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Питание и образ жизни как факторы риска возникновения преэклампсии: опыт Нигерии (Юго-Запад Джигавы) и его значение для России

E.E. Onda, A.B. Фомина✉, S.I. Onyekwelu

Российский университет дружбы народов имени Патриса Лумумбы, Москва, Российская Федерация

Автор, ответственный за переписку: Фомина Анна Владимировна, fomina-av@rudn.ru

АННОТАЦИЯ

Введение. Преэклампсия, нарушение течения беременности по гипертоническому типу, является важной причиной материнской заболеваемости, особенно в регионах с низким уровнем дохода, таких как Юго-Запад Джигавы (Нигерия), где риск возникновения усиливается наличием социально-экономических барьеров. Питание и образ жизни как факторы риска, хотя и модифицируемые, но в настоящее время остаются недостаточно изученными.

Цель. Изучить такие факторы риска преэклампсии, как питание и образ жизни среди женщин, получающих перинатальную помощь в государственных больницах Юго-Запада Джигавы (Нигерия) в 2024 году, что имеет значение и для России, где в сельской местности возникают аналогичные проблемы.

Материалы и методы. В исследовании «случай–контроль» участвовали 395 женщин из Юго-Запада Джигавы (Нигерия), из них 146 случаев с преэклампсией и 249 участников группы контроля с аналогичным сроком беременности. Случаи преэклампсии были диагностированы после 20 недель беременности по артериальному давлению ≥140/90 мм рт. ст. и протеинурии ≥300 мг/сут. Данные о нутритивном статусе MUAC (ОСТП), потреблении белка (<50 г/сут определяется как недостаточное), наличии в питании фруктов, овощей и кофе, уровне гемоглобина (<11 г/дл указывает на анемию), использовании сульфата железа и пренатальном консультировании были получены с помощью анкет и результатов клинических измерений. С помощью многофакторной логистической регрессии были рассчитаны скорректированные отношения шансов (СОШ) с учетом возраста, образования и дохода с использованием программы SPSS версии 27 (p <0,05).

Результаты. Заболевшие женщины были в основном из сельской местности (56,2% против 34,1%), с низким уровнем образования (55,5% против 30,1%) и дохода (<70,000₦/месяц: 70,5% против 43,0%). Риск возникновения преэклампсии повышался при низком уровне гемоглобина (p=0,006) и недостаточном потреблении белка до беременности (p=0,002), а избыток белка во время беременности (≥50 г/сут) играл защитную роль (p <0,001). Употребление кофе до беременности ((≥1 чашка в неделю) снижало риск (p=0,024). Отсутствие консультаций стало причиной незначительной тенденции к росту риска патологии (p=0,173).

Заключение. Дефицит белка, анемия и ограниченное дородовое консультирование являются ключевыми факторами риска возникновения преэклампсии на Юго-Западе Джигавы (Нигерия), что актуально и для России из-за аналогичных проблем среди малообеспеченной части населения. Целевые действия, направленные на их устранение, могут снизить риск преэклампсии в Нигерии и послужить основой для разработки стратегии в России, потенциально снизив глобальную материнскую заболеваемость.

Ключевые слова: материнское здоровье; Россия; Нигерия; пренатальное консультирование; питание; преэклампсия.

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Nutritional and Lifestyle Determinants of Preeclampsia: Insights from Nigeria (Jigawa South West) with Implications for Russia

Ekaette E. Onda, Anna V. Fomina✉, Sylvester I. Onyekwelu

Peoples' Friendship University of Russia named after Patrice Lumumba, Moscow, Russian Federation

Corresponding author: Anna V. Fomina, fomina-av@rudn.ru

ABSTRACT

INTRODUCTION: Preeclampsia, a hypertensive pregnancy disorder, significantly contributes to maternal morbidity, particularly in low-income regions like Jigawa South West, Nigeria, where socio-economic barriers heighten risks. Nutritional and lifestyle factors, though modifiable, remain underexplored.

AIM: This study aimed to investigate Nutritional and lifestyle factors and preeclampsia risk among women attending perinatal care in public hospitals in Jigawa South West (Nigeria), in 2024 with implications for Russia, where similar dietary deficiencies are emerging in rural areas.

MATERIALS AND METHODS: A case-control study enrolled 395 women (146 preeclampsia cases, 249 gestationally matched controls) in Jigawa South West, Nigeria. Cases were defined by blood pressure ≥140/90 mmHg after 20 weeks' gestation and proteinuria ≥300 mg/24 hours. Data on nutritional status of MUAC, protein intake (<50 g/day defined as low), fruit, vegetable, and coffee consumption, hemoglobin levels (<11 g/dL indicating anemia), ferrous sulfate use, and prenatal counseling were collected via Hausa-language questionnaires and clinical measurements. Multivariate logistic regression calculated adjusted odds ratios (AORs), controlling for age, education, and income, using SPSS version 27 (p <0.05).

RESULTS: Cases were more likely rural (56.2% vs. 34.1%), uneducated (55.5% vs. 30.1%), and low-income (<₦70,000/month: 70.5% vs. 43.0%). Low hemoglobin elevated risk (p=0.006). Low protein intake before pregnancy raised risk (p=0.002), while high intake (≥50 g/day) during pregnancy was protective (p <0.001). Pre-pregnancy coffee consumption (≥1 cup/week) reduced risk (p=0.024). Lack of counseling showed a non-significant trend toward higher risk (p=0.173).

CONCLUSIONS: Low protein intake, anemia, and limited prenatal counseling are key preeclampsia risk factors in Jigawa South West, Nigeria, with relevance to Russia due to shared nutritional challenges in underserved populations. Targeted interventions addressing at their elimination may reduce preeclampsia risk in Nigeria and inform strategies in Russia, potentially lowering global maternal morbidity.

Keywords: maternal health; Russia; Nigeria; prenatal counseling; nutrition; preeclampsia.

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Introduction

Preeclampsia is a multisystem disorder involving endothelial dysfunction, oxidative stress, and immune dysregulation, leading to hypertension and organ damage [1]. Globally, it accounts for 14% of maternal deaths, with Low-Middle Income Countries (LMICs) bearing the heaviest burden [2]. In Sub-Saharan Africa, maternal mortality ratios (MMRs) reach 536 per 100 thousand live births, with preeclampsia as a primary driver [3]. In Nigeria, the MMR is 512 per 100 thousand live births, reflecting systemic healthcare gaps [4].

Nutritional deficiencies significantly contribute to preeclampsia risk. For instance, low protein intake disrupts placental angiogenesis, increasing risk [5]. A 2022 study in Ethiopia found that women with low protein intake had a 3.8-fold increased risk of preeclampsia [6]. Iron deficiency anemia, affecting 30% of pregnant women in Sub-Saharan Africa, is another risk factor, with hemoglobin levels <11 g/dL linked to a 1.8-fold increased risk [7]. Micronutrient deficiencies, such as calcium and vitamin D, also play a role, though their impact in Jigawa South West is understudied [8].

Lifestyle factors, including coffee consumption, have sparked debate in preeclampsia research. Caffeine, a vasoconstrictor, may elevate blood pressure and reduce placental blood flow, potentially increasing risk [9]. A 2024 meta-analysis reported a 1.3-fold increased risk with >200 mg/day caffeine intake during pregnancy [10]. However, some studies suggest coffee's antioxidants may offer protective effects, highlighting the need for context-specific research [11].

Nutritional interventions, such as protein supplementation and iron therapy, show promise in reducing preeclampsia risk. A 2023 trial in Ethiopia found that iron supplementation decreased incidence by 25% among anemic women [12]. Nutritional counseling reduced risk by 30% in a 2022 Ghana study [13]. In Jigawa South West, where only 20% of pregnant women receive counseling, these interventions are underutilized [14].

In Russia, maternal mortality is significantly lower, but preeclampsia affects 5–7% of pregnancies [15]. Nutritional challenges, including anemia (20–30% prevalence) and low protein intake in rural regions, mirror those in Jigawa South West [16]. A 2024 study in Russia highlighted dietary imbalances as contributors to adverse outcomes, suggesting that strategies from low-resource settings could inform public health policies [17]. Shared challenges, such as limited nutritional counseling in rural areas, underscore the global applicability of this research.

The **aim** of this study to investigate Nutritional and lifestyle factors and preeclampsia risk among women attending perinatal care in public hospitals in Jigawa South West (Nigeria), in 2024 with implications for Russia, where similar dietary deficiencies are emerging in rural areas.

Materials and Methods

A case-control study was conducted in 2024 among women attending perinatal care in public hospitals in Jigawa South West (Nigeria). Jigawa South West is a rural region with limited healthcare infrastructure, high poverty rates, and elevated maternal mortality, making it an ideal setting to explore context-specific risk factors for preeclampsia.

The study included 395 women: 146 cases (diagnosed with preeclampsia) and 249 controls (without preeclampsia). Cases were identified based on clinical criteria: blood pressure ≥140/90 mmHg after 20 weeks of gestation and proteinuria ≥300 mg/24 hours, confirmed by hospital records. Controls were matched for gestational age and had no hypertensive disorders. Exclusion criteria included incomplete medical records, pre-existing chronic conditions unrelated to pregnancy (e.g., chronic kidney disease, pre-pregnancy hypertension), or unwillingness to provide informed consent.

Data were collected using structured questionnaires and clinical measurements. Nutritional status was assessed by measuring mid-upper arm circumference (MUAC) using a standard tape, categorized as ≤23 cm

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(severe undernutrition), 23–28 cm (moderate undernutrition), and ≥28 cm (adequate or over nourished). Dietary habits were evaluated using a validated food frequency questionnaire adapted for the local context, capturing consumption patterns of fruits, vegetables, and protein (e.g., meat, fish, legumes) before and during pregnancy, with response options including 'heavy several times', 'in moderation', and 'very rarely/ on holidays'. Coffee intake was similarly assessed. Hemoglobin levels were measured using a portable hemoglobinometer, with anemia defined as <11 g/dL. Ferrous sulfate use and nutritional counseling were recorded through medical records and self-reports. Questionnaires were administered in Hausa by trained healthcare workers to accommodate participants' literacy levels.

Descriptive statistics summarized participant characteristics, reported as means (with standard deviations) for continuous variables and percentages for categorical variables. Bivariate logistic regression calculated odds ratios (OR) and 95% confidence intervals (CI). Multivariate logistic regression calculated adjusted odds ratios (AOR), adjusting for age, education, and income, which were selected based on their known association with preeclampsia risk [18], a p <0.05 was considered significant. For variables with low frequencies in certain categories (e.g., protein consumption), sparse data occasionally led to unstable estimates in initial multivariate models. These were addressed by verifying model outputs and ensuring biologically plausible AORs, with any limitations noted in the discussion. Analyses were conducted using SPSS version 27.

The study was approved from the Ethics Committee of Jigawa State Ministry of Health (Approval No. JGHREC/2024/0074). Informed consent was obtained from all participants, with strict measures to ensure confidentiality and data security.

Results

Of the 395 participants, 146 (37.0%) were cases with preeclampsia, and 249 (63.0%) were controls. The mean age was 27.8 years (SD 5.2) for cases and 28.3 years (SD 4.9) for controls. Most participants were married (92.5% of cases, n=135; 94.4% of controls, n=235) and Muslim (99.3% of cases, n=145; 98.0% of controls, n=244). Cases were more likely to reside in rural areas (56.2%, n=82 vs. 34.1%, n=85), be uneducated (55.5%, n=81 vs. 30.1%, n=75), and have a monthly income <₦70,000 (70.5%, n=103 vs. 43.0%, n=107).

Socio-demographic and economic factors were associated with preeclampsia risk. Low monthly income (<₦70,000) increased risk (AOR 2.153, 95% CI 1.072–4.322, p=0.031), while higher education was protective (AOR 0.392, 95% CI 0.182–0.843, p=0.016). Younger age (20-34 years) was associated with lower risk compared to ≥35 years (AOR 0.305, 95% CI 0.131–0.712, p=0.006).

The associations between nutritional and lifestyle factors and preeclampsia risk are summarized in Tables 1–3. Figure 1 illustrates the prevalence of key nutritional risk factors, highlighting higher rates of anemia, low protein intake before pregnancy, and severe undernutrition (MUAC ≤23 cm) among cases compared to controls.

Mid-Upper Arm Circumference (MUAC): With MUAC 23–28 cm as the reference (35.6% of cases, n=52; 58.6% of controls, n=146), MUAC ≤23 cm (48.6% of cases, n=71; 28.1% of controls, n=70) had a higher unadjusted risk (OR 2.848, 95% CI 1.803–4.499), but this was not significant after adjustment (AOR 1.117, 95% CI 0.608–2.053, p=0.721). MUAC ≥28 cm (15.8% of cases, n=23; 13.3% of controls, n=33) increased risk (AOR 3.493, 95% CI 1.545–7.896, p=0.003).

Hemoglobin Levels: Low hemoglobin (<11 g/dL) increased risk (AOR 2.136, 95% CI 1.246–3.661, p=0.006), with 52.7% of cases (n=77) versus 28.5% of controls (n=71) affected.

Ferrous Sulfate Use: No significant association was found (AOR 0.950, 95% CI 0.272–3.317, p=0.935), with 89.7% of cases (n=131) and 96.8% of controls (n=241) taking ferrous sulfate.

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Table 1. Prevalence of Key Risk Factors for Preeclampsia Among Cases and Controls in Jigawa South West, 2024

Variable (*n*=395)	Categories	Control (*n*=249)	Case (*n*=146)
Mid-Upper Arm Circumference	<23 cm	70 (28.1%)	71 (48.6%)
	≥28 cm	33 (13.3%)	23 (15.8%)
	23–28 cm (Ref.)	146 (58.6%)	52 (35.6%)
Eating Fruits	Before pregnancy, often eat lots of fruits	12 (4.8%)	4 (2.7%)
	Before pregnancy, very rarely, only on holidays	79 (31.7%)	72 (49.3%)
	During pregnancy, eat fruit heavily several times	60 (24.1%)	17 (11.6%)
	Eat fruits in moderation during pregnancy (Ref.)	98 (39.4%)	53 (36.3%)
Vegetable Consumption	Before pregnancy, very rarely, only on holidays	49 (19.7%)	59 (40.4%)
	During pregnancy, eat vegetables heavily several times	63 (25.3%)	17 (11.6%)
	Eat vegetables in moderation during pregnancy (Ref.)	137 (55.0%)	70 (47.9%)
Protein Consumption	Before pregnancy, very rarely, only on holidays	61 (24.5%)	68 (46.6%)
	During pregnancy, eat protein heavily several times	71 (28.5%)	21 (14.4%)
	Eat protein in moderation during pregnancy (Ref.)	117 (47.0%)	57 (39.0%)
Received Nutritional Counseling	No	10 (4.0%)	23 (15.8%)
	Yes (Ref.)	239 (96.0%)	122 (83.6%)
Coffee Consumption	Before pregnancy, often drink lots of coffee	25 (10.0%)	5 (3.4%)
	Before pregnancy, very rarely, only on holidays	94 (37.8%)	37 (25.3%)
	Drink coffee in moderation during pregnancy	11 (4.4%)	1 (0.7%)
	Never drink coffee during pregnancy	20 (8.0%)	11 (7.5%)
	No, never (Ref.)	99 (39.8%)	92 (63.0%)
Hemoglobin Level	<11 g/dL	71 (28.5%)	77 (52.7%)
	≥11 g/dL (Ref.)	178 (71.5%)	68 (46.6%)
Taking Ferrous Sulfate	No	8 (3.2%)	15 (10.3%)
	Yes (Ref.)	241 (96.8%)	131 (89.7%)

Table 2. Nutritional and Lifestyle Determinants of Preeclampsia in Jigawa South West, 2024

Variable	Category	Control (*n*=249)	Case (*n*=146)	OR (95% CI)	AOR (95% CI)	*p*
Mid-Upper Arm Circumference	≤23 cm	70 (28.1%)	71 (48.6%)	2.848 (1.803–4.499)	1.117 (0.608–2.053)	0.721
	≥28 cm	33 (13.3%)	23 (15.8%)	1.957 (1.053–3.635)	3.493 (1.545–7.896)	0.003
	23–28 cm (Ref.)	146 (58.6%)	52 (35.6%)	–	–	–
Eating Fruits	Before pregnancy, often eat lots	12 (4.8%)	4 (2.7%)	0.616 (0.189–2.006)	0.558 (0.141–2.217)	0.407
	Before pregnancy, very rarely/on holidays	79 (31.7%)	72 (49.3%)	1.685 (1.061–2.675)	0.473 (0.194–1.155)	0.100
	During pregnancy, eat heavily several times	60 (24.1%)	17 (11.6%)	0.524 (0.278–0.987)	1.268 (0.283–5.676)	0.756
	Eat fruits in moderation during pregnancy (Ref.)	98 (39.4%)	53 (36.3%)	–	–	–

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Продолжение таблицы 2

Vegetable Consumption	Before pregnancy, very rarely/on holidays	49 (19.7%)	59 (40.4%)	2.357 (1.464–3.793)	2.181 (0.952–4.993)	0.065
	During pregnancy, eat heavily several times	63 (25.3%)	17 (11.6%)	0.528 (0.287–0.970)	0.374 (0.044–3.186)	0.368
	Eat vegetables in moderation during pregnancy (Ref.)	137 (55.0%)	70 (47.9%)	–	–	–
Protein Consumption	Before pregnancy, very rarely/on holidays	61 (24.5%)	68 (46.6%)	2.418 (1.552–3.767)	2.114 (1.317–3.394)	0.002
	During pregnancy, eat heavily several times	71 (28.5%)	21 (14.4%)	0.607 (0.353–1.045)	0.230 (0.114–0.464)	<0.001
	Eat protein in moderation during pregnancy (Ref.)	117 (47.0%)	57 (39.0%)	–	–	–
Received Nutritional Counseling	No	10 (4.0%)	23 (15.8%)	4.506 (2.078–9.768)	2.157 (0.714–6.519)	0.173
	Yes (Ref.)	239 (96.0%)	122 (83.6%)	–	–	–
Coffee Consumption	Before pregnancy, often drink lots	25 (10.0%)	5 (3.4%)	0.215 (0.079–0.586)	0.266 (0.084–0.843)	0.024
	Before pregnancy, rarely/on holidays	94 (37.8%)	37 (25.3%)	0.424 (0.264–0.681)	0.645 (0.356–1.168)	0.148
	Never drink coffee during pregnancy	20 (8.0%)	11 (7.5%)	0.592 (0.269–1.302)	0.777 (0.271–2.225)	0.638
	No, never (Ref.)	99 (39.8%)	92 (63.0%)	–	–	–
Hemoglobin Level	<11 g/dL	71 (28.5%)	77 (52.7%)	2.839 (1.853–4.350)	2.136 (1.246–3.661)	0.006
	≥11 g/dL (Ref.)	178 (71.5%)	68 (46.6%)	–	–	–
Taking Ferrous Sulfate	No	8 (3.2%)	15 (10.3%)	3.449 (1.425–8.350)	0.950 (0.272–3.317)	0.935
	Yes (Ref.)	241 (96.8%)	131 (89.7%)	–	–	–

Table 3. Socio-Demographic and Economic Determinants of Preeclampsia in Jigawa South West, 2024

Variable	Category	Control (*n*=249)	Case (*n*=146)	OR (95% CI)	AOR (95% CI)	*p*
Age Group	< 20	25 (10.0%)	32 (21.9%)	1.067 (0.450–2.526)	0.408 (0.149–1.121)	0.082
	20–34	209 (83.9%)	96 (65.8%)	0.383 (0.185–0.792)	0.305 (0.131–0.712)	0.006
	≥ 35 (Ref.)	15 (6.0%)	18 (12.3%)	–	–	–
Location	Rural	85 (34.1%)	82 (56.2%)	2.472 (1.626–3.758)	0.735 (0.323–1.676)	0.464
	Urban (Ref.)	164 (65.9%)	64 (43.8%)	–	–	–
Educational Status	Educated	174 (69.9%)	65 (44.5%)	0.346 (0.226–0.529)	1.192 (0.414–3.434)	0.745
	Uneducated (Ref.)	75 (30.1%)	81 (55.5%)	–	–	–

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Продолжение таблицы 3

Level of Education	Higher Education	79 (31.7%)	18 (12.3%)	0.516 (0.272–0.977)	0.392 (0.182–0.843)	0.016
	None	44 (17.7%)	56 (38.4%)	2.880 (1.663–4.989)	3.331 (0.892–12.438)	0.073
	Primary	40 (16.1%)	34 (23.3%)	1.924 (1.060–3.490)	1.891 (0.608–5.885)	0.271
	Secondary (Ref.)	86 (34.5%)	38 (26.0%)	–	–	–
Income per Month	< ₦70,000	107 (43.0%)	103 (70.5%)	3.313 (2.075–5.289)	2.153 (1.072–4.322)	0.031
	₦160,000–250,000	25 (10.0%)	9 (6.2%)	1.239 (0.528–2.905)	1.229 (0.466–3.240)	0.677
	₦80,000–150,000 (Ref.)	117 (47.0%)	34 (23.3%)	–	–	–

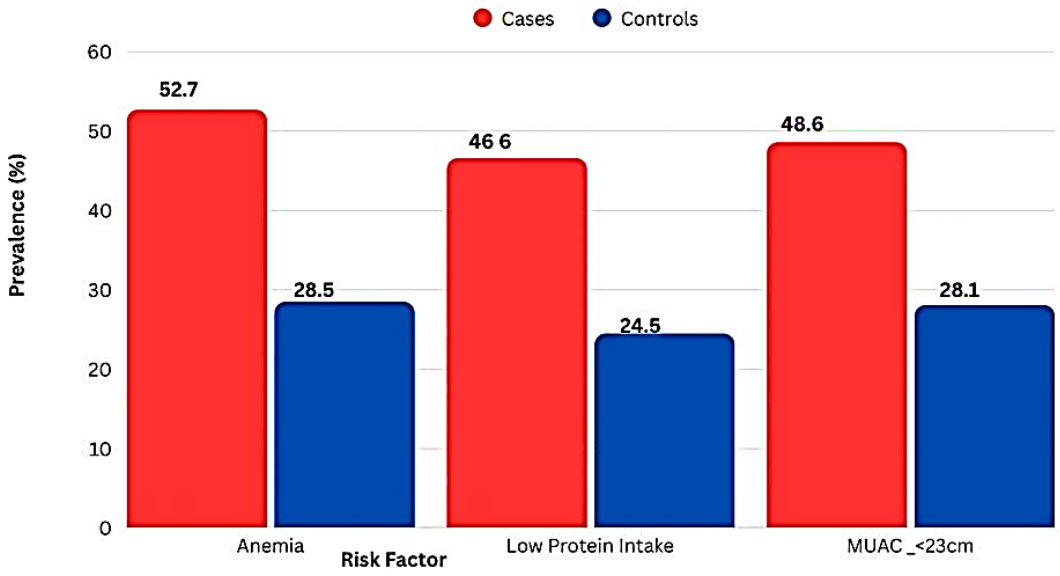

Fig. 1. Prevalence of anemia (<11 g/dL hemoglobin), low protein intake before pregnancy (very rarely/on holidays), and severe undernutrition (MUAC ≤23 cm) among cases (*n*=146) and controls (*n*=249) in Jigawa South West, 2024.

Fruit Consumption: Before pregnancy, frequent consumption (2.7% of cases, *n*=4; 4.8% of controls, *n*=12) had an AOR of 0.558 (95% CI 0.141–2.217, *p*=0.407). Infrequent consumption (49.3% of cases, *n*=72; 31.7% of controls, *n*=79) had an AOR of 0.473 (95% CI 0.194–1.155, *p*=0.100).

During pregnancy, heavy consumption (11.6% of cases, *n*=17; 24.1% of controls, *n*=60) showed no significant association (AOR 1.268, 95% CI 0.283–5.676, *p*=0.756) compared to moderation (36.3% of cases, *n*=53; 39.4% of controls, *n*=98).

Vegetable Consumption: Before pregnancy, infrequent consumption (40.4% of cases, *n*=59; 19.7% of controls, *n*=49) had an AOR of 2.181 (95% CI 0.952–4.993, *p*=0.065).

During pregnancy, heavy consumption (11.6% of cases, *n*=17; 25.3% of controls, *n*=63) showed no significant association (AOR 0.374, 95% CI 0.044–3.186, *p*=0.368) compared to moderation (47.9% of cases, *n*=70; 55.0% of controls, *n*=137).

Protein Consumption: Before pregnancy, infrequent consumption (46.6% of

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cases, *n*=68; 24.5% of controls, *n*=61) increased risk (AOR 2.114, 95% CI 1.317–3.394, *p*=0.002).

During pregnancy, heavy consumption (14.4% of cases, *n*=21; 28.5% of controls, *n*=71) was protective (AOR 0.230, 95% CI 0.114–0.464, *p* <0.001) compared to moderation (39.0% of cases, *n*=57; 47.0% of controls, *n*=117).

Coffee Consumption: Before pregnancy, frequent consumption (3.4% of cases, *n*=5; 10.0% of controls, *n*=25) was protective (AOR 0.266, 95% CI 0.084–0.843, *p*=0.024). Infrequent consumption (25.3% of cases, *n*=37; 37.8% of controls, *n*=94) had an AOR of 0.645 (95% CI 0.356–1.168, *p*=0.148).

Coffee consumption in moderation during pregnancy (0.7% of cases, *n*=1; 4.4% of controls, *n*=11) had an unadjusted OR of 0.098 (95% CI 0.012–0.773, *p*=0.027), but was excluded from multivariate analysis due to insufficient sample size (*n*=1 case), rendering adjusted estimates unreliable.

Never drinking coffee during pregnancy (7.5% of cases, *n*=11; 8.0% of controls, *n*=20) showed no significant association (AOR 0.777, 95% CI 0.271–2.225, *p*=0.638).

Nutritional Counseling: Lack of counseling does not directly increase the risk (AOR 2.157, 95% CI 0.714–6.519, *p*=0.173), with 15.8% of cases (*n*=23) versus 4.0% of controls (*n*=10) reporting no counseling.

Discussion

Key Findings and Implications

This study identifies low protein intake, low hemoglobin levels, and lack of nutritional counseling as key determinants of preeclampsia in Jigawa South West. Socioeconomic factors, such as low income and lack of education, were also significant risk factors, consistent with prior studies in Nigeria [4]. Low protein intake before pregnancy increased risk (AOR 2.114, *p*=0.002), while heavy consumption during pregnancy was protective (AOR 0.230, *p*<0.001). Protein supports placental development and vascular health, and its deficiency impairs endothelial function, a key mechanism in preeclampsia pathogenesis [19]. This aligns with a 2022 Ethiopian study reporting a 3.8-fold increased risk with low protein intake [6].

Low hemoglobin levels (<11 g/dL) increased risk (AOR 2.136, *p*=0.006), consistent with a 2023 Kenyan study [7]. Anemia exacerbates oxidative stress and endothelial dysfunction, contributing to preeclampsia. The high prevalence of anemia (52.7% in cases) underscores the need for iron supplementation programs.

The unexpected finding that MUAC ≥28 cm increased risk (AOR 3.493, *p*=0.003) suggests overnutrition or poor dietary quality may contribute to preeclampsia, possibly due to metabolic factors or excessive carbohydrate intake. A 2023 Ugandan study reported a similar 2.5-fold increased risk with higher MUAC [20].

Coffee consumption before pregnancy was protective (AOR 0.266, *p*=0.024), possibly due to antioxidants. This contrasts with a 2024 meta-analysis reporting a 1.3-fold increased risk with high caffeine intake [10], possibly due to lower caffeine doses or antioxidant-rich local coffee varieties in Jigawa South West, warranting further investigation. Lack of nutritional counseling does not directly increase the risk (AOR 2.157, *p*=0.173), but overnutrition highlights a critical gap in maternal healthcare delivery.

Relevance to Russia

In Russia, preeclampsia affects 5–7% of pregnancies [21], and nutritional challenges mirror those in Jigawa South West [15]. Anemia prevalence (20–30%) and low protein intake in rural Russian regions are significant concerns [16]. A 2024 Russian study found that dietary imbalances, particularly low protein and high carbohydrate intake, increased preeclampsia risk [17]. The protective effect of protein intake observed in Jigawa South West suggests that similar interventions could benefit Russian women, especially in rural areas where access to diverse foods is limited. Russia could adapt Jigawa's proposed community-based protein supplementation programs by integrating them into existing prenatal care systems, such as those managed by regional health centers, to address

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low protein intake and anemia. Nutritional counseling, underutilized in both settings, could be scaled up in Russia, leveraging community health workers to deliver education on balanced diets and anemia prevention.

Conclusion

This study highlights the role of low protein intake, low hemoglobin levels, and possibly overnutrition in preeclampsia risk in Jigawa South West (Nigeria). Socioeconomic factors, including low income and education, further exacerbate vulnerability. The findings have global implications, particularly for Russia, where nutritional challenges contribute to maternal morbidity. Targeted interventions promoting protein-rich diets, anemia management, and enhanced counseling can reduce maternal mortality, supporting global health goals.

Список литературы | References

1. Rana S, Lemoine E, Granger JP, Karumanchi SA. Preeclampsia: Pathophysiology, Challenges, and Perspectives. *Circ Res.* 2019;124(7):1094–1112. doi: 10.1161/circresaha.118.313276 EDN: HADBMU Erratum in: *Circ Res.* 2020;126(1):e8. doi: 10.1161/res.0000000000000315 EDN: BWKRNI
2. Say L, Chou D, Gemmill A, et al. Global causes of maternal death: A WHO systematic analysis. *Lancet Glob Health.* 2014;2(6):e323–e333. doi: 10.1016/s2214-109x(14)70227-x EDN: SPJLUB
3. GBD 2015 Maternal Mortality Collaborators. Global, regional, and national levels of maternal mortality, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*. 2016;388(10053):1775–1812. doi: 10.1016/s0140-6736(16)31470-2 Erratum in: *Lancet*. 2017;389 (10064):e1. doi: 10.1016/s0140-6736(16)32609-5
4. Yaya S, Bishwajit G, Ekholuenetale M, et al. Timing and adequate attendance of antenatal care visits among women in Ethiopia. *PLoS One.* 2017;12(9): e0184934. doi: 10.1371/journal.pone.0184934
5. Kinshella M-LW, Pickerill K, Bone JN, et al. An evidence review and nutritional conceptual framework for pre-eclampsia prevention. *Br J Nutr.* 2023; 130(6):1065–1076. doi: 10.1017/s0007114522003889 EDN: QAXSEE
6. Hofmeyr GJ, Manyame S, Medley N, Williams MJ. Calcium supplementation commencing before or early in pregnancy, for preventing hypertensive disorders of pregnancy. *Cochrane Database Syst Rev.* 2019;9 (9):CD011192. doi: 10.1002/14651858.cd011192.pub3
7. Gebreyohannes RD, Abdella A, Ayele W, Eke AC. Association of dietary calcium intake, total and ionized serum calcium levels with preeclampsia in Ethiopia. *BMC Pregnancy Childbirth.* 2021;21(1):532. doi: 10.1186/s12884-021-04005-y EDN: CAPVBW
8. Hofmeyr GJ, Lawrie TA, Atallah ÁN, Torloni MR. Calcium supplementation during pregnancy for preventing hypertensive disorders and related problems. *Cochrane Database Syst Rev.* 2018;10(10): CD001059. doi: 10.1002/14651858.cd001059.pub5
9. James JE. Maternal caffeine consumption and pregnancy outcomes: A narrative review with implications for advice to mothers and mothers-to-be. *BMJ Evid Based Med.* 2021;26(3):114–115. doi: 10.1136/bmjebm-2020-111432 EDN: TYCMIX
10. Berglundh S, Vollrath M, Brantsæter AL, et al. Maternal caffeine intake during pregnancy and child neurodevelopment up to eight years of age—Results from the Norwegian Mother, Father and Child Cohort Study. *Eur J Nutr.* 2021;60(2):791–805. doi: 10.1007/s00394-020-02280-7 EDN: TLBDRT
11. Grosso G, Godos J, Galvano F, Giovannucci EL. Coffee, Caffeine, and Health Outcomes: An Umbrella Review. *Annu Rev Nutr.* 2017;37:131–156. doi: 10.1146/annurev-nutr-071816-064941 EDN: YENMWY
12. Haider BA, Olofin I, Wang M, et al. Anaemia, prenatal iron use, and risk of adverse pregnancy outcomes: systematic review and meta-analysis. *BMJ*. 2013;346:f3443. doi: 10.1136/bmj.f3443
13. Gernand AD, Schulze KJ, Stewart CP, et al. Micronutrient deficiencies in pregnancy worldwide: Health effects and prevention. *Nat Rev Endocrinol.* 2016;12(5):274–289. doi: 10.1038/nrendo.2016.37
14. Ntoimo LF, Okonofua FE, Ogu RN, et al. Prevalence and risk factors for maternal mortality in referral hospitals in Nigeria: a multicenter study. *Int J Womens Health.* 2018;10:69–76. doi: 10.2147/ijwh.s151784
15. Cresswell JA, Alexander M, Chong MYC, et al. Global and regional causes of maternal deaths 2009–2020: a WHO systematic analysis. *Lancet Glob Health.* 2025;13(4):e626–e634. doi: 10.1016/s2214-109x(24)00560-6
16. Keats EC, Das JK, Salam RA, et al. Effective interventions to address maternal and child malnutrition: an update of the evidence. *Lancet Child Adolesc Health.* 2021;5(5):367–384. doi: 10.1016/s2352-4642(20)30274-1 EDN: WRLCVP
17. Brown MA, Magee LA, Kenny LC, et al.; International Society for the Study of Hypertension in Pregnancy (ISSHP). Hypertensive Disorders of Pregnancy: ISSHP Classification, Diagnosis, and Management Recommendations for International Practice. *Hypertension*. 2018;72(1):24–43. doi: 10.1161/hypertensionaha.117.10803

https://doi.org/10.23888/HMJ2025134615-624

18. Magee LA, Nicolaides KH, von Dadelszen P. Preeclampsia. *N Engl J Med.* 2022;386(19):1817–1832. doi: 10.1056/nejmra2109523 EDN: JZYHJS
19. Olawade DB, Wada OZ, Ojo IO, et al. Determinants of maternal mortality in south-western Nigeria: Midwives' perceptions. *Midwifery*. 2023;127:103840. doi: 10.1016/j.midw.2023.103840 EDN: HMQFZC
20. Mezzano J, Namirembe G, Ausman LM, et al. Effects of Iron and Vitamin A Levels on Pregnant Women and Birth Outcomes: Complex Relationships Untangled Using a Birth Cohort Study in Uganda. *Matern Child Health.* 2022;26(7):1516–1528. doi: 10.1007/s10995-022-03387-5 EDN: ZKFXET
21. Matveyev IM, Trokhanova OV, Syagin AA, Boykov AV. Diagnostics of Preeclampsia Based on Screening Parameters of the I Trimester and Body Components. *Science of the Young (Eruditio Juvenium).* 2022;10(1):5362. doi: 10.23888/HMJ202210153-62 EDN: AHUWVS

Дополнительная информация

Этическая экспертиза. Проведение исследования одобрено Комитетом по этике Министерства здравоохранения штата Джигава (разрешение № JGHREC/2024/0074).
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Источники финансирования. Отсутствуют.
Раскрытие интересов. Авторы заявляют об отсутствии отношений, деятельности и интересов, связанных с третьими лицами (коммерческими и некоммерческими), интересы которых могут быть затронуты содержанием статьи.
Оригинальность. При создании статьи авторы не использовали ранее опубликованные сведения (текст, иллюстрации, данные).
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Об авторах:
Onda Ekaette Ekpenyong, аспирант кафедры общественного здоровья, здравоохранения и гигиены Медицинского института;
ORCID: 0009-0008-8102-0324;
e-mail: ekaetteonda@gmail.com

✉***Фомина Анна Владимировна***, д-р фарм. наук, профессор, заведующий кафедрой общественного здоровья, здравоохранения и гигиены Медицинского института;
адрес: Российская Федерация, 117198, г. Москва, ул. Миклухо-Маклая, д. 6;
eLibrary SPIN: 5385-2586;
ORCID: 0000-0002-2366-311X;
e-mail: fomina-av@rudn.ru

Onyekwelu Sylvester Ik, ординатор кафедры общественного здоровья, здравоохранения и гигиены Медицинского института;
ORCID: 0009-0006-7506-086X;
e-mail: iykesyl2003@gmail.com

Authors' Info:
Ekaette E. Onda, Postgraduate Student of the Department of Public Health, Healthcare and Hygiene of the Medical Institute;
ORCID: 0009-0008-8102-0324;
e-mail: ekaetteonda@gmail.com

✉***Anna V. Fomina***, MD, Dr. Sci. (Medicine), Professor, Head of the Department of Public Health, Healthcare and Hygiene of the Medical Institute;
address: 6 Miklukho-Maklaya st, Moscow, Russian Federation, 117198;
eLibrary SPIN: 5385-2586;
ORCID: 0000-0002-2366-311X;
e-mail: fomina-av@rudn.ru

Sylvester I. Onyekwelu, Resident of the Department of Public Health, Healthcare and Hygiene of the Medical Institute;
ORCID: 0009-0008-8102-0324;
e-mail: ekaetteonda@gmail.com

Вклад авторов:
Onda E.E. — концепция и дизайн исследования, сбор материала, статистическая обработка данных, написание текста.
Фомина А.В. — концепция и дизайн исследования, редактирование.
Ониеквелу С.А. — сбор материала, написание текста.
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Onda E.E. — concept and design of the study, collection of material, statistical processing of data, writing the text.
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