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ORIGINAL ARTICLE

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Optimizing Health Communication Through Job Aids to Enhance Maternal Knowledge of Antenatal Nutrition: A Randomized Controlled Trial in Ondo State, Nigeria

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ABSTRACT

Background: Effective health communication constitutes a cornerstone of enhanced maternal nutritional literacy; however, its implementation within Nigerian antenatal clinics remains sub-optimal. Although job aids are widely recognized as valuable instruments for the enhancement of health education, their systematic integration into antenatal nutrition education remains limited.

Aims: This study sought to assess maternal knowledge of nutritional information provided during antenatal care and to evaluate the efficacy of job aids in enhancing maternal knowledge of antenatal nutrition in Ondo State, Nigeria.

Patients and Methods: A randomized controlled trial was conducted involving 200 pregnant women, who were assigned to either an intervention group (n = 100) or a control group (n = 100). The intervention group received specialized job aids—comprising pictorial materials, posters, and a comprehensive booklet on antenatal nutrition—whereas the control group received routine care. Data were collected via a semi-structured, interviewer-administered questionnaire evaluating socio-demographic characteristics and four key components of antenatal nutrition knowledge: general health literacy, antenatal nutritional messages, nutrient-food associations, and gestational food taboos. Knowledge was quantified employing a 40-point scale, with scores ≥23 categorized as "good" and <23 as poor. Baseline and end-line difference were analyzed through paired *t*-tests, with statistical significance set at $p < 0.05$.

Results: The mean ages of the intervention (29.0 ± 3.9 years) and control groups (28.1 ± 4.5 years) exhibited no significant demographic variance. Most participants possessed tertiary-level education and a parity of one to three children. At baseline, mean nutritional knowledge scores for the control (23.1 ± 3.6) and intervention (23.6 ± 4.9) groups were comparable ($p > 0.05$), with 60.0% and 57.0% of the cohorts, respectively, demonstrating adequate knowledge. Following the intervention, the mean knowledge score significantly increased in the intervention group (27.9 ± 4.3; $p < 0.001$), whereas the control group remains stagnant (23.0 ± 5.2; $p = 0.410$). By the study's conclusion, the proportion of participants with "good" knowledge rose to 91.8% in the intervention group, compared to 61.0% in the control group.

Conclusion: These findings demonstrate that the strategic utilization of job aids significantly enhances maternal knowledge regarding antenatal nutrition. Accordingly, this study advocates for the formal incorporation of such educational tools into routine antenatal nutrition education protocols to improve maternal health outcomes.

Keywords: Antenatal Nutrition Education; Maternal Health Literacy; Nutritional Intervention; Healthcare Pedagogical Tools; Social and Behavior Change Communication (SBCC).

Article Information

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1 INTRODUCTION

Effective health communication is essential for improving maternal knowledge of antenatal nutrition, which plays a crucial role in ensuring positive pregnancy outcomes (Zelalem *et al.*, 2017). Maternal nutrition, as defined by the United Nations Children's Fund (UNICEF), refers to the dietary requirements of women before conception, during pregnancy, and while breastfeeding. Proper nutrition at each stage is vital for maternal health and foetal development (Black *et al.*, 2008). However, limited awareness and inadequate access to reliable nutritional information often hinder expectant mothers from making informed dietary choices (Gebremichael and Belachew, 2023).

Antenatal nutrition is particularly important during pregnancy as it influences maternal well-being and the child's long-term health (Blondin and LoGiudice, 2018). Poor nutritional knowledge can contribute to deficiencies that may lead to complications such as low birth weight, anaemia, and increased risk of maternal and neonatal morbidity (Tesfa *et al.*, 2022). Despite the World Health Organization (WHO) providing antenatal care guidelines (WHO, 2020), there is still a gap in disseminating nutrition-related information to pregnant women, especially in healthcare settings (Blondin and LoGiudice, 2018).

Job aids, structured tools designed to reinforce learning and improve knowledge retention, have proven to be effective in healthcare communication (Chikanya and James, 2024;

Baruwa *et al.*, 2022; Dwyer *et al.*, 2019; Agarwal *et al.*, 2016). In the context of antenatal nutrition, leveraging job aids can enhance the way healthcare providers educate expectant mothers, ensuring they receive clear, consistent, and practical guidance (Billah *et al.*, 2022; Jennings *et al.*, 2010; Omer *et al.*, 2020). However, the extent to which job aids are utilized in antenatal clinics, particularly in Mother and Child Hospitals in Ondo State, remains unclear. Addressing this gap requires evaluating the effectiveness of job aids in improving maternal understanding of nutritional requirements during pregnancy.

This quasi-experimental study assessed maternal knowledge regarding nutrition information received during antenatal care and examined the role of job aids in improving that knowledge. To ensure culturally tailored and effective counseling, the intervention adapted a gestational food guide model—originally developed at Brigham and Women's Hospital—by incorporating locally available, indigenous Nigerian dietary staples. Ultimately, by evaluating the efficacy of these structured job aids within healthcare delivery settings, this research aims to provide a scalable strategy for optimizing maternal health outcomes through enhanced dietary knowledge.

2 METHODS

2.1 Study Design

This study employed a quasi-experimental intervention design to assess the effectiveness of nutrition education utilizing job aids among pregnant women.

2.2 Study Location

The research was conducted at the Mother and Child Hospitals in Akure and Ondo, Ondo State, Nigeria. Data collection spanned four months. These hospitals were selected due to their high antenatal care coverage and specialized focus on maternal and neonatal health.

2.3 Study Population

Study participants comprised healthy pregnant women attending routine antenatal care at the selected facilities. All pregnant women presenting for antenatal consultation during the data collection were assessed for eligibility. A systematic sampling strategy was employed for recruitment; eligible women were approached in the outpatient waiting area, informed of the study's objectives, and invited to participate. Prospective participants were assured of strict confidentiality and informed that participation was entirely voluntary, with no bearing on the clinical care received. Institutional and administrative clearance was obtained from the respective healthcare facilities and providers prior to study initiation.

2.4 Sampling Technique

This study aims to assess the role of job aids in improving maternal understanding of antenatal nutrition. Participants were purposively assigned to either the experimental or control group. Pregnant women attending the Mother and Child Hospital in Ondo were assigned to the control group, whereas those attending the Mother and Child Hospital in Akure constituted the experimental cohort.

- **Experimental Group:** Participants received enhanced nutritional education that extended beyond standard antenatal care (ANC) guidelines. This specialized curriculum was delivered by registered dietitians who had undergone structured training in the utilization of the designated job aids.
- **Control Group:** Participants received standard-of-care, routine antenatal nutrition education as traditionally administered during ANC visits. This standard counseling included general recommendations regarding dietary diversification, compliance with iron–folate supplementation, appropriate gestational meal frequency, safe food handling and hygiene practices, malaria prevention, and the avoidance of alcohol and other teratogenic substances.

Data collection was executed at baseline (pre-intervention) and endline (post-intervention) across both facilities, yielding four distinct comparative cohorts for statistical evaluation.

2.5 Study Instruments

Job Aids

The job aids developed for this study consisted of pictorial counselling bulletins accompanied with written information designed to enhance communication between healthcare providers and pregnant women regarding maternal knowledge of antenatal nutrition. The design of these job aids was informed by the pregnancy food guide developed by a scientific panel at Brigham and Women's Hospital, a Harvard teaching affiliate (Barbieri *et al.*, 2012). Accordingly, twelve antenatal counselling bulletins were developed covering key thematic areas, including appropriate pregnancy weight gain, food groups and dietary diversity, food safety and preparation, food taboos, and the role of essential micronutrients such as iron, folic acid, iodine, choline, and vitamin A in maternal and fetal health. In addition, the job aids addressed breastfeeding practices, including correct positioning, early initiation, exclusive breastfeeding, and complementary feeding to prepare pregnant women for optimal infant feeding practices immediately after delivery. The inclusion of these themes was intended to provide comprehensive, evidence-based nutrition education during antenatal care, thereby strengthening maternal knowledge and supporting improved nutritional practices across the continuum from pregnancy to early infancy.

Each counselling bulletin featured a provider-facing section guiding healthcare professionals on key messages to communicate (the job aid) and a client-facing section with pictorial illustrations to visually convey core messages (the visual aid). The primary objective of these counselling bulletins was to facilitate effective knowledge transfer, reinforce key health messages, and promote adherence to recommended nutritional practices.

Description of Job Aids Implementation

The introduction of job aids involved a 30-minute training session for two dietitians at the health facility. The training focused on the content of the counselling bulletins and their application during antenatal consultations.

The counselling sessions followed a structured 10-step approach:

- Introduce the discussion topic.
- Assess the participant's prior knowledge of the topic.
- Present the counselling bulletin.
- Ask the participant to describe what they observe on the bulletin.
- Encourage the participant to interpret the key message conveyed by the bulletin.
- Elaborate on the message using images and written content.
- Verify understanding by asking the participant to summarize key points.
- Invite the participant to ask questions.
- Summarize any remaining key messages.
- Review the bulletin to ensure all messages were covered.

Healthcare providers in the control group did not receive any training on these job aids.

2.6 Sample Size Determination

To ensure the study was sufficiently powered to detect a statistically significant intervention effect, the minimum sample size for comparing paired pre- and post-intervention continuous outcomes was calculated using the standard formula outlined by Rosner (1995):

$$n = \frac{A \,.\, B}{C}$$

Where:

- A = 1.000 (representing the matching ratio or design configuration factor for a paired design).
- B = $(Z_{\alpha/2} + Z_{\beta})^2$ = 7.849, representing the critical power component based on standard normal deviates.
    - $Z_{\alpha/2}$ = 1.960 corresponds to a two-tailed Type I error rate (α) of 0.05.
    - Z_{β} = 0.842 corresponds to a Type II error rate (β) of 0.20, achieving 80% statistical power.
- $C = \left(\frac{E}{\sigma\Delta}\right)^2 = 0.104$, where E denotes the expected effect size and $\sigma\Delta$ represents the standard deviation of the difference or change in the primary outcome.

Substituting these parameters into the formula yielded a minimum required sample size

$$n = \frac{1.000 \,.\, 7.849}{0.104} = 75.47$$

Rounding to the nearest whole integer, the minimum required sample size was determined to be 75 pregnant women per study arm. To mitigate the impact of potential participant attrition, this figure was adjusted upward by approximately 25%, resulting in a final enrollment target of 100 participants per group. Consequently, a total sample of 200 participants across both groups was established to ensure adequate statistical power to detect meaningful changes from baseline to post-intervention.

2.7 Data Collection Tools

Data collection was conducted utilizing a semi-structured, interviewer-administered questionnaire. The instrument captured data across six primary domains: socio-demographic characteristics, general health knowledge, nutrition-related content of antenatal communications, food-nutrient association knowledge, general maternal dietary practices, and gestational food taboos. To ensure thematic alignment with the study objectives, the questionnaire was adapted from validated instruments utilized in prior literature (Akeredolu *et al.*, 2014; Jennings *et al.*, 2010; Maduforo, 2011). Prior to the primary investigation, the tool underwent pilot testing and iterative revisions to optimize comprehension, item clarity, and contextual relevance.

2.8 Data Analysis

Statistical analysis was performed using IBM SPSS Statistics (Version 21.0). Both descriptive and inferential statistics were applied. Categorical variables were expressed as frequencies and percentages, while continuous variables were summarized as means and standard deviations. A 95% confidence interval (CI) was established, and statistical significance was defined as $p < 0.05$. The assessment of participant knowledge focused on four primary domains:

- General health knowledge
- Nutrition-related content of antenatal messages
- Knowledge of food-nutrient associations
- Adherence to or knowledge of gestational food taboos

Knowledge scores were calculated by assigning 1 point for a correct response and 0 points for an incorrect response, yielding a maximum possible score of 40. Within-group changes in knowledge from baseline to endline were evaluated using paired samples *t*-tests, whereas differences between the

experimental and control groups at each time point were assessed using independent samples *t*-tests. A p-value < 0.05 was considered statistically significant.

To facilitate categorical analysis, participants were stratified into two proficiency levels based on the mean baseline score:

- Poor knowledge: Score less than 23 (below the mean baseline score)
- Good knowledge: Score greater than or equal 23 (equal or above the mean baseline score).

2.9 Ethical Considerations

Verbal informed consent was collected from all participants. No harm occurred to participants, and they were free to withdraw from the study at any point without any repercussion. Ethical clearance was obtained from the mother and child ethical review committee, Ondo state.

3 Results

This section provides data on the socio-demographic characteristics of respondents and key components of antenatal nutrition, including general health knowledge, nutrition-related content of antenatal messages, knowledge of nutrient-food associations, and knowledge of food taboos during pregnancy.

Socio-Demographic Characteristics of Pregnant Women

As summarized in Table 1, the experimental and control groups were comparable in age, marital status, ethnicity, religion, and obstetric characteristics. The mean age of participants in the experimental group was 29.01 ± 3.9 years, while the control group had a mean age of 28.05 ± 4.5 years, with no statistically significant difference between the two groups. At the time of the study, the national minimum wage in the study area was ₦18,000 (USD 70) per month. Household income was reported in Nigerian naira, with U.S. dollar equivalents provided for reference using the prevailing exchange rate at data collection. The experimental group

Table 1. Socio-Demographic Characteristics of Respondents

Variable	Experimental		Control		
	Frequency	%	Frequency	%	*p*-value
Age					0.108
19 – 28	43	43.0	58	58.0	
29 – 38	56	56.0	42	42.0	
39 – 48	1	1.0	0	0	
Mean ±SD	29.0±3.9		28.1±4.5		
Marital status					
Single	8	8.0	2	2.0	
Married	92	92.0	98	98.0	
Level of Education					
No formal education	1	1.0	3	3.0	
Primary education	6	6.0	11	11.0	
Secondary education	25	25.0	31	31.0	
Tertiary education	68	68.0	55	55.0	
Household income					
<#5,000 ($19	4	4.0	28	28.0	
#5,000 ($19 -#20,000 ($76	21	21.0	38	38.0	
#20,000 ($76 -#50,000 ($194	51	51.0	22	22.0	
>#50,000	24	24.0	12	12.0	
Number of children					
Primigravid	46	46.0	38	38.0	
1-3	53	53.0	60	60.0	
>3	1	1.0	2	2.0	
Ethnic group					
Yoruba	83	83.0	85	85.0	
Igbo	9	9.0	12	12.0	
Hausa	1	1.0	1	1.0	
Others	7	7.0	2	2.0	
Religion					
Christianity	93	93.0	88	88.0	
Islam	6	6.0	8	8.0	
Traditional	1	1.0	4	4.0	
Family type					
Monogamous	88	88.0	85	85.0	
Polygamous	12	12.0	15	15.0	

Note: Data are presented as frequencies and percentages of total respondents

generally had higher educational attainment and household income, while lower-income households were more common in the control group.

General Health Knowledge (Baseline and Endline)

Data are presented as percentages of respondents (Table 2). Exp denotes the experimental group and Ctrl the control group. Baseline and endline assessments were conducted before and after the intervention, respectively. *P*-values were calculated to compare responses between groups at each time point; values less than 0.05 were considered statistically significant.

At baseline, limited knowledge and misconceptions regarding breastfeeding practices, micronutrient supplementation, and complementary feeding were common in both groups. At endline, the experimental group exhibited marked improvements across most indicators, including exclusive breastfeeding, breastfeeding positioning, early initiation of breastfeeding, micronutrient knowledge, and reduced misconceptions about HIV and breastfeeding, while little change was observed in the control group.

Nutrition-Related Content of Antenatal Messages (Baseline and Endline)

At baseline, as displayed in Table 3, the control group demonstrated significantly higher knowledge and practices related to several antenatal nutrition and breastfeeding indicators compared with the experimental group. At end line, significant differences between groups persisted for multiple variables, with notable improvements observed in appropriate breastfeeding attachment and understanding of anemia and iron-rich foods in the experimental group. However, misconceptions related to eating practices during pregnancy remained more prevalent in the experimental than the control group.

Nutrient-Food Association Knowledge (Baseline & Endline)

Values represent the percentage of respondents correctly identifying the main nutrients in common foods (Table 4). At baseline, knowledge was generally moderate across both groups, with some significant differences for protein, fiber, folic acid, and iodine sources. At endline, the experimental group exhibited improvements in identifying key nutrient sources, particularly protein, carbohydrates, fiber, and iodine, while changes in the control group were less pronounced. *P*-values indicate differences between groups at each time point.

Knowledge of Food Taboos During Pregnancy (Baseline & Endline)

At baseline, no statistically significant differences ($p > 0.05$ across all variables) between the experimental and control groups in knowledge of food taboos during pregnancy

Table 2. General Health Knowledge of Participants at Baseline and Endline

Variables	Baseline			End line		
	Exp (%	Ctrl (%	*p*-value	Exp (%	Ctrl (%	*p*-value
Provision of breast milk and water to infants	65.0	69.0	0.549	44.7	70.0	0.005
Adherence to iron and folic acid supplementation (only when symptomatic	40.0	48.0	0.240	27.1	41.0	0.032
Perception that biscuits and watery foods are optimal for 6-month-old infants	52.0	56.0	0.191	28.2	46.0	0.019
Received education on using olive oil for nipple cleansing prior to bathing	67.0	58.0	0.582	78.8	62.0	0.031
Received education on correct positioning and attachment during breastfeeding	58.0	60.0	0.787	70.6	63.0	0.414
Misconception that HIV-positive women cannot breastfeed under any circumstances	61.0	38.0	0.596	28.2	47.0	0.021
Belief that breastfeeding should be initiated within the first hour postpartum	47.0	55.0	0.296	92.9	60.0	0.000
Recognition of the nutritional/health benefits of colostrum	66.0	70.0	0.549	88.2	63.0	0.000

Note: Comparison of participants' general knowledge before and after the intervention for both the control and experimental groups. Data are presented as percentages of total respondents.

Table 3. Participants' Knowledge on Nutrition-Related Content of Antenatal Messages at Baseline and Endline

Variables	Baseline			Endline		
	Exp (%	Ctrl (%	*p*-value	Exp (%	Ctrl (%	*p*-value
Increase food intake at every stage of pregnancy	78.0	95.0	0.000	71.8	87.0	0.015
Eat for two or more people as a pregnant woman	56.0	78.0	0.001	34.1	68.0	0.000
Dieting is necessary to maintain shape and size in pregnancy	20.0	22.0	0.747	27.1	26.0	0.874
Folic acid prevents blood loss in pregnancy	86.0	84.0	0.672	81.2	87.0	0.567
Babies should be breast fed as often as possible not only when they are hungry	87.0	87.0	1.000	78.8	86.0	0.223
Anemia means sufficient blood in the body	48.0	66.0	0.010	56.5	72.0	0.039
Foods such as meat, egg are better sources of iron compared to green vegetables	48.0	54.0	0.368	62.4	54.0	0.288
Appropriate attachment while breastfeeding	37.0	44.0	0.339	85.9	48.0	0.000

Note: Comparison of Participants' Knowledge of Nutrition-Related Content of Antenatal Messages Before and After Intervention. Data are presented as percentages of total respondents.
Ctrl: Control group; Exp: Experimental group

were recorded (Table 5). At endline, significant differences were observed for selected taboos. Misconceptions related to avoiding snails due to fears of infant drooling and avoiding bananas due to perceived effects on the baby's dentition avoidance of cocoa drinks or substitution with tea/coffee during pregnancy ($p > 0.05$). Overall, the results indicate that the intervention was effective in addressing specific pregnancy-related food taboos, while others persisted.

Table 4. Participants' Knowledge of Nutrition-Food Association at Baseline and Endline

Variables	Baseline Exp (%	Ctrl (%	*p*-value	Endline Exp (%	Ctrl (%	*p*-value
Identification of vitamins and minerals as primary nutrients in fruits (True	96.0	93.0	0.368	89.4	91.0	0.567
Rejection of protein as a primary nutrient in fruits (False	49.0	57.0	0.260	44.7	66.0	0.005
Rejection of carbohydrates as the primary nutrient in fruits (False	26.0	36.0	0.158	27.1	38.0	0.184
Identification of dietary fiber/roughage as a primary nutrient in fruits (True	50.0	53.0	0.677	50.6	49.0	0.890
Identification of vitamins and minerals as primary nutrients in vegetables (True	74.0	64.0	0.141	71.8	77.0	0.741
Rejection of protein as a primary nutrient in vegetables (False	59.0	67.0	0.269	54.1	63.0	0.252
Rejection of carbohydrates as a primary nutrient in vegetables (False	25.0	26.0	0.870	25.9	36.0	0.277
Identification of dietary fiber/roughage as a primary nutrient in vegetables (True	59.0	57.0	0.779	43.5	54.0	0.200
Accurate identification of the richest dietary source of protein	84.0	96.0	0.007	96.5	96.0	1.000
Accurate identification of the richest dietary source of carbohydrates	70.0	65.0	0.469	89.4	75.0	0.027
Accurate identification of the richest dietary source of dietary fiber	22.0	54.0	0.000	43.5	35.0	0.277
Accurate identification of the richest dietary source of iron	55.0	68.0	0.080	69.4	72.0	0.867
Accurate identification of the richest dietary source of folic acid	14.0	26.0	0.023	20.0	23.0	0.453
Accurate identification of the richest dietary source of choline	25.0	26.0	0.642	37.6	30.0	0.358
Accurate identification of the richest dietary source of vitamin C	66.0	76.0	0.132	69.4	80.0	0.015
Accurate identification of the richest dietary source of vitamin A	43.0	49.0	0.408	54.1	39.0	0.063
Accurate identification of the richest dietary source of Iodine	72.0	47.0	0.001	76.5	53.0	0.02

Note: Comparison of Participants' Knowledge of Nutrition-Related Content of Antenatal Messages Before and After Intervention. Data are presented as percentages of total respondents.
Ctrl: Control group; Exp: Experimental group

Table 5. Participants' Knowledge of Food Taboos During Pregnancy at Baseline and Endline

Variables	Baseline Exp (%	Ctrl (%	*p*-value	Endline Exp (%	Ctrl (%	*p*-value
Avoidance of fortified cocoa beverages to prevent prolonged or obstructed labor						
- Yes	67.0	72.0	0.469	49.4	56.0	0.650
- No	33.0	28.0		50.6	44.0	
Substitution of cocoa beverages with commercial teas/coffees to limit fetal macrosomia (excessive birth weight						
- Yes	60.0	70.0	0.141	43.5	52.0	0.219
- No	40.0	30.0		56.5	48.0	
Avoidance of snail consumption to prevent infantile hypersalivation (drooling						
- Yes	32.0	27.0	0.558	10.6	35.0	0.001
- No	68.0	73.0		89.4	65.0	
Avoidance of banana consumption due to perceived fetal discomfort or anatomical abnormalities						
- Yes	27.0	24.0	0.633	2.4	20.0	0.001
- No	73.0	76.0		97.6	80.0	
Restriction of maternal water intake to prevent fetal growth restriction (low birth weight						
- Yes	5.0	6.0	0.320	2.4	6.0	0.045
- No	95.0	94.0		97.6	94.0	

Note: Comparison of Participants' Knowledge of Food Taboos During Pregnancy Before and After Intervention. Data are presented as percentages of total respondents.
Ctrl: Control group; Exp: Experimental group

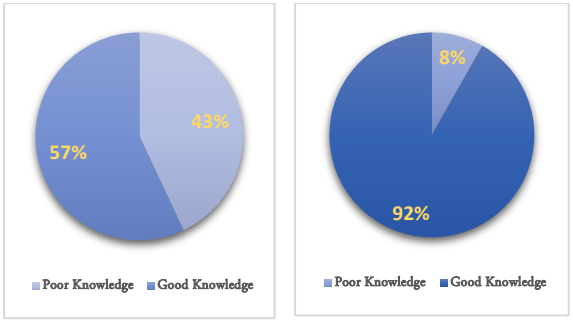
revealed significant improvement between groups (p = 0.001 for both). In addition, a modest but significant difference was found regarding the belief that excessive water intake could make the baby too small (p = 0.045). No significant differences were observed at endline for beliefs concerning

Categories of Knowledge Scores at Baseline and Endline

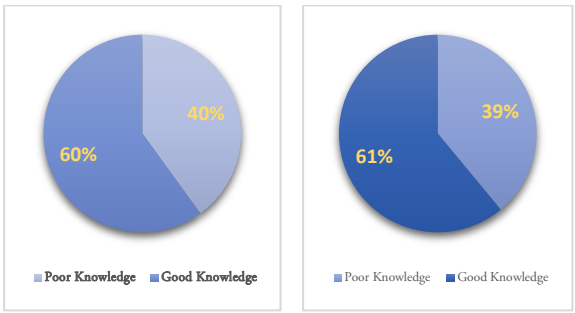
As illustrated in Figure 1, at baseline (before the intervention), a significant proportion of respondents possesses poor knowledge, with 43% in the experimental group and 40% in the control group.

Conversely, 57% of the experimental group and 60% of the control group demonstrated good knowledge.

At end line (following the intervention), there was a marked improvement in the experimental group, where only 8% retained poor knowledge, compared to 39% in the control group. The majority (92%) of the experimental group attained good knowledge, while 61% of the control group also exhibited good knowledge.



(A)



(B)

Figure 1. Knowledge Score at Baseline and Endline in the Experimental (A) and Control (B) Groups

The chart displays the percentage distribution of participants' knowledge scores before and after the intervention

Knowledge Score Analysis Within Groups

In the experimental group, the mean knowledge score increased from 23.0 ± 5.2 prior the intervention to 27.9 ± 4.3 following the intervention (Table 6). This enhancement was statistically significant (p = 0.000), indicating a meaningful effect of the intervention.

Table 6. Knowledge Score Analysis Within Groups

	Baseline*	Endline*	p– value	t– value
Experimental	23.0 ± 5.2	27.9 ± 4.3	0.000	-6.826
Control	23.1 ± 3.6	23.6 ± 4.9	0.410	-0.827

Note: values are expressed as mean ± SD. Within-group comparison of knowledge scores before (baseline) and after (endline) the intervention.

Conversely, in the control group, the mean knowledge score slightly increased from 23.1 ± 3.6 to 23.6 ± 4.9 after the intervention. This difference was not statistically significant (p = 0.410), suggesting that no substantial change occurred in the absence of the intervention.

Knowledge Score Comparison Across Groups

As summarized in Table 7, prior the intervention, the mean knowledge scores were 23.0 ± 5.2 in the experimental group and 23.1 ± 3.6 in the control group. The difference between the two groups was not statistically significant (p = 0.988), indicating similar baseline knowledge levels.

Table 7. Knowledge Score Analysis Across Groups

	Experimental *	Control *	p– value	t– value
Baseline	23.0 ± 5.2	23.1 ± 3.6	0.988	0.016
Endline	27.9 ± 4.3	23.6 ± 4.9	0.000	-5.691

Note: values are expressed as mean ± SD. Within-group comparison of knowledge scores before (baseline) and after (endline) the intervention.

After the intervention, the mean knowledge score increased to 27.9 ± 4.3 in the experimental group, while the control group remained at 23.6 ± 4.9. This difference was statistically significant (p = 0.000), demonstrating the effectiveness of the intervention in improving knowledge levels within the experimental group.

4 Discussions

Studies have revealed that maternal education and effective antenatal education are associated with improved pregnancy outcomes, largely through enhanced maternal knowledge (Al-Ateeq *et al.*, 2015; Carroli *et al.*, 2001). However, the baseline findings of the present study revealed limited nutrition-related knowledge among pregnant women, despite their exposure to routine antenatal care messages. This suggests that the nutrition information received during antenatal care may be insufficient or inadequately communicated.

This observation aligns with findings from studies conducted in Nigeria, Ethiopia and Melbourne, which reported poor nutrition knowledge among pregnant women attending antenatal care and highlighted the need to strengthen antenatal nutrition education and counselling (Akeredolu *et al.*, 2014; Gezimu *et al.*, 2022; Keyata, 2018; Lee *et al.*, 2018). Lee *et al.* (2018) further noted that several pregnant women received limited nutrition information from healthcare providers, including nurses and midwives, underscoring gaps in the delivery of nutrition-related messages during antenatal visits.

In the present study, although a higher proportion of women in the experimental group had attained tertiary education compared with the control group, no significant

difference in baseline nutrition knowledge was observed between the two groups. This finding contrasts with the report by Carroli *et al.* (2001), which suggested that educated women are more likely to demonstrate better pregnancy outcomes. The lack of difference in baseline knowledge despite higher educational attainment suggests that formal education alone may not guarantee adequate nutrition knowledge during pregnancy and emphasizes the importance of structured and context-appropriate nutrition education within antenatal care services.

In Nigeria, cultural beliefs and food taboos commonly influence dietary advice given to pregnant women, often shaping the nutrition information received during antenatal care. The findings of this study indicate that such cultural practices continue to affect maternal nutrition knowledge and may limit the acceptance or utilization of certain nutritious foods. For antenatal nutrition education to be effective, these cultural beliefs must be addressed, and accurate, evidence-based information should be clearly communicated to pregnant women.

The endline findings revealed an improvement in pregnant women's knowledge related to food taboos and aversions, suggesting that targeted nutrition education can enhance maternal understanding of nutrition-related information provided during antenatal care.

Furthermore, the findings of this study provide evidence of the positive effect of nutrition interventions that incorporate job aids on improving maternal nutrition knowledge. Pregnant women in the experimental group demonstrated significantly higher nutrition knowledge at endline compared with those in the control group, indicating that the use of job aids enhanced understanding of nutrition-related information. This improvement suggests that routine antenatal education methods alone may be insufficient for effectively communicating key messages on nutrition, or that such information is not consistently or clearly conveyed during routine antenatal visits.

These findings are consistent with studies by Jennings *et al.* (2010) and Blondin and LoGiudice (2018), which demonstrated that job aid–based interventions improved the quality of counselling and, in turn, enhanced maternal understanding of health and nutrition messages. Similarly, Di Mario *et al.* (2015) reported improvements in the overall quality of antenatal care services following structured interventions among community health extension workers, as evidenced by higher endline quality scores. More recently, Billah *et al.* (2022) have reported that practical demonstrations delivered by community health workers using electronic job aids resulted in greater retention of exclusive breastfeeding practices among pregnant women. Collectively, these findings suggest that job aids, when appropriately utilized, not only enhance knowledge acquisition but also promote the adoption of appropriate maternal nutrition practices.

In addition, Katepa-Bwalya *et al.* (2011) demonstrated that the use of counselling cards as job aids enhanced the delivery of appropriate infant feeding information to HIV-positive mothers, further supporting the role of job aids in improving maternal understanding of nutrition-related guidance. Collectively, these findings reinforce the effectiveness of job aids as tools for strengthening nutrition education and counselling during antenatal care.

5 Conclusions

This study demonstrates that conventional, unstructured antenatal care counseling may be insufficient to ensure adequate maternal nutrition knowledge, as evidenced by the deficient baseline knowledge observed among the investigated pregnant women. Conversely, the findings reveal that structured nutrition education facilitated by point-of-care job aids significantly accelerates maternal comprehension of gestational nutrition. The pronounced longitudinal improvement observed within the experimental cohort underscores the clinical utility of structured visual aids in optimizing the clarity, consistency, and communicative efficacy of health education during antenatal care. Consequently, embedding contextually and culturally adapted job aids within routine antenatal services offers a viable, systemic approach to strengthening maternal health literacy.

Strengths and Limitations of the Study

A primary methodological strength of this investigation is its quasi-experimental, facility-assigned design, which permitted a direct comparative analysis between distinct intervention and control cohorts over time. Furthermore, the systematic adaptation of the pregnancy food guide to incorporate indigenous dietary staples ensured that the educational interventions were culturally relevant, thereby maximizing practical applicability for the target demographic.

Despite these strengths, several limitations must be acknowledged:

- **Response Bias:** Data collection relied exclusively on interviewer-administered, self-reported metrics, introducing potential vulnerability to social desirability and recall biases.
- **Scope of Outcomes:** While a significant increase in cognitive knowledge was achieved, actual behavioral translation and dietary adherence were not empirically evaluated; thus, the direct transfer of knowledge to nutritional practice remains unverified.
- **Geographic Generalizability:** The study was localized to facility clusters within a single state, which constrains the generalizability of the findings to broader regional or

national populations characterized by differing socio-cultural and economic dynamics.

Implications for Maternal Health Communication and Policy

The empirical evidence generated by this study strongly support the integration of structured job aids into routine antenatal care delivery frameworks. By offering a standardized pedagogical approach, these instruments mitigate the inconsistencies frequently associated with purely verbal health communication (Dwyer *et al.*, 2019; Omer *et al.*, 2020). Given the robust knowledge gains demonstrated in the experimental group, secondary and tertiary obstetric institutions should prioritize the deployment of structured, visually driven educational materials that are meticulously tailored to local dietary patterns.

From a health policy perspective, maternal and child health programs should formally integrate evidence-based job aids as an institutionalized component of antenatal care education. This is particularly in critical in low-resource or low-literacy settings where visual and scaffolded communication tools can bridge comprehension gaps. Furthermore, policymakers allocate resources toward structured capacity-building and training frameworks for frontline healthcare personnel to ensure these tools are used effectively at the point of care.

Future Research Directions

To build upon the findings of this study and address its inherent limitations, future research should prioritize several key areas:

- Longitudinal designs are required to track long-term knowledge retention post-intervention and evaluate its direct impact on objective dietary behaviors and maternal-fetal birth outcomes.
- Comparative trials should investigate the relative effectiveness of digital health applications versus traditional print media to determine which modality yields superior engagement and comprehension.
- Future studies should explore the provider-side factors, examining how varying levels of healthcare worker engagement, workload, and training fidelity modulate the efficacy of job aids.
- Execution of multi-center, cluster-randomized controlled trials across heterogeneous states is warranted to validate scalability and establish broader nationwide generalizability.

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