AOR = 2.49, 95 CI: 1.21, 5.13) times more likely to be knowledgeable than those who earned less than 250,000 TZS. Further, pregnant women who earned be-

tween 250 000 – 500 000 TZS were 1.89 (AOR = 1.89, 95 CI: 1.05, 3.41) times more likely to be knowledgeable than those who earned $< 250\,000$ TZS. This shows that income plays a crucial role in shaping knowledge because higher-income households are more likely to afford diverse food options including fruits, vegetables dairy, and protein sources. This can lead to greater awareness of the importance of consuming a range of food groups for both maternal and fetal health. This result is in line with earlier research in Rwanda [16] and Bangladesh's Rohingya [42], which found that socioeconomic limitations and a lack of knowledge about nutrition made it difficult to achieve a sufficient variety of foods during pregnancy. These findings have significant treatment implications, especially for strengthening prenatal dietary variety counseling. Addressing current knowledge gaps can be facilitated by integrating thorough dietary diversity education and counseling into ANC services [43].

4.2. Pregnant Women's Attitudes On Dietary Diversity

Negative attitudes toward dietary diversity among pregnant women are shaped by cultural beliefs, socioeconomic conditions, and inadequate dietary diversity. For example, some foods are perceived as harmful, such as eggs or animal proteins, which are thought to cause a large baby and complicate delivery [44]. Such beliefs discourage the consumption of diverse food groups.

Overall, 71.1% of the pregnant women in this study had negative attitudes regarding dietary diversity. This finding was consistent with studies from Kigeme Refugee Camp in Rwanda (67.2%) [45] and Ambo district, Ethiopia (68.7%) [20]. Also this finding was greater than studies conducted in Southern Ethiopia (40.5%) [10], Addis Ababa in Ethiopia (51.6%) [33] and Malaysia (33%) [35]. Time changes and various socio-demographic factors could be contributing factors to this disparity.

Overall, 28.9% of the pregnant women in this study had a positive attitude regarding dietary diversity. This finding was consistent with studies from Ambo district in Ethiopia (31.3%) [20] and Addis Ababa, Ethiopia (33.5%) [38]. Also this finding was lower than studies conducted in Addis Ababa, Ethiopia (48.4%) [33], Southern Ethiopia (59.5%) [10] and (67%), Manzini Region of Swaziland [46]. The parameters used to measure it and the nature of the outcome variable, research period, study design and socio-cultural factors may all be the sources of this variation. Likewise, a negative attitude toward dietary diversity was shown by over two-thirds of pregnant women. This indicates that health care providers, including health extension workers, community health agents, and planners should work hard to change the attitudes of pregnant women regarding dietary diversity.

In the current study, an attitude regarding dietary diversity among pregnant women was significantly associated with

locations (Urban and rural areas). Pregnant women who were living in urban areas had an AOR=1.81(1.11-2.94) times greater likelihood of having positive attitude than those who were located in rural areas. Findings revealed a positive correlation between knowledge and attitudes, indicating that pregnant women with better knowledge of the benefits of diverse diets had more positive attitudes toward consuming a variety of foods or food groups during pregnancy. The study emphasized the role of maternal education and awareness in shaping attitudes, which in turn influenced dietary behaviors. This study was similar previous study conducted in Ethiopia [47] and Ambo district and Eastern, Ethiopia [20, 48].

4.3. Pregnant Women's Practices Regarding Dietary Diversity During Pregnancy

Pregnant women's dietary habits are frequently described by a reliance on energy-dense staples, a lack of variety, and a restricted intake of nutrient-dense foods. Inadequate maternal nutrient intake from a diet lacking in diversity has a detrimental impact on fetal development and pregnancy outcomes. Access to a wide range of foods is further hampered by low household income. Because they are less expensive than fruits, vegetables, and foods derived from animals, pregnant women in many low- and middle-income countries frequently consume monotonous diets that are primarily composed of staples like rice, maize, or cassava [16, 49].

Overall, 60.7% of the pregnant women in this study had poor practices regarding dietary diversity. This finding was consistent with studies from Addis Ababa in Ethiopia (65.5%) [33]. Finding of this study was also greater than studies conducted in public hospitals of Southern Ethiopia (47.7%) [10], Syria refugees (47%) [50], Malaysia (45%) [35] and Addis Ababa in Ethiopia [11] but was lower than in studies conducted in Misha Woreda, South Ethiopia (70.5%) [51] and Ambo district in Ethiopia (72.7%) [20]. Possible reasons for this dis-similarity may be the feasibility of accessing nutritional dietary diversity information and socio-demographic variations among study sample. Possible reason for this similarity might be the effect of pregnant women's feelings and perceptions of dietary diversity in the antenatal period.

In this study, education levels, attitudes, and monthly income of pregnant women were found to be factors but not significantly associated with dietary diversity practices. The finding suggests that sometimes even when pregnant women had better economic standing or knowledge of healthy dietary diversity can not afford adequate dietary diversity. Other factors such as traditional dietary habits, food taboos and food availability may have strong influence on the actual dietary diversity practice. This study was supported by the studies conducted in Central and Addis Ababa, Ethiopia [6, 52].

4.4. Limitation of the Study

The study used a cross-sectional design to capture infor-

mation at a single point in time making it impossible to determine whether knowledge, attitudes, practices directly influence dietary diversity. Additionally focus on one district the generalization limits of the findings to other regions with different socioeconomic, cultural and environmental contexts. Future research should explore the long-term impact of dietary diversity on pregnancy outcomes such as birth weight, maternal anemia and neonatal health through longitudinal studies.

5. Conclusion

In this study, pregnant women's knowledge, attitudes and practices regarding dietary diversity were low. Rural areas and household monthly income were significantly associated with dietary diversity knowledge, urban areas were significantly associated with dietary diversity attitudes and there was no any factor which associated with dietary diversity practices. The findings of this study indicate that while rare pregnant women possess adequate knowledge and hold positive attitudes toward dietary diversity, there are still gaps in practices particularly in low-resource settings. Factors such as limited access to diverse foods, cultural beliefs, and economic constraints contribute to these challenges. The data underscore the importance of targeted educational and community-based interventions to enhance awareness and improve dietary diversity practices. Addressing the issues is crucial to reducing inadequate dietary diversity and associated adverse pregnancy outcomes, ultimately contributing to the overall well-being of pregnant women and their households.

Abbreviations

LMICs	Low and Middle Income Countries
WHO	World Health Organization
FAO	Food and Agriculture Organization
MDD-W	Minimum Dietary Diversity for Women
NBS	National Bureau Statistics
KAP	Knowledge, Attitudes and Practices
RCH	Reproductive and Child Health
NGO	Non Government Organization
MHL	Measuring Hemoglobin Levels
AOR	Adjusted Odds Ratios
COR	Crude Odds Ratios
ANC	Antenatal Clinic
MoHCD	Ministry of Health, Community Development,
GEC	Gender, Elderly and Children

Acknowledgments

The authors would like to thank Institute of Judicial Administration - Lushoto Tanzania, for partly funding this study, the pregnant women for their participation, the enumerators

for their efforts in data collection and all who contributed to the achievement of this study.

Author Contributions

Paul Hudson: Conceptualization, Funding acquisition, Resources, Software, Visualization, Writing - original draft, Writing review and editing

Happiness Muhimbula: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Supervision, validation, Writing review and editing

Theobald Mosha: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Supervision, validation, Writing review and editing

Funding

Institute of Judicial Administration - Lushoto Tanzania, partly financially supported this study.

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] World Health Organization. (2021). The State of Food Security and Nutrition in the World 2021: Transforming food systems for food security, improved nutrition and affordable healthy diets for all (Vol. 2021). Food & Agriculture Org.
- [2] Heri, R., Malqvist, M., Yahya-Malima, K. I., & Mselle, L. T. (2024). Dietary diversity and associated factors among women attending antenatal clinics in the coast region of Tanzania. *BMC nutrition*, 10(1), 16.
- [3] Mohammed, F., Abdirizak, N., Jibril, A., & Oumer, A. (2023). Correlates of minimum dietary diversity among pregnant women on antenatal care follow up at public health facility in Puntland, Somalia. *Scientific reports*, 13(1), 21935.
- [4] Alemu, F. T., Desta, A. A., & Tola, A. G. (2024). Dietary diversity and associated factors among pregnant women attending antenatal care at public hospitals in North Shewa, Oromia, Ethiopia, 2023. *Frontiers in Nutrition*, 11, 1400813.
- [5] Tareke, A. A., Melak, E. G., Mengistu, B. K., Hussien, J., & Molla, A. (2024). Association between maternal dietary diversity during pregnancy and birth outcomes: evidence from a systematic review and meta-analysis. *BMC nutrition*, 10(1), 151.
- [6] Tesfaye, A., Gerbaba, M., Tamiru, D., & Belachew, T. (2024). Inadequate dietary diversity practices and associated factors among pregnant adolescents in the West Arsi Zone, Central Ethiopia: a community-based cross-sectional study. *Scientific Reports*, 14(1), 2871.
- [7] World Health Organization. (2023). Globally, Anemia in pregnancy.
- [8] FAO. (2021). Minimum dietary diversity for women. Guide for measurements. Rome <https://doi.org/10.4060/cb3434en>
- [9] FAO. (2014). Guidelines for assessing nutrition-related Knowledge, Attitudes and Practices. Rome.
- [10] Gezimu, W., Bekele, F., & Habte, G. (2022). Pregnant mothers' knowledge, attitude, practice and its predictors towards nutrition in public hospitals of Southern Ethiopia: A multi-center cross-sectional study. *SAGE Open Medicine*, 10, 20503121221085843.
- [11] Tefera, W., Brhanie, T. W., & Dereje, M. (2020). Dietary diversity practice and associated factors among pregnant women attending ANC in Kolfe Keranyo sub city health centers, Addis Ababa, Ethiopia. *medRxiv*, 2020-04.
- [12] Gokhale, D., & Rao, S. (2022). Socio-economic and socio-demographic determinants of diet diversity among rural pregnant women from Pune, India. *BMC nutrition*, 8(1), 54.
- [13] Zerfu, T. A., & Biadgilign, S. (2018). Pregnant mothers have limited knowledge and poor dietary diversity practices, but favorable attitude towards nutritional recommendations in rural Ethiopia: evidence from community-based study. *BMC nutrition*, 4(1), 43.
- [14] Lekey, A., Masumo, R. M., Jumbe, T., Ezekiel, M., Daudi, Z., Mchome, N. J.,... & Leyna, G. H. (2024). Food taboos and preferences among adolescent girls, pregnant women, breastfeeding mothers, and children aged 6–23 months in Mainland Tanzania: a qualitative study. *PLOS Global Public Health*, 4(8), e0003598.
- [15] Olajide, B. R., Van Der Pligt, P., & McKay, F. H. (2024). Cultural food practices and sources of nutrition information among pregnant and postpartum migrant women from low-and middle-income countries residing in high income countries: A systematic review. *Plos one*, 19(5), e0303185.
- [16] Uwase, A., Nsereko, E., Pillay, N., & Levin, J. (2024). Dietary diversity and associated factors among pregnant women in the Southern Province of Rwanda: A facility-based cross-sectional study. *Plos one*, 19(2), e0297112.
- [17] Wang, W. C., Zou, S. M., Ding, Z., & Fang, J. Y. (2023). Nutritional knowledge, attitude and practices among pregnant females in 2020 Shenzhen China: A cross-sectional study. *Preventive Medicine Reports*, 32, 102155.
- [18] Bikila, H., Ariti, B. T., Fite, M. B., & Sanbata, J. H. (2023). Prevalence and factors associated with adequate dietary diversity among pregnant women in Nekemte town, Western Ethiopia, 2021. *Frontiers in Nutrition*, 10, 1248974.
- [19] FAO, IFAD, UNICEF (2021) The State of Food Security and Nutrition in the World: transforming food systems for food security, improved nutrition and affordable healthy diets for all. Rome: FAO, 2021.

- [20] Gebremichael, M. A., & Lema, T. B. (2023). Prevalence and predictors of knowledge and attitude on optimal nutrition and health among pregnant women in their first trimester of pregnancy. *International Journal of Women's Health*, 1383-1395.
- [21] Madzorera, I., Isanaka, S., Wang, M., Msamanga, G. I., Urasa, W., Hertzmark, E., & Fawzi, W. W. (2020). Maternal dietary diversity and dietary quality scores in relation to adverse birth outcomes in Tanzanian women. *The American Journal of Clinical Nutrition*, 112(3), 695-706.
- [22] Lennox, J., Petrucka, P., & Bassendowski, S. (2017). Eating practices during pregnancy: perceptions of select Maasai women in Northern Tanzania. *Global Health Research and Policy*, 2, 1-9.
- [23] Nambile Cumber, S., Williams, A., Elden, H., & Bogren, M. (2024). Fathers' involvement in pregnancy and childbirth in Africa: an integrative systematic review. *Global Health Action*, 17(1), 2372906.
- [24] Falade-Fatila, O., & Adebayo, A. M. (2020). Male partners' involvement in pregnancy related care among married men in Ibadan, Nigeria. *Reproductive Health*, 17, 1-12.
- [25] Mehboob, A., & Sanghi, D. (2023). Influence of nutrition knowledge on the association between maternal nutrition and birth outcomes. *International Journal*, 12(2), 59.
- [26] Gudeta, T. G., Terefe, A. B., Mengistu, G. T., & Sori, S. A. (2022). Determinants of dietary diversity practice among pregnant women in the Gurage zone, Southern Ethiopia, 2021: Community based cross sectional study. *Obstetrics and Gynecology International*, 2022(1), 8086793.
- [27] Seid, A., Dugassa Fufa, D., Weldeyohannes, M., Tadesse, Z., Fenta, S. L., Bitew, Z. W., & Dessie, G. (2023). Inadequate dietary diversity during pregnancy increases the risk of maternal anemia and low birth weight in Africa: A systematic review and meta - analysis. *Food Science & Nutrition*, 11(7), 3706-3717.
- [28] Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC) [Tanzania Mainland], Ministry of Health (MoH) [Zanzibar], *National Bureau of Statistics (NBS), Office of the Chief Government Statistician (OCGS), and ICF*. 2022. Tanzania Demographic and Health Survey and Malaria Indicator Survey 2022 Summary Report. Dodoma, Tanzania, and Rockville, Maryland, USA: MoHCDGEC, MoH, NBS, OCGS, and ICF.
- [29] Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC). (2016). Tanzania Demographic and Health Survey and Malaria Indicator Survey 2015-2016. MoHCDGEC.
- [30] World Bank. (2018). Tanzania Economic Update: The Power of Investing in Girls. World Bank Group.
- [31] The United Republic of Tanzania (2024) Ministry of Health, Annual Health Statistical Tables and Figures 2023.
- [32] Brydges, C. R. (2019). Effect size guidelines, sample size calculations and statistical power in gerontology. *Innovation in aging*, 3(4), igz036.
- [33] Tenaw, Z., Arega, M., & Tachbele, E. (2018). Nutritional knowledge, attitude and practices among pregnant women who attend antenatal care at public hospitals of Addis Ababa, Ethiopia. *International Journal of Nursing and Midwifery*, 10(7), 81-89.
- [34] Singh, T., & Deepti, S. S. (2019). Knowledge, attitude, practice and determining factors regarding nutrition during pregnancy among females of rural Punjab.
- [35] Ikhsan, L. N., Nasaruddin, N. A. M., Othman, F., Abd Aziz, K. H., & Ismail, H. (2018). Nutritional knowledge, attitude and practice among antenatal and postnatal mothers in hospital Tengku Ampuan Afzan (Htaa), Kuantan, Pahang 2016. *IIUM Medical Journal Malaysia*, 17(1).
- [36] Mugyia, A. S. N., Tanya, A. N. K., Njotang, P. N., & Ndombo, P. K. (2016). Knowledge and attitudes of pregnant mothers towards maternal dietary practices during pregnancy at the Etoug-Ebe Baptist Hospital Yaounde. *Health sciences and disease*, 17(2).
- [37] Sossa, C. J., Salami, L., Metonnou, C. G., Tozoukan, E., Azandjeme, C., Mongbo, V., & Para ño, M. N. (2023). Knowledge, attitudes, and practices relating to food and nutrition among pregnant women attending antenatal clinics at Menontin hospital (Benin). *Health*, 15(11), 1202-1217.
- [38] Zelalem T, Erdaw A, Tachbele E. Nutritional knowledge, attitude and practices among pregnant women who attend antenatal care at public hospitals of Addis Ababa, Ethiopia. *Int J Nurse Midwifery*. 2018; 10(7): 81–89. <https://doi.org/10.5897/IJNM2017.0289>
- [39] Ibikunle, H. A., Okafor, I. P., & Adejimi, A. A. (2021). Pre-natal nutrition education: Health care providers' knowledge and quality of services in primary health care centres in Lagos, Nigeria. *PloS one*, 16(11), e0259237.
- [40] Kiboi, W., Kimiywe, J., & Chege, P. (2017). Determinants of dietary diversity among pregnant women in Laikipia County, Kenya: a cross-sectional study. *Bmc Nutrition*, 3, 1-8.
- [41] Geta, T. G., Gebremedhin, S., & Omigbodun, A. O. (2022). Dietary diversity among pregnant women in Gurage Zone, South Central Ethiopia: assessment based on longitudinal repeated measurement *International Journal of Women's Health*, 599-615.
- [42] Jahan, T. E. (2022). Assessment of knowledge & practices regarding antenatal care guidelines and impact of dietary practice on the nutritional status of pregnant women in the rohingya community (Doctoral dissertation, Chattogram Veterinary & Animal Sciences University).
- [43] Omer, A. M., Haile, D., Shikur, B., Macarayan, E. R., & Haagos, S. (2020). Effectiveness of a nutrition education and counselling training package on antenatal care: a cluster randomized controlled trial in Addi Ababa. *Health Policy and Planning*, 35(Supplement_1), i65-i75.
- [44] Ramulondi, M., de Wet, H., & Ntuli, N. R. (2021). Traditional food taboos and practices during pregnancy, postpartum recovery, and infant care of Zulu women in northern KwaZulu-Natal. *Journal of Ethnobiology and Ethnomedicine*, 17, 1-19.

- [45] Iradukunda, D., & Ngomi, N. N. (2020). Knowledge, attitude and practices towards nutrition and influencing factors among pregnant and lactating women in Kigeme Refugee Camp, Rwanda.
- [46] Masuku, S. K., & Lan, S. J. J. (2014). Nutritional knowledge, attitude, and practices among pregnant and lactating women living with HIV in the Manzini region of Swaziland. *Journal of Health, Population, and Nutrition*, 32(2), 261.
- [47] Bayked, E. M., Yimer, E. M., Gelaw, T., Mohammed, A. S., & Mekonen, N. A. (2024). Dietary knowledge, attitude, practice, and associated factors among pregnant mothers in Ethiopia: a systematic review and meta-analysis. *Frontiers in Public Health*, 12, 1393764.
- [48] Mengie, T., Dessie, Y., Egata, G., Muche, T., Habtegiorgis, S. D., & Getacher, L. (2022). Food taboos and associated factors among agro-pastoralist pregnant women: A community-based cross-sectional study in Eastern Ethiopia. *Heliyon*, 8(10).
- [49] Lander, R. L., Hambidge, K. M., Westcott, J. E., Tejeda, G., Diba, T. S., Mastiholi, S. C., & Women First Preconception Nutrition Trial Group. (2019). Pregnant women in four low-middle income countries have a high prevalence of inadequate dietary intakes that are improved by dietary diversity. *Nutrients*, 11(7), 1560.
- [50] Abou Haidar PhD, M. Y., & Bou Yazbeck PhD, E. (2018). Knowledge, attitude and practices toward nutrition and diet during pregnancy among recently delivered women of Syrian refugees. *Journal of Refugee & Global Health*, 1(2), 6.
- [51] Abute, L., Beyamo, A., Erchafo, B., Tadesse, T., Sulamo, D., & Sadoro, T. (2020). Dietary Practice and Associated Factors among Pregnant Women in Misha Woreda, South Ethiopia: A Community Based Cross - Sectional Study. *Journal of Nutrition and Metabolism*, 2020(1), 5091318.
- [52] Tesfa, S., Aderaw, Z., Tesfaye, A., Abebe, H., & Tsehay, T. (2022). Maternal nutritional knowledge, practice and their associated factors during pregnancy in Addis sub city health centers, Addis Ababa, Ethiopia. *International Journal of Africa Nursing Sciences*, 17, 100482.