Research Article

Assessment Of Nutritional Status Among A Sample Of Pregnant Women In Al -Samawah City In Iraq

Tabark J. Abd AL-kadhim[1], Atta Ah. Mousa AL- Sarray[2], Kareem Ghdhban Sajem[3]

[1]Middle Technical University in Baghdad / College of Health and Medical Techniques /Community Health Department /Iraq. E-mail: eac5001@mtu.edu.iq
[2]Prof. Middle Technical University in Baghdad / College of Health and Medical Techniques /Community Health Department /Iraq. E-mail: attaahalsarray@gmail.com
[3]Assist Prof. Middle Technical University/ Community Health Department /Iraq.

Abstract

Poor nutritional status among pregnant women remains a common public health problem in Iraq and contributes to increased maternal morbidity and mortality. Aim: Assess the nutritional status of pregnant women and to determine the association between Body Mass Index(BMI)categories and socio-demographic and obstetric variables. Methods: A cross-sectional study was conducted among 400 pregnant women. Participants were recruited from Al-Hussein Teaching Hospital, Maternity and Children's Teaching Hospital, and Samawah Primary Healthcare Sector. Data were collected from December 21,2025 to March 1, 2026. The reliability of the questionnaire was assessed to determine its internal consistency and stability. Results: Overweight and obesity were observed in 47.3% and 26.3% of women, respectively. A significant association was found between age group and BMI categories (p = 0.044) with women aged 20-34 years having higher rates of overweight and obesity (81.0% and 77.1%, respectively). Additionally, there was a significant association between BMI and gravidity (p = 0.025), as multigravida women were more likely to fall into the overweight and obese categories (79.9% and 84.8%, respectively). Gestational trimester showed a highly significant association with BMI (p = 0.001), where obesity was higher during the third trimester (58. 1%). Nevertheless, no significant associations were found between BMI and other socio-demographic, obstetric, or physical activity characteristics. Conclusion: Pregnant women are frequently overweight or obese, and these conditions were significantly associated with maternal age, gravidity and gestational trimester. However, no significant associations were found between BMI and most other socio-demographic, obstetric, or physical activity variables.

Keywords: Assessment, Nutritional status, Pregnant, Women, Iraq.

1. Introduction

Pregnancy is a period of significant physical, emotional, and hormonal changes in a woman's life. During this time, the body undergoes certain changes to support the growth and development of the fetus. Nutrition is one of the most significant factors affecting the health of both moms and fetuses [1]. Nutrition, throughout the life of human beings, has a major effect on health. A nutritious diet is one of the most crucial strategies to safeguard the welfare of both the mother and the fetus in both developed and developing countries, therefore this is especially crucial for expectant mothers. A mother's nutritional status plays a critical role in defining both her and her child's general health from conception till nursing. A good diet reduces the likelihood of getting chronic illnesses later in life, according to recent studies[2].

Furthermore, to support fetal development and maintain maternal health, the mother's nutritional requirements rise dramatically. Both macronutrients like proteins, fats, and carbohydrates and micronutrients like folic acid, iron, calcium, vitamin D, and iodine are necessary. Each type of food serves an essential purpose. For example, proteins aid in the creation of fetal tissue, lipids, especially omega-3 fatty acids, promote the development of the fetal brain and vision, and carbohydrates provide energy [3,4].

Undernourished women are more likely to suffer from obstetric difficulties, which can result in maternal morbidity and mortality. Common obstetric issues associated with maternal undernourishment include preeclampsia, obstructed labor, premature labor, early rupture of the membrane, prolonged labor, surgical delivery, and sepsis/chorioamnionitis [5].

Maternal malnutrition also effects fetal and child health Intrauterine growth restriction (IUGR), which happens when the fetus does not reach its full potential, leads in low birth weight and an increased risk of newborn death. Congenital anomalies: Deficits in essential nutrients like as folic acid and iodine can cause neural tube defects and other birth abnormalities. Preterm birth, impaired growth and development, chronic ailments, etc.[6].

The socioeconomic, sociocultural, anthropological, and psychological facets of a person's surroundings are intimately related to their eating habits. As a result, it is crucial to accept both the eating habits and characteristics of the groups that most commonly adhere to them. This data is crucial for developing tailored solutions that effectively address each group's particular requirements [7].

2. Methodology

2.1 Study Design and Setting

A cross-sectional study was conducted to assess the nutritional status of pregnant women in Al- Samawah city. The study was conducted at Al- Samawah City which includes two main government hospitals: Al-Hussein Teaching Hospital and the Maternity and Children's Teaching Hospital. It also has two primary healthcare sectors: Samawah Primary Healthcare Sector 1 and Samawah Primary Healthcare Sector 2.

2.2 Sample Size

400 samples of pregnant women were collected. They ranged in age from 15 to 45 years.
The Sample Size Was Calculated Using the following Formula [8] **:** $n = Z^2 \times P (1 - P) / d^2$ Where:
n = sample size (= 385)

Z = Z-score corresponding to the level of confidence (for a 95% confidence level, Z = 1.96) P = Expected prevalence or proportion. Since no recent population-based
prevalence data for Assessment of Nutritional status of pregnant women in Al-Samawah city, a conservative estimate of 50% (0.5) was used to obtain the maximum sample size.
d = Precision or margin of error (0.05), representing the maximum allow able difference between the sample proportion and the population proportion.
The calculated minimum sample size was 385 women. To enhance the statistical power and Reliability of the study, the final sample size was increased to 400 women.

Inclusion Criteria

Pregnant women aged 15 to 45 residing in Al- Samawah City, and pregnant women attend the Maternity and Children's Hospital and health centers affiliated with the Al- Samawah City First and Second Sectors only.

Exclusion Criteria

Pregnant women over 45 years of age, and pregnant women who visited the hospital and health centers from outside the city of Al- Samawah City.

2.3 Data Collection

After confirming the validity and reliability of the study instrument, the researcher used an approved questionnaire by structured interview technique with pregnant women, the first step was to get a diagnosis from the specialist physician that this woman is pregnant to collect Socio-demographic Information, and Clinical Examination. The laboratory team has completed the biochemical tests (Blood group, Hemoglobin level, Blood Glucose level, GUE) for pregnant women as a final step. Data were collected 21, December 2025 to 1, March 2026.

2.4 Statistical Analysis

The collected data were coded, entered, presented, and analyzed by computer using the available data base software program statistical package of IBM SPSS-29 (IBM Statistical Packages for Social Sciences- version 29, Chicago, IL, USA). Data were presented in simple measures of frequency, percentage, mean, standard deviation, and range (minimum-maximum values). The Pearson's Chi-square (χ^2) test was used to evaluate the relationship between categorical variables. Statistical significance was defined as a p-value of less than 0.05.

2.5 Ethical Consideration

Ethical considerations are among the researcher's most crucial actions. The Middle Technical University/Medical Ethics Committee granted ethical approval with reference number (MEC: 176). One of the most fundamental precepts prior to data collection is protecting participants' values and dignity.

3. Result

Table (1): showed the demographic characteristics of the study sample, which included 400 pregnant women in the city of Samawah. The findings show that 81.5% of participants were between the ages of 20 and 34, with the largest percentage in the 25–29 age group (33.0%) and the lowest number in the under-20 age group (6.8%). The participants' ages ranged from 16 to 40, with a mean age of 26.9 ± 5.5 years. In terms of the mothers' level of education, the largest proportion had a university degree or above (33.8%), followed by those with only a primary school education (22.3%), and those who were only Read and write (5.0%). In a similar vein, husbands with a university degree or above made up the largest percentage (37.3%), while those who were merely literate had the lowest percentage (6.3%). According to this study, the majority of moms were housewives (70.8%), followed by working mothers (24.8%) and self-employed mothers (0.5%). In terms of the husbands' occupations, over half (51.5%) were skilled, followed by liberal professionals (37.0%), and unskilled workers (11.5%). In terms of marital status, 99.8% of participants were married, whilst only 0.3% were separated.

Table (1): Socio-demographic characteristics of the study sample

		No.	%
Age (years)	<20years	27	6.8
	20---24	112	28.0
	25---29	132	33.0
	30---34	82	20.5
	=>35years	47	11.8
Age (years)	<20years	27	6.8
	20---34	326	81.5
	=>35years	47	11.8
	Mean± SD (Range)	26.9± 5.5	(16-40)
Educational level of mother	Illiterate	84	21.0
	Read & Write	20	5.0
	Primary	89	22.3
	Intermediate	34	8.5
	Secondary	38	9.5
	College & Higher	135	33.8
Educational level of husband	Illiterate	56	14.0
	Read & Write	25	6.3

	Primary	82	20.5
	Intermediate	52	13.0
	Secondary	36	9.0
	College & Higher	149	37.3
Occupation of mother	Employee	99	24.8
	Free work	2	0.5
	Student	16	4.0
	Housewife	283	70.8
Occupation of husband	Professional	148	37.0
	Skilled labour	206	51.5
	Unskilled labour	46	11.5
Marital status	Married	399	99.8
	Separated	1	0.3
	Others	-	-

Table (2): demonstrated a relationship between the study participants' socio demographic characteristics and BMI categories. Age and BMI were shown to be statistically significantly correlated (p = 0.044), suggesting that the distribution of BMI differs significantly among age groups. The age group of 20–34 had the highest percentage of overweight (81.0) and obese participants (77.1), whereas the under-20 age group had the lowest percentages. However, there were no statistically significant associations found between body mass index and the mother's educational level (p = 0.238), the husband's educational level (p = 0.544), the mother's occupation (p = 0.326), or the husband's occupation (p = 0.295). With the exception of age in this study, differences in BMI categories between other social and demographic groups were not statistically significant.

Table (2): Association between BMI and socio-demographic characteristics of pregnant women

		BMI (Kg/m2)						P value
		Normal (n=106)		Overweight (n=189)		Obese (n=105)		
		No.	%	No.	%	No.	%	
Age (years)	<20years	9	8.5	13	6.9	5	4.8	0.044*
	20---34	92	86.8	153	81.0	81	77.1	
	=>35years	5	4.7	23	12.2	19	18.1	
Educational level of mother	Illiterate	19	17.9	41	21.7	24	22.9	0.238
	Read & Write	5	4.7	9	4.8	6	5.7	
	Primary	24	22.6	39	20.6	26	24.8	
	Intermediate	16	15.1	15	7.9	3	2.9	
	Secondary	12	11.3	16	8.5	10	9.5	
	College & Higher	30	28.3	69	36.5	36	34.3	

Educational level of husband	Illiterate	13	12.3	28	14.8	15	14.3	0.544
	Read & Write	10	9.4	10	5.3	5	4.8	
	Primary	18	17.0	38	20.1	26	24.8	
	Intermediate	18	17.0	23	12.2	11	10.5	
	Secondary	7	6.6	16	8.5	13	12.4	
	College & Higher	40	37.7	74	39.2	35	33.3	
Occupation of mother	Employee	19	17.9	54	28.6	26	24.8	0.326
	Free work	-	-	1	.5	1	1.0	
	Student	6	5.7	8	4.2	2	1.9	
	Housewife	81	76.4	126	66.7	76	72.4	
Occupation of husband	Professional	33	31.1	72	38.1	43	41.0	0.295
	Skilled labor	58	54.7	93	49.2	55	52.4	
	Unskilled labor	15	14.2	24	12.7	7	6.7	
*Significant difference between percentages using Pearson Chi-square test (c^2-test) at 0.05 level.								

Table (3): presented the association between obstetric, reproductive, and health-related characteristics and BMI categories (normal, overweight, and obese) among pregnant women. Gravidity and BMI were shown to be statistically significantly correlated (p=0.025), with multigravida women making up a larger percentage of the overweight and obese groups than prim gravida. In contrast, no significant associations were found between BMI and number of parity (p=0.658) or inter-pregnancy interval (p=0.333). However, there was a highly significant correlation (p=0.001) between gestational age (trimester) and BMI, with obesity being more common in the third trimester. Furthermore, there was no significant correlation found between BMI and the majority of obstetric history characteristics, such as history of ectopic pregnancy or miscarriage (p=0.195), stillbirth (p=0.196), preterm labor (p=0.432), cesarean section (p=0.161), and twin pregnancy (p=0.283). Regarding healthcare utilization, antenatal care visits did not show a statistically significant association (p=0.080), while vaccination during pregnancy was significantly associated with BMI (p=0.010), indicating higher vaccination rates among overweight and obese women. Additionally, there were no significant correlations found between BMI and general health disorders, such as dietary preference (p=0.855), menstrual cycle issues (p=0.890), allergy or medication use (p=0.095), or history of medical difficulties (p=0.350).

Table (3): Association Between Obstetric, Reproductive, and Health-Related Characteristics and Body Mass Index (BMI) Among Pregnant Women

		BMI (Kg/m2)						P value
		Normal (n=106)		Overweight (n=189)		Obese (n=105)		
		No.	%	No.	%	No.	%	
Gravidity	Prim gravida	32	30.2	38	20.1	16	15.2	0.025*
	Multigravida	74	69.8	151	79.9	89	84.8	
Number of parity for multigravida	P2	33	44.0	64	42.7	30	33.7	0.658
	P3	17	22.7	33	22.0	23	25.8	
	P4 & more	25	33.3	53	35.3	36	40.4	
Inter-pregnancy interval (years)	<2	30	40.0	54	36.0	26	29.2	0.333
	=>2	45	60.0	96	64.0	63	70.8	
GA Trimester	First trimester	40	37.7	48	25.4	18	17.1	0.001*
	Second trimester	33	31.1	63	33.3	26	24.8	
	Third trimester	33	31.1	78	41.3	61	58.1	
History of miscarriage \ectopic	Yes	29	27.4	62	32.8	41	39.0	0.195
	No	77	72.6	127	67.2	64	61.0	
History of still birth	Yes	3	2.8	13	6.9	9	8.7	0.196
	No	103	97.2	176	93.1	95	91.3	
History of preterm labour	Yes	2	1.9	9	4.8	5	4.8	0.432
	No	104	98.1	180	95.2	100	95.2	
History of cesarean section	Yes	28	26.4	58	30.7	40	38.5	0.161

	No	78	73.6	131	69.3	64	61.5	
Have a twin pregnancy or more	Yes	1	.9	3	1.6	4	3.8	0.283
	No	105	99.1	186	98.4	101	96.2	
History of antenatal care visits at a primary health center	Yes	48	45.3	110	58.2	52	49.5	0.080
	No	58	54.7	79	41.8	53	50.5	
History vaccine injected during this pregnancy	Yes	53	50.0	128	67.7	67	63.8	0.010*
	No	53	50.0	61	32.3	38	36.2	
History of health problem or medical condition not related to pregnancy	Yes	17	16.2	35	18.5	25	23.8	0.350
	No	88	83.8	154	81.5	80	76.2	
History of allergy or medication	Yes	12	11.3	35	18.5	11	10.5	0.095
	No	94	88.7	154	81.5	94	89.5	
Diet preference	Vegetarian	8	7.5	16	8.5	7	6.7	0.855
	Non-vegetarian	98	92.5	173	91.5	98	93.3	
History of problem menstruation cycle	Yes	29	27.4	54	28.6	27	26.0	0.890
	No	77	72.6	135	71.4	77	74.0	
*Significant difference between percentages using Pearson Chi-square test (c^2-test) at 0.05 level.								

Table (4): showed the relationship between physical activity levels and different body mass index (BMI) categories (normal weight, overweight, and obesity). According to the results, 92.5% of participants in the normal weight category, 90.5% in the overweight category, and 89.5% in the obese category were classified as having moderate physical activity (MET 600–3000). In contrast, the proportions of participants who did not engage in any physical activity (no) or engaged in very low physical activity (low) were relatively small and did not differ significantly between BMI categories. According to the statistical analysis (P = 0.531), there was no statistically significant correlation between physical activity level and BMI categories at the 0.05 significance level. This means there was no statistically significant association between physical activity level and BMI in the studied population.

Table 4: Association Between Physical Activity Level (IPAQ Score) and Body Mass Index (BMI)

		BMI (Kg/m2)						P value
		Normal (n=106)		Overweight (n=189)		Obese (n=105)		
		No.	%	No.	%	No.	%	
IPAQ Score	No	3	2.8	9	4.8	8	7.6	0.531
	Low (MET<600)	5	4.7	9	4.8	3	2.9	
	Moderate (600-3000 MET)	98	92.5	171	90.5	94	89.5	
	High (>3000 MET)	-	-	-	-	-	-	
*Significant difference between percentages using Pearson Chi-square test (c^2-test) at 0.05 level.								

4. Discussion

One indication of the community's nutritional condition is the nutritional status of pregnant women. Nutritional deficits may result if a pregnant woman's diet is not harmonized with her body's requirements. The study results showed that 81.5% of participants were between the ages of 20 and 34 years this study in line with [9],According to this age distribution, women are most likely to be in stable reproductive and household responsibilities during the years when pregnancies in the research setting occur.

Regarding the educational level, the present study shows that (21.0%) of the women were illiterate and (33.8%) had attended college and higher education. Which is similar to other result reported in Nigeria[10], which found that (50.5%) of participants had finished postsecondary education, indicating a high level of literacy. The high proportion of educated mothers may reflect better access to higher education in urban areas. Maternal education plays an important role in health by influencing nutritional knowledge and lifestyle, which can directly affect maternal and fetal health.

Regarding to occupation of mother most mothers were housewives (70.8%), this result similar to study conducted by [11], [12], which showed that (91.2%) mother was housewives .Cultural standards that require women to take on more household duties or to concentrate on the pregnancy after conception are responsible for this high percentage.

The current study shows a strong association between maternal age and BMI with the highest percentage of overweight (81.0%) and obesity (77.1%) among women in the 20–34 age group. Which is similar to what had been reported in Iraq[13] which found that the best reproductive age range is between 20-35 years. it also agree with other study in Brazil [14], which found that metabolic risks and BMI frequently peak during this time due to cumulative lifestyle factors. and as women go through their reproductive years, the percentage of weight-related problems rises linearly. This trend may result from age-related fat distribution changes, lower physical activity, and repeated reproductive cycles.[15]

Conversely, no statistically significant correlations were found between BMI and education level The absence of correlation between education and profession indicates that pregnancy-stage characteristics, lifestyle choices, and biological/behavioral processes may have a greater impact on BMI during pregnancy in this cohort than formal education alone. This results in line with study conducted by [16], which stated that Knowledge of a healthy diet and exercise may be influenced by education, but knowledge does not necessarily convert into practice because of factors including cultural feeding customs, family duties, food availability, and limits on physical activity during pregnancy.

Furthermore, study presented that the association between obstetric, reproductive, and health-related characteristics and BMI categories (normal, overweight, and obese) among pregnant women. The present study shows that association between gravidity and BMI with multigravida women making up a much higher percentage of the overweight (79.9%) and obese (84.8%) groups than prim gravida women. Which is agree with other study done in Africa[17] which found that with each subsequent pregnancy, multiparous women frequently experience alterations in the distribution of body fat. These result agree with study in Iran[18] which found that residual weight retention from prior gestations is associated with higher gravidity and increased weight indicators. This link may result from the metabolic stress of multiple pregnancies and inadequate weight control between pregnancies. [13]
BMI and gestational age (trimester) were shown to be extremely significantly correlated ($p = 0.001$), with obesity being more prevalent in the third trimester. As a study conducted by [19], these findings indicate that gestational weight gain during the 3rd trimesters is more strongly associated with BMI. For reasons this makes biological sense because due to fetal development, placental bulk, increased maternal blood volume, and physiological fluid retention, BMI normally rises as gestation goes on. Increased obesity prevalence later in pregnancy may result from women with higher baseline BMIs gaining weight in diverse ways throughout pregnancy [20].

This study shows no significant association between BMI and physical activity levels with the vast majority of women maintaining moderate activity across all weight categories .This is agree with study in Iraq and India [13],[21]which found that pregnant women prefer to maintain baseline activity levels regardless of their weight status and frequently lack particular knowledge regarding physical activity recommendations. The absence of a link may be due to pregnancy-related limitations such as fatigue, back pain, and shortness of breath, which reduce physical activity. Therefore, weight gain during pregnancy in this population appears to be more related to dietary habits and physiological changes than to physical activity[22].

5. Conclusion

Maternal age, gravidity, and gestational age "trimester" are significantly association with BMI categories among pregnant women in Samawah City; however, there was no statistically significant correlation between BMI and the majority of sociodemographic variables, obstetric history factors, physical activity, and numerous health-related disorders. These results emphasize the necessity of BMI-focused maternal care systems that take mainly considered multigravida women, women in the "third trimester" of pregnancy, and women in age groups at higher risk.

Authors Contribution

Ta. Ja.: Conceptualization of the study, literature search, data collection, and statistical analysis.
At. Sa: manuscript writing and editing, contributed to the conceptualization of the study.

KaGh. assisted in data collection and analysis, participated in drafting and revising the manuscript, provided critical feedback throughout the research process and helped shape the final version of the article.
All authors equally contribute to this study.

Acknowledgments
The author would like to express their gratitude to Middle Technical University in Baghdad / College of Health and Medical Techniques, especially the Community Health Department. Finally, the authors extend their appreciation to all mothers who participated in this research.

Conflict of Interest Statement
The authors declare no conflict of interest.

References

1. N. Abdunazarova, “PROPER NUTRITION FOR PREGNANT WOMEN,” Int. J. Med. Sci., vol. 1, no. 1, pp. 430–432, 2025.
2. S. Shemsu, A. Argaw, and B. Zinab, “Dietary practice and nutritional status among pregnant women attending antenatal care at Mettu Karl referral hospital, southwest Ethiopia,” Open Public Health J., vol. 13, no. 1, 2020.
3. S. Suparji, H. S. W. Nugroho, T. P. Rahayu, A. N. Hanifah, and A. S. Prayogi, “The Importance of Optimal Nutritional Intake for The Health of Pregnant Women in Indonesia: Key Challenges and Strategic Solutions,” Natl. J. Community Med., vol. 15, no. 11, pp. 993–997, 2024.
4. A. M. Habeeb, A. Ah, M. Al-Sarray, A. Hussein, and A. Hafidh, “Vitamin D3 level and Liver Enzymes Among a sample of Type 2 Diabetes patients in Hilla city, Iraq,” J. Surv. Fish. Sci., vol. 10, no. 3S, p. 2023, 2023.
5. Z. Figa, T. Temesgen, A. A. Mahamed, and E. Bekele, “The effect of maternal undernutrition on adverse obstetric outcomes among women who attend antenatal care in Gedeo zone public hospitals, cohort study design,” BMC Nutr., vol. 10, no. 1, p. 64, 2024.
6. J. Dayan, “Maternal and Pediatric Nutrition The Impact of Malnutrition on Mothers and Children : A Comprehensive Overview,” vol. 9, no. 10002, pp. 28–29, 2024, doi: 10.35248/2472-1182.24.9.236.
7. T. Fikadu, D. Tamiru, and B. W. Ademe, “Factors associated with dietary patterns (DPS) and nutritional status among pregnant women in AM-HDSS, South Ethiopia,” Front. Nutr., vol. 11, p. 1443227, 2024.
8. I. Z. Sadiq, A. Usman, A. Muhammad, and K. H. Ahmad, “Sample size calculation in biomedical , clinical and biological sciences research,” J. Umm Al-Qura Univ. Appl. Sci., vol. 11, no. 1, pp. 133–141, 2025, doi: 10.1007/s43994-024-00153-x.
9. F. Abedini, M. Mohammadian Amiri, M. Danaei, and N. Eshraghi, “Assessment of Communication AFI and Uterocervical Angle with Pregnancy Duration in Patients with Pretem Premature Rupture of Membranes 24-34 Weeks,” J. Obstet. Gynecol. Cancer Res., vol. 7, no. 6, pp. 489–496, 2022.
10. O. Emmanuel, “Nutritional Status of Pregnant Women Attending Antenatal Care in a tertiary Health Facility in Abeokuta, South West Nigeria,” Egypt. J. Nutr., vol. 39, no. 2, pp. 100–115, 2024, doi: 10.21608/enj.2024.353279.
11. A. Auranissa, Y. Zuhairini, and W. Nurdiawan, “Relationship between age, occupation, education, and parity with the chronic energy deficiency among pregnant women,” Int. J. Public Heal. Sci., vol. 13, no. 3, pp. 1223–1229, 2024.
12. A. A. Mousa Al-Sarray, W. A. Al-Ani, and S. N. Abed, “Clinico-Epidemiological Study of Patients with Erectile Dysfunction Attending Al-Kadymia Teaching Hospital in Baghdad.,” Indian J. Public Heal. Res. Dev., vol. 10, no. 4, 2019.
13. R. T. Hasan, “Mid-upper arm circumference as a tool to assess the nutritional status of pregnant women and associated factors,” J. Educ. Health Promot., vol. 14, no. 1, p. 284, 2025.
14. M. J. Miele et al., “Maternal nutrition status associated with pregnancy-related adverse outcomes,” Nutrients, vol. 13, no. 7, p. 2398, 2021.
15. S. Msollo, “Correlations of Anthropometric Measurements Among Pregnant Women Residing in Arusha City, Tanzania,” East African J. Sci. Technol. Innov., vol. 5, no. 3, 2024.
16. G. Rezaeizadeh et al., “Maternal education and its influence on child growth and nutritional status during the first two years of life: a systematic review and meta-analysis,” EClinicalMedicine, vol. 71, 2024.
17. A. Fakier, G. Petro, and S. Fawcus, “Mid-upper arm circumference: A surrogate for body mass index in pregnant women.,” S. Afr. Med. J., vol. 107, no. 7, pp. 606–610, Jun. 2017, doi: 10.7196/SAMJ.2017.v107i7.12255.

18. G. Rezaeizadeh et al., “Maternal socioeconomic status and early childhood growth and nutrition in the PERSIAN Birth Cohort with insights into the double burden of malnutrition,” Sci. Rep., vol. 15, no. 1, p. 14893, 2025.
19. P. Rekawek et al., “Large-for-gestational age diagnosed during second-trimester anatomy ultrasound and association with gestational diabetes and large-for-gestational age at birth,” Ultrasound Obstet. Gynecol., vol. 56, no. 6, pp. 901–905, 2020.
20. D. C. Pacyga, M. Henning, C. Chiang, R. L. Smith, J. A. Flaws, and R. S. Strakovsky, “Associations of pregnancy history with BMI and weight gain in 45–54-year-old women,” Curr. Dev. Nutr., vol. 4, no. 1, p. nzz139, 2020.
21. M. Suresh, S. Jain, and N. B. Kaul, “Evaluation of MUAC as a tool for assessing nutritional status during pregnancy (> 20 weeks of gestation) in Delhi India,” World Nutr., vol. 12, no. 1, pp. 65–72, 2021.
22. K. Yasodhadevi, S. A. E. Preethi, and S. Banumathi, “Assessment of Nutritional Status of Pregnant Women in Coimbatore District and Imparting Nutrition Education,” vol. 10, no. June, pp. 29–36, 2023, doi: 10.15613/fijrfn/2023/v10i1/220469.