



Research Article

Prevalence and Predictors of Undernutrition Among Pregnant Women Attending Antenatal Care at Salale University Comprehensive Specialized Hospital

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Abstract

Background: Maternal undernutrition remains a persistent and critical public health issue in Ethiopia, significantly elevating risks of maternal morbidity, preterm birth, low birth weight, and increased maternal mortality. Recent evidence shows that undernourished pregnant women have 2.5 times higher odds of delivering low birth weight babies. In Ethiopia, the prevalence of undernutrition among pregnant women ranges from 14.4% to 52.6% across different settings. However, there is limited context-specific evidence on the magnitude and determinants of maternal undernutrition among pregnant women attending antenatal care in Salale, Fitcha. **Objective:** To assess prevalence and predictors of undernutrition among pregnant women attending antenatal care at Salale university comprehensive specialized, Fitcha, North Shewa Zone, Oromia, Ethiopia 2026. **Methods:** An institution-based cross-sectional study was conducted among 296 pregnant women attending antenatal care follow-up at Salale University Comprehensive Specialized Hospital from December 22, 2025, to May 18, 2026. A systematic sampling technique was employed. Data were collected using a structured questionnaire and anthropometric measurements, including Mid-Upper Arm Circumference (MUAC), designed using KoboToolbox. Dietary diversity was assessed using the Food and Agriculture Organization (FAO) 10-food group system, and household food security was evaluated using the Household Food Insecurity Access Scale (HFIAS). Bivariate and multivariable logistic regression analyses were performed. **Results:** In this study, the magnitude of undernutrition among pregnant women was 31.4% (95% CI: 26.4–36.92%). Multivariable analysis showed that consistent iron and folic acid supplementation significantly reduced the odds of undernutrition by 68.1% (AOR = 0.319; 95% CI: 0.152–0.672; $p = 0.003$). Higher household income and better dietary diversity also served as strong protective factors against maternal malnutrition ($p < 0.003$). Additionally, improved household food security heavily influenced outcomes, with targeted families showing a 78.3% lower risk of undernutrition (AOR = 0.217; 95% CI: 0.118–0.399; $p < 0.001$). **Conclusion:** Maternal undernutrition is a severe public health problem in the study area. Regular prenatal monitoring, enhancement of household food security intervention models, intensive nutritional counseling, and scaling up iron-folic acid supplementation uptake are highly recommended to address the underlying challenges.

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Keywords

Undernutrition, Pregnant Women, ANC, Fiche, Ethiopia

1. Introduction

1.1. Background

Pregnancy is defined as the condition from the time of conception until the time of childbirth which involves anatomical, physiological and metabolic adaptation of the mother to support growth of the fetus [1]. Pregnancy and childbirth have major implications on maternal and child health since the conditions under which they occur influence the viability of the fetus and its development [2]. Pregnancy is an anabolic state which enhances nutritional requirements of the mothers in order to support the needs of the growing fetus, placenta, and maternal tissue; therefore, macronutrients and micronutrients play a critical role in pregnant mothers in meeting the increasing nutritional demand of metabolic activity [2, 3].

Undernutrition can be defined as an insufficient intake of energy, protein, and essential micronutrients to maintain normal bodily function [4]. It can be expressed as a low Body Mass Index (BMI), insufficient dietary intake, or a deficiency of specific micronutrients [4]. Undernutrition during pregnancy is strongly associated with unfavorable consequences such as intrauterine growth restriction (IUGR), low birth weight (LBW), preterm birth, and increased maternal and neonatal morbidity and mortality [5, 6]. Furthermore, undernutrition during pregnancy directly contributes to the perpetuation of the intergenerational malnutrition cycle [7].

Anthropometric measurements such as Mid-Upper Arm Circumference (MUAC) represent one of the simplest and most efficient methods for screening undernourished women during pregnancy due to their reliability, feasibility, and stability across gestational periods. For instance, a MUAC below 23 cm in pregnant mothers has been recommended by the World Health Organization (WHO) to indicate maternal undernutrition [6]. Antenatal care (ANC) is a crucial window of opportunity for mothers to receive specialized care and guidance regarding their nutrition during pregnancy. This service provides routine nutritional assessment services such as MUAC tracking, nutrition counseling, iron and folic acid supplementation, and monitored weight gain. Inadequate ANC utilization significantly limits the opportunity to provide optimal nutritional support to pregnant mothers compared to appropriate, timely utilization patterns [6, 8].

1.2. Statement of the Problem

Maternal undernutrition has been a serious global public health problem and a major cause of morbidity and mortality

among mothers and children, especially in the developing world and low- and middle-income countries [9]. Globally, an estimated 10 to 20 percent of women of reproductive age are undernourished, with substantially higher proportions observed in resource-limited countries [6]. Nutritional deficiencies during pregnancy have profound long-term consequences, resulting in physical and cognitive development delays in childhood and increasing susceptibility to infectious diseases [10, 11]. Each year, around 20 million newborns worldwide are born with low birth weight, of which maternal undernutrition is a primary cause [12]. Low birth weight infants face a high risk of death during the early neonatal period, and even after reaching adulthood, they exhibit a higher risk of developing non-communicable chronic diseases like diabetes and cardiovascular conditions later in life [10, 11, 13].

Maternal undernutrition still poses a major threat in sub-Saharan Africa, with the prevalence varying between 15% and 30% among pregnant women [14]. The determinants associated with this high burden include deep-seated poverty, chronic food insecurity, poor access to health care, and inappropriate maternal feeding practices [8, 15]. In Ethiopia, the prevalence of maternal undernutrition has been consistently high. Cross-sectional studies conducted in different settings have revealed a prevalence ranging between 20% and 30%, with certain pockets exhibiting even higher numbers [15, 16]. One such study reported a prevalence of 24.2% among pregnant women attending ANC services [8]. Among the several factors implicated in maternal undernutrition in Ethiopia are low socioeconomic status, low maternal education, poor dietary diversity, poor nutritional knowledge, maternal infections, and heavy physical workloads [8, 15, 17]. Furthermore, low access to and under-utilization of maternal healthcare services drastically reduce opportunities for early detection and management of under-nutrition [11, 18].

Despite the implementation of national nutrition programs and an overall expansion in access to ANC services, maternal under-nutrition has continued to remain persistent in Ethiopia [19]. This stagnation implies the existence of gaps in health service utilization, accessibility barriers, or context-specific ineffectiveness of the applied interventions. Moreover, wide variation in nutritional status between different geographical areas implies the presence of context-specific determining factors for which little local evidence is currently available [8, 15]. Studies are available from many parts of Ethiopia, but most are restricted to specific geographical regions and specific localized settings [19]. Extremely limited studies are

available focusing specifically on the magnitude and determinants of maternal under-nutrition in the study area of Salale and Fiche town. Socio-economic conditions, specific local dietary practices, and access to healthcare can influence nutritional status differently in this particular highland community. Changing situations regarding food insecurity, economic status, and healthcare access can significantly alter nutritional profiles over time, meaning existing historic findings cannot serve as exact representations of current conditions. Based on this context, it is crucial to determine the current magnitude and risk factors for maternal undernutrition among pregnant mothers attending ANC in Salale University Comprehensive Specialized Hospital.

1.3. Significance of the Study

This study provides current and context-specific empirical evidence on maternal nutritional status among pregnant women attending antenatal care. By identifying key factors associated with maternal undernutrition, it helps healthcare managers recognize highly vulnerable groups and targeting areas requiring prioritized attention to improve maternal and pregnancy outcomes. The findings will directly support healthcare providers in strengthening routine antenatal care practices, particularly early screening, tailored nutrition counseling, and robust follow-up protocols, which can minimize adverse outcomes such as low birth weight and poor fetal growth. Beyond clinical outcomes, the study contributes to improving the overall quality of maternal health services by emphasizing the integration of routine nutritional assessment and counseling into continuous care while enhancing active awareness among pregnant women about proper nutrition. In addition, the findings will be highly useful for policymakers and health planners by providing timely evidence to support decision-making and modify maternal nutrition interventions across the region. The study will also serve as a valuable reference for other researchers and provide baseline tracking data for future studies in similar institutional or community settings.

2. Literature Review

2.1. Prevalence of Maternal Malnutrition

Globally, approximately 10–13% of women aged 20–49 years are underweight, with the highest prevalence concentrated in low- and middle-income countries, particularly across Eastern and Southern Africa [20]. A systematic review in sub-Saharan Africa reported a pooled prevalence of maternal undernutrition of about 23.5%, reaching more than 30–40% in rural and food-insecure areas [17]. Across reviewed studies conducted in Ethiopia, the prevalence of undernutrition among pregnant women shows wide variation, ranging from 17.7% to 43.1% [21, 22]. Study from Southern Ethiopia reported prevalences of 21% in Gedeo Zone [23], 21.8% in Silte Zone [15], and 43.1% in Konso District [24] while studies

from Northwest Ethiopia and North Shewa documented prevalences of 17.71% and 22.2%, respectively [22, 25]. High prevalences are consistently found in pastoral and rural settings, including 30.9% in the Afar Regional State [26]. In Ethiopia, a meta-analysis of 19 studies reported an overall pooled prevalence of 32% among pregnant women, with major associated factors including illiteracy (AOR = 3.6), rural residence (AOR = 2.6), lack of nutrition counseling, household food insecurity (AOR = 2.5), and low dietary diversity (AOR = 3.7) [27]. Regionally, studies show similarly high rates. In Tigray public hospitals, 40.6% of pregnant women were undernourished [28]. In Bench-Sheko and Kaffa zones, the prevalence reached 42.4%, driven by young maternal age, food insecurity, and poor dietary knowledge [29]. In Konso, 43.1% of pregnant women were undernourished, with key predictors including household food insecurity, low dietary diversity, food taboos, and lack of latrine access [24]. In Eastern Ethiopia, the prevalence was reported at 41.2%, with unintended pregnancy, low dietary diversity, and non-participation in community health networks identified as major contributing factors [30].

2.2. Factors Associated with Maternal Malnutrition

Socio-demographic parameters are major drivers of maternal nutritional status. According to a multi-center cross-sectional study in the North Shewa Zone, low household monthly income (AOR = 3.69) and limited maternal education were significantly associated with a higher undernutrition prevalence among pregnant women. Institutional studies in the Tigray Region indicated that rural residence and employment in agricultural labor increased the risk, whereas a wanted pregnancy served as a strong protective factor for participants. In terms of dietary and household practices, household food insecurity, low dietary diversity, an absence of latrines, and husband-only household resource decision-making significantly increased maternal undernutrition risk. Large household size (≥ 5), non-completion of recommended ANC visits, and reliance on unprotected drinking water are also strongly linked to undernutrition.

Obstetric and reproductive history heavily influences nutritional status. Low hemoglobin levels (< 11 g/dL; AOR = 4.9) and regular high coffee intake during pregnancy (AOR = 1.6) significantly predict maternal undernutrition. National meta-analyses emphasize that unplanned pregnancies and a low daily meal frequency (< 3 meals per day) are critical risk factors for undernutrition among pregnant women. Health service and educational factors are equally vital; the absence of routine nutrition education and counseling during ANC tracks directly with increased risk. Cultural and environmental determinants include restrictive food taboos (such as avoiding eggs, milk, or avocado due to cultural misconceptions), daily consumption of local alcoholic beverages like 'Cheka', weak sanitation infrastructures, lack of latrine access, and reliance on

unprotected water sources.

n=265 (women)

3. Methods and Materials

This study was carried out at Salale University Comprehensive Specialized Hospital (SUCSH) in Fiche town, the administrative center of the North Shewa Zone in Oromia Regional State, Ethiopia. Located about 112 kilometers north of Addis Ababa along the main highway to Debre Markos, Fiche sits at an altitude of approximately 2,738 meters above sea level. The region is characterized by a highland climate that supports the cultivation of various staple crops, including barley, wheat, and vegetables, which play a vital role in local food production and nutrition. Additionally, the Salale area is highly prominent for its livestock production, particularly milk and dairy products, which contribute significantly to the local diet and economy. SUCSH functions as a key tertiary-level public teaching and referral facility, serving a broad catchment area for maternal, neonatal, and child health services. The institutional cross-sectional study was conducted from December 22, 2025, to May 18, 2026.

The source population included all pregnant women residing in Selale who attended ANC services at SUCSH during the study period. The study population consisted of pregnant women who met the predefined eligibility criteria and consented to participate. Inclusion criteria comprised pregnant women of any gestational age tracking ANC who were permanent residents of Fiche City (residing for >=6 months). Exclusion criteria applied to pregnant women who were seriously ill or unable to respond to the interview at the time of data collection, women with known chronic medical conditions affecting nutritional status (such as diabetes, hypertension, renal disease, or malignancy), and women with physical deformities affecting accurate MUAC measurement.

The sample size was determined using the single population proportion formula based on a 95% confidence level ($Z = 1.96$), a 5% margin of error ($d = 0.05$), and a regional prevalence (p) of 22.2% taken from a previous study conducted in North Shewa, Ethiopia [25]

$$n=Z^2P(1-P)/d^2$$
$$1.962*0.222(1-0.222)/0.05 = 265$$

By considering a 11.6% non-response rate, the final target sample size was determined to be 296 women. A systematic random sampling technique was used to select participants. The average monthly ANC attendance across the selected facility was 748 women. The sampling interval ($k = N/n = 748/296 \approx 2$) was determined based on daily ANC logs, and subsequent participants were selected at every 2nd interval until the desired sample size was achieved. Data were collected using a structured questionnaire administered via face-to-face interviews on KoboToolbox. Anthropometric measurements were taken twice using a standard insertion tape, and the average MUAC was recorded. Data analysis was performed in SPSS version 27, utilizing binary logistic regression models to compute Crude and Adjusted Odds Ratios (COR and AOR) with 95% confidence intervals, declaring statistical significance at $p < 0.05$. Ethical clearance was obtained from the Salale University Institutional Research Review Board.

4. Results

4.1. Socio-demographic and Economic Characteristics

A total of 296 pregnant women attending ANC services at SUCSH were included in the study, yielding a perfect response rate of 100%. The mean age of the respondents was 30.30 years (+- 6.36 SD), with nearly half of the respondents (49.7%, n=147) falling within the 25–34 age range. The vast majority of the women were married (90.9%, n=269) and resided in urban environments (65.9%, n=195). In terms of educational background, primary education was the most common level of attainment (39.2%, n=116), followed by 20.9% (n=62) who had achieved college education or higher (4). Over half of the respondents were housewives (53.4%, n=158). Economic status showed that 44.9% (n=133) earned a monthly income between 3,000 and 10,000 ETB, while 40.9% (n=121) exceeded 10,000 ETB. Piped water was used by 78.0% (n=231) of the households, and 92.2% (n=273) utilized pit latrines. Detailed characteristics are presented in Table 1.

Table 1. Socio-demographic and economic characteristics of participants (n=296).

Characteristics	Categories	Frequency (n=296)	Percentage (%)
Marital Status	Single	5	1.7
	Married	269	90.9
	Widowed	11	3.7
	Divorced	11	3.7

Characteristics	Categories	Frequency (n=296)	Percentage (%)
Residence	Rural	101	34.1
	Urban	195	65.9
	Housewife	158	53.4
	Merchant	55	18.6
Occupational Status	Government Employee	51	17.2
	Farmer	29	9.8
	Others	3	1.0
Age Group	15–24	59	19.9
	25–34	147	49.7
	35–49	90	30.4
	No Formal Education	57	19.3
Educational Status	Primary Education	116	39.2
	Secondary Education	61	20.6
	College & above	62	20.9
	<3000 ETB	42	14.2
Household Monthly Income	3000–10000 ETB	133	44.9
	>10000 ETB	121	40.9

4.2. Obstetric and Health Service Characteristics

Regarding reproductive history, a significant majority were multigravida (79.1%, n=234). In terms of parity, 50.3% (n=149) were nulliparous, while 29.7% (n=88) were primiparous. Short birth spacing (<24 months) was observed among 58.4% (n=173) of the participants. Nearly all respondents (97.3%, n=288) had attended antenatal care (ANC) for the current pregnancy. Visually, 31.1% (n=92) were on their third visit, and 29.4% (n=87) had reached their fourth visit. More than 9 out of 10 pregnant women (92.9%, n=275) received comprehensive nutritional guidance during their current pregnancy, 83.8% (n=248) were actively utilizing iron and folic acid supplements, and 59.1% (n=175) had undergone deworming treatment. All 296 women planned to deliver at a health facility.

4.3. Prevalence of Undernutrition and Food Security Profiles

Out of the 296 pregnant women who participated in the study, 68.6% (n=203) were found to have normal nutritional status (MUAC $\geq$ 23 cm). However, 93 women, representing 31.4% (95% CI: 26.4–36.92%) of the total sample, were identified as being undernourished (MUAC < 23 cm). Based on

the Household Food Insecurity Access Scale (HFIAS), 61.1% (n=181) of households were classified as food secure, whereas 38.9% (n=115) were found to be food insecure. Analysis of the Dietary Diversity Score (DDS) showed that 55.4% (n=164) fell into the high diversity category, 16.2% (n=48) had medium diversity, and 28.4% (n=84) exhibited low dietary diversity.

4.4. Regression Analysis of Factors Associated with Undernutrition

The multivariable logistic regression model identified several highly significant predictors of maternal nutritional status. Women taking iron and folic acid supplements regularized a 68.1% lower risk of being undernourished compared to non-users (AOR = 0.319; 95% CI: 0.152–0.672; p = 0.003). Income brackets were heavily predictive: women in the highest household income category (>10,000 ETB) served as the reference group, while low-income brackets (<3,000 ETB) showed massive risks, showing an explicit positive association with undernutrition outcomes (AOR = 0.249; 95% CI: 0.098–0.630; p = 0.003). Dietary diversity was also exceptionally potent; respondents classified within low or medium categories faced significantly higher odds of undernutrition compared to those with high dietary diversity (p < 0.001). Lastly, household food insecurity heavily influenced clinical outcomes; pregnant women from food-insecure households had

significantly higher odds of undernutrition compared to those in the food-secure reference cohort (AOR = 0.217; 95% CI:

0.118–0.399; $p < 0.001$). The details are summarized in Table 2.

Table 2. Multivariable logistic regression analysis of factors associated with maternal undernutrition.

Associated Factor	Category	Undernourished (Yes/No)	COR (95% CI)	AOR (95% CI)	p-value
Iron & Folic Acid	No	27 / 21	0.28 (0.14–0.53)	0.319 (0.152–0.672)	0.003
	Yes	66 / 182	1.00 (Ref)	1.00 (Ref)	—
Household Income	<3000 ETB	21 / 21	0.22 (0.10–0.47)	0.249 (0.098–0.630)	0.003
	3000–10000 ETB	50 / 83	0.36 (0.20–0.65)	0.306 (0.155–0.604)	0.001
	>10000 ETB	22 / 99	1.00 (Ref)	1.00 (Ref)	—
Dietary Diversity	Low Diversity	36 / 48	0.29 (0.16–0.53)	0.214 (0.107–0.428)	<0.001
	Medium Diversity	27 / 21	0.17 (0.08–0.34)	0.224 (0.100–0.502)	<0.001
	High Diversity	30 / 134	1.00 (Ref)	1.00 (Ref)	—
Food Security (HFIAS)	Food Insecure	61 / 54	0.19 (0.11–0.32)	0.217 (0.118–0.399)	<0.001
	Food Secure	32 / 149	1.00 (Ref)	1.00 (Ref)	—

5. Discussion

This study was conducted with the aim to assess the prevalence and associated factors of undernutrition among pregnant women attending ANC follow-up at Salale University Comprehensive Specialized Hospital. The study found that the prevalence of undernutrition among the participants was 31.4%. This result is closely comparable to findings from a study in Afar, northeast Ethiopia, which reported 30.9% [26], and it almost exactly matches the national meta-analysis in Ethiopia, which stands at 32% pooled prevalence [27].

When compared to other specific regions, the prevalence observed in this study was considerably higher than the 14.4% reported in Gondar town [31], 17.71% in Northwest Ethiopia [31], 21% in the Somali region's Dolo-Ado town [32], 21% in the Gedeo Zone [23], 21.8% in the Silte zone [15] and 22.2% in the North Shewa Zone [25]. These prominent differences likely arise from variations in specific study settings, agricultural macro-environments, micro-climates, urban-rural distribution of populations involved, and local socio-cultural feeding taboos during gestation. Conversely, the current findings were lower than those from western Ethiopia, which documented 39.2% [13], 40.6% in the Tigray region of Northern Ethiopia [28], and 43.1% in the Konso district of southern Ethiopia [24]. These gaps in the comparative data could be safely attributed to differences in specific baseline socioeconomic characteristics of the study populations, distinct seasonal variations during data collection, and total sample size variations.

Furthermore, this research explicitly revealed that women

living in households with lower monthly incomes had a significantly higher likelihood of being undernourished. Pregnant women from households earning less than 3,000 ETB were significantly more likely to be undernourished compared to those in the highest income groups (AOR = 0.249, 95% CI: 0.098–0.630, $p = 0.003$). Similarly, women from households with a monthly income between 3,000 and 10,000 ETB also faced higher odds of undernutrition compared to the reference group (AOR = 0.306, 95% CI: 0.155–0.604, $p = 0.001$). These results are heavily supported by another study conducted in North Shewa, Ethiopia [25], which demonstrated that a low average monthly household income is strongly and positively linked to poor nutritional outcomes, primarily because low purchasing power restricts regular access to high-quality macronutrients and animal-source proteins.

Dietary diversity and household food security were confirmed to be among the strongest predictors of maternal undernutrition in the final model. Pregnant women with low dietary diversity were significantly more likely to be undernourished, experiencing nearly five times higher adjusted odds of undernutrition compared to those in the highest diversity reference group. This is entirely consistent with a study done in the Konso district, which found an AOR of 4.9 for low diversity [24], and a study in North Shewa that reported an AOR of 4.42 for inadequate dietary diversity [25]. Other regional studies showed even higher risks, with low diversity reaching an AOR of 7.56 in Western Ethiopia [13]. Correspondingly, pregnant women with medium dietary diversity showed a 77.6% lower risk compared to the lowest tier, aligning with data from Konso [24] and Western Ethiopia [13]. Taking iron and folic acid (IFA)

supplements was significantly associated with a reduced risk of undernutrition; women taking regular IFA supplements had 68.1% lower adjusted odds of being undernourished compared to non-adherent counterparts (AOR = 0.319; 95% CI: 0.152–0.672; $p = 0.003$), aligning with literature emphasizing that routine prenatal clinical supplementation mitigates systematic gestative nutritional depletion [27]. Lastly, household food insecurity was a massive determinant; women living in food-insecure households had significantly higher risk profiles, which is supported by broad national data indicating that food insecurity increases maternal undernutrition by 2.5 to 6.7 times across rural communities [24, 27].

6. Conclusion

Based on the findings of the present study, it can be concluded that maternal undernutrition is a prominent public health issue in the study area, affecting 31.4% of pregnant women tracking antenatal care. The study clearly demonstrated that consistent iron and folic acid supplementation significantly reduces the odds of maternal undernutrition by 68.1%. Furthermore, higher average household monthly income and better individual dietary diversity scores serve as exceptionally strong protective factors against maternal malnutrition. Additionally, improved household food security heavily influences clinical anthropometric outcomes, with food-secure families showing a 78.3% lower risk of maternal undernutrition. Therefore, interventional focus must be directed toward improving household financial security, scaling up comprehensive multi-sectoral food security frameworks, integrating intensive dietary diversity counseling into routine ANC protocols, and reinforcing structural compliance with prenatal iron-folic acid supplementation regimens.

Abbreviations

ANC	Antenatal Care
DDS	Dietary Diversity Score
EDHS	Ethiopia Demographic Health Survey
FANTA	Food and Nutrition Technical Assistance
HFIAS	Household Food Insecurity Access Scale
MUAC	Mid-upper Arm Circumference
SDG	Sustainable Development Goal
SPSS	Statistical Package for Social Sciences
WHO	World Health Organization.

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Data Availability Statement

All data generated or analyzed during this study are included in this article and can be obtained available from the corresponding author on reasonable request

Author Contributions

Mahder Muluken Yilima: Formal Analysis, Investigation, Methodology

Fikadu Tolesa Alemu: Writing – review & editing

Asegid Regas Tabour: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Software, Writing – original draft

Busera Seman Kedir: Formal Analysis, Investigation, Methodology

Assefa Hamato Kebede: Writing – review & editing

Conflicts of Interest

The authors declare no conflicts of interest.

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