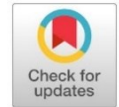




## Knowledge and attitudes of health workers determine maternal nutrition counseling practices: a cross-sectional study

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### ABSTRACT

**Background:** Maternal ignorance regarding nutritional needs during pregnancy and breastfeeding is influenced by the knowledge, attitudes, and practices (KAP) of health workers in providing nutrition counseling to mothers.

**Objective:** This study aims to analyze the knowledge, attitudes, and practices (KAP) of health professionals regarding maternal nutrition.

**Materials and Methods:** A cross-sectional study was conducted between April-June, 2025 in Bandung, Indonesia. A census approach was used by inviting all 80 Primary Healthcare Centers (PHCs/Puskesmas) to participate; 77 PHCs/Puskesmas returned completed questionnaires. All eligible healthcare workers involved in maternal and child health services within participating PHCs/Puskesmas were invited to complete a validated questionnaire administered via Google Forms. Knowledge and practice items were scored dichotomously (1 = correct/appropriate; 0 = incorrect), while attitudes were measured on a 5-point Likert scale. Median values were used to categorize KAP outcomes, and associations were analyzed using chi-square tests and multivariable logistic regression with statistical significance set at  $p < 0.05$ .

**Results:** Results showed that 75.07% of healthcare workers demonstrated good knowledge, yet only 61.13% exhibited positive attitudes. Knowledge gaps existed for portion recommendations. Bivariate analysis revealed significant associations between profession and attitudes ( $p=0.043$ ) and practices ( $p=0.002$ ), and between training attendance and attitudes ( $p=0.015$ ). Multivariate analysis identified profession as the strongest independent predictor of practices: midwives (OR=6.664; 95% CI: 2.166-20.504;  $p<0.001$ ), nutritionists (OR=3.952; 95% CI: 1.315-11.876;  $p=0.014$ ) and public health officer (OR=4.483; 95% CI: 1.829-10.987;  $p=0.001$ ) showed significantly higher odds compared to doctors. Only 15.13% had attended recent maternal nutrition training.

**Conclusion:** Professional background is the strongest determinant of maternal nutrition counseling effectiveness. Addressing the KAP gap through profession-specific, continuous training is crucial to enhance nutrition services during pregnancy and lactation and support stunting prevention efforts.

**Keywords :** Attitude; healthcare workers; knowledge; maternal; nutrition counseling

### BACKGROUND

The first 1,000 days of a child's life represent a critical window for stunting prevention, where maternal nutrition plays a central role in determining child growth outcomes.<sup>1,2</sup> During this period, what mothers eat is extremely important, especially during pregnancy and the first six months when babies only drink breast milk.<sup>3</sup> Research shows that when mothers don't get enough nutrition, their children are more likely to become stunted.<sup>4</sup> Studies have found that pregnant and breastfeeding women in Indonesia and Malaysia often don't eat enough nutritious foods.<sup>5</sup> This problem is confirmed by a nationwide survey (Survey Kesehatan Indonesia) in 2023, which showed that 6.1% of babies are born with low birth weight nationwide.<sup>6</sup> When babies are born too small, this usually means their mothers didn't get enough nutrition during pregnancy, and these babies have a higher chance of becoming stunted.<sup>7-9</sup> The same problem continues after birth. If breastfeeding mothers don't eat well enough, their breast milk may have lower levels of some important nutrients like vitamins and healthy fats, which can affect their babies' growth.<sup>10</sup> However, improving maternal nutrition is not solely dependent on food availability, but also on the quality of nutrition counseling received by mothers.

Healthcare workers play a crucial role in preventing stunting. According to the KAP framework, their level of nutrition knowledge determines the quality of counseling delivered to mothers, which subsequently shapes maternal knowledge, attitudes, and feeding practices that directly influence child growth outcomes.

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Research shows that Indonesian women trust healthcare workers more than any other source when it comes to nutrition information, regardless of whether they are rich or poor.<sup>1121</sup> This level of trust strengthens the effectiveness of counseling. Therefore, healthcare workers function not only as clinical service providers but also as key agents of health promotion and disease prevention.<sup>12</sup>

Because of the high stunting rates, the Indonesian government has made nutrition counseling a required part of Antenatal Care (ANC).<sup>13</sup> While 74% of pregnant women in Indonesia attend ANC at least four times, there is limited evidence showing whether healthcare workers are providing good quality nutrition advice.<sup>14</sup> Despite their central role, there is limited evidence on how healthcare workers knowledge, attitudes, and practices influence maternal nutrition counseling practices. No prior studies have investigated how profession and other factors independently predict maternal nutrition counseling practice in Bandung's Primary Health Center (PHCs/Puskesmas) settings. This study aims to assess healthcare workers knowledge, attitudes, and practices (KAP) and identify key determinants of maternal nutrition counseling practices in PHCs/Puskesmas settings in Bandung.

## MATERIALS AND METHODS

This cross-sectional study employed a descriptive quantitative design to assess the knowledge, attitudes, and practices (KAP) of healthcare workers regarding nutritional fulfilment during pregnancy and lactation. This study utilized secondary data derived from a survey conducted under the Academic Learning Grant titled *Prevention, Early Detection, and Management of Obesity and Stunting as Determinants of Child Well-Being in Indonesia*. At the time of data collection (April-June, 2025), Bandung City had registered 80 Primary Health Centers (PHCs)—commonly known in Indonesia as Puskesmas—which serve as the first-level government health facilities. Questionnaires were distributed to all PHCs/Puskesmas using a total population (census) approach that employed total sampling. The target population comprised healthcare workers employed at PHCs/Puskesmas facilities in Bandung City. Inclusion criteria were: (1) respondents working as healthcare workers at registered PHCs/Puskesmas in Bandung City and (2) respondents who agreed to participate by completing the informed consent section of the questionnaire. Exclusion criteria were (1) healthcare workers who submitted the questionnaire after the predetermined deadline and (2) responses not completed by one of the following professional categories (doctors, nurses, midwives, nutritionist, bachelor of public health (public health officer), health promotion agents, and pharmacist). Public health officer and health promotion agents were classified as distinct roles based on educational background and functional position within the primary healthcare system. For example, public health officers typically coordinate community-based programs such as stunting prevention, whereas health promotion officers mainly focus on designing and implementing community outreach and educational services. Of the 80 PHCs/Puskesmas invited, 77 returned completed responses. A total of 371 individuals submitted the online questionnaire. After eligibility screening and data cleaning, 34 responses were excluded because they did not meet the predefined inclusion criteria (e.g., non-health professionals, community health cadres, or incomplete responses), resulting in a final analytic sample of 337 eligible healthcare workers.

Data collection was conducted online using a self-administered Google Form questionnaire. Nutritionists from each PHCs/Puskesmas were invited to attend a centralized training session at Hasan Sadikin General Hospital, where the study objectives, the questionnaire content, and data-collecting procedures were explained to ensure consistent implementation. These nutritionists subsequently acted as liaison officers responsible for disseminating the questionnaire link to healthcare workers in their respective PHCs/Puskesmas.

The research instrument used in this study was a structured questionnaire assessing KAP regarding nutritional fulfilment during pregnancy and lactation. The instrument underwent Content Validity Ratio (CVR) method based on Lawshe's approach. The original content validation study was conducted by Setiawati et al., who developed and evaluated the knowledge and attitude domains of the instrument.<sup>15</sup> Content validation was performed by a panel of eight dietitians from Hasan Sadikin General Hospital, Bandung, with expertise in Infant and Young Child Feeding (IYCF). The experts were selected based on the following criteria: (1) professional registration as dietitians, (2) a minimum of five years of experience in maternal and child nutrition, and (3) direct involvement in IYCF-related clinical services or program implementation. Each item was evaluated for essentiality ("essential," "useful but not essential," or "not essential") using Lawshe's CVR formula. For a panel size of eight experts, the minimum acceptable CVR value according to Lawshe's critical value table is 0.75. In the original validation study, 24 knowledge items and 31 attitude items achieved CVR values ranging from 0.75 to 1.00 were therefore retained, while items below the threshold were revised or excluded. All items applied in the present study were those that met the acceptable CVR criteria. Because the

validation process focused on establishing content validity through expert judgement using CVR method, internal consistency reliability testing (e.g., Cronbach’s alpha) was not conducted at the initial stage.

The questionnaire consisted of 5 sections with the following order: informed consent, sociodemographic characteristics, questions related to assess knowledge (9 items), questions related to assess attitude (10 items), and questions related to assess practice (15 items). Respondents needed to complete 34 KAP questions in total. The sociodemographic characteristics section covered variables such as age, gender, profession, level of education, and history of attending nutrition training for pregnant and breastfeeding mothers. Age (measured in years) was treated as a continuous variable and assessed for linearity with the logit using the Box-tidwell procedure, whereas education level, professional background, and training attendance were entered as categorical variables.

The knowledge section consisted of 9 items related to nutritional needs during pregnancy and lactation with the answer options of “Yes”, “No”, or “I Don’t Know” except for item number 7. Correct responses were scored 1, while incorrect and “I Don’t Know” responses were scored 0. The attitude section consisted of 10 items measured using a 5-point Likert scale (“Strongly Agree” to “Strongly Disagree”, with higher scores assigned to responses reflecting agreement with positive statements. The practice section included 15 dichotomous (“Yes/No”) items assessing the implementation of recommended nutritional practices, with “Yes” responses were scored as 1 and “No” as 0. Total scores for each domain (knowledge, attitude, and practice) were initially calculated and analyzed as continuous variables. Because no standardized or validated cut-off points are available for this specific KAP instrument and study population, median values were used as data-driven and distribution-based threshold to classify respondents into two groups: knowledge was categorized as “good” if the score was  $\geq 8$  and “sufficient” if the score was  $< 8$ ; attitude was categorized as “positive” if the score was  $\geq 46$  and “negative” if the score was  $< 46$ ; practice was categorized as “good” if the score was  $\geq 15$  and “poor” if the score was  $< 15$ . Continuous KAP scores were retained for descriptive analysis and interpretation to preserve data variability and minimize information loss.

Data were analyzed using Microsoft Excel and IBM SPSS Statistics. Normality testing using the Kolmogorov-Smirnov showed that KAP domain scores were non-normally distributed (p-values less than 0,001 for all domains). Descriptive statistics characterized participant demographics. Chi-square tests examined bivariate associations between categorical variables and KAP scores. Binary logistic regression models were constructed to identify independent predictors, with variables showing  $p < 0.25$  in bivariate analysis included in initial models. Multicollinearity was assessed using Variance Inflation Factors ( $VIF < 10$ ). Model fit was evaluated using Hosmer-Lemeshow goodness-of-fit tests and Nagelkerke R-squared values. All statistical analyses were performed with statistical significance set at  $p < 0.05$ . This study was approved for ethical clearance with the reference number PK.03.04.05/0002-BKBP/I/2025.

## RESULTS

Table 1 presents the sociodemographic characteristics of the participating healthcare workers. A total of 337 healthcare workers participated in the study. Most respondents were aged 31-40 years (45.40%). Most were women (92.28%) and represented various professional backgrounds, with the largest group being nutritionists (24.04%). Regarding education level, the highest proportion had a Diploma (D3) (41.54%), followed by bachelor’s degree (S1) holders (28.78%). Only 15.13% had attended training on nutrition for pregnant and breastfeeding mothers in the last year.

**Table 1. Sociodemographic Characteristics (n=337)**

Characteristics	n	%
<b>Age</b>		
21-30	89	26.41
31-40	153	45.40
41-50	59	17.51
>50	36	10.68
<b>Gender</b>		
Male	26	7.72
Female	311	92.28
<b>Education Level</b>		
Diploma (D3)	140	41.54
Diploma (D4)	13	3.86

**Table 1. Sociodemographic Characteristics (continue...)**

Characteristics	n	%
Bachelor (S1)	97	28.78
Profession	78	23.15
Master (S2)	9	2.67
<b>Profession</b>		
Doctor	57	16.91
Nurse	73	21.66
Midwife	70	20.77
Nutritionist	81	24.04
Bachelor of Public Health	52	15.43
Health Promotion Agent	3	0.89
Pharmacist	1	0.30
<b>Training Attendance for Pregnant and Breastfeeding Mother Nutrition</b>		
Yes	51	15.13
No	286	84.87

Table 2 shows that the majority of respondents demonstrated good knowledge (75.07%) regarding maternal nutrition counseling. In terms of attitudes, 61.13% of respondents exhibited positive attitudes towards maternal nutrition counseling and 62.61% reported good counseling practices. Although the overall level of knowledge was high, the proportions of respondents with positive attitudes and good practices were about 13-14 percentage points lower, indicating a statistically significant decline across KAP domains.

**Table 2. Knowledge, Attitudes, and Practices (KAP) of Healthcare Workers Towards Nutritional Fulfilment During Pregnancy and Lactation (n=337)**

Variable	Good/Positive n (%)	Poor/Negative n (%)	Median (range)	Mean ± SD
Knowledge	253 (75.07%)	84 (24.93%)	8 (5-9)	7.84 ± 0.908
Attitudes	206 (61.13%)	131 (38.87%)	46 (33-50)	45.58 ± 3.698
Practices	211 (62.61%)	126 (37.39%)	15 (1-15)	14.11 ± 1.921

Table 3, Table 4, and Table 5 showed substantial gaps existed for portion recommendations. Only 49.85% correctly identified daily fruit portions (3-4 portions) for pregnant women and 77.15% knew appropriate rice/staple food portions (4-6 portions) for breastfeeding mothers. These gaps directly corresponded to lower attitudes and practices: only 40.36% “strongly agreed” with carbohydrate portion recommendations for breastfeeding mothers, and 47.48 “strongly agreed” with vegetable and fruit portion guidelines. Correspondingly, 76.85% reported advising breastfeeding mothers about carbohydrate needs, while 87.24% counselled on vegetable and fruit consumption.

**Table 3. Distribution Frequencies Knowledge of Healthcare Workers Towards Nutritional Fulfilment During Pregnancy and Lactation (n=337)**

Items	n	%
1. The health of the mother and fetus can be supported by consuming balanced nutritional food.		
Yes	337	100.00
No	0	0.00
I Don't Know	0	0.00
2. Broccoli and dark green vegetables are types of vegetables that contain calcium, iron, folate, vitamin C, fiber, vitamin K and potassium which are good for pregnant women to consume.		
Yes	335	99.41
No	2	0.59
I Don't Know	0	0.00

**Table 3. Distribution Frequencies Knowledge of Healthcare Workers Towards Nutritional Fulfilment During Pregnancy and Lactation (n=337) (continue...)**

Items	n	%
3. Folic acid is important for pregnant women		
Yes	337	100.00
No	0	0.00
I Don't Know	0	0.00
4. Milk is a good source of calcium for pregnant and breastfeeding mothers.		
Yes	319	94.66
No	17	5.04
I Don't Know	1	0.30
5. Anchovies are a high source of calcium which is good for fetal growth.		
Yes	314	93.18
No	12	3.56
I Don't Know	11	3.26
6. The portion of animal protein (such as fish, eggs, chicken, meat) and/or vegetable protein (such as tofu, tempeh, nuts) for pregnant women in the 3rd trimester is 4-6 portions.		
Yes	281	83.38
No	31	9.20
I Don't Know	25	7.42
7. Pregnant women should be given a portion of fruit a day of		
3-4 Portion	168	49.85
1-2 Portion	160	47.48
I Don't Know	9	2.67
8. The portion of rice or staple food for breastfeeding mothers is 4-6 portions a day.		
Yes	260	77.15
No	59	17.51
I Don't Know	18	5.34
9. Apart from food, pregnant women need additional iron in the form of iron-boosting tablets.		
Yes	333	98.81
No	2	0.59
I Don't Know	2	0.59

Table 4 presents the distribution of healthcare workers' attitudes toward nutritional fulfilment during pregnancy and lactation at the item level. Overall, most respondents expressed strong agreement with general nutrition principles, such as the importance of balanced diets, iron supplementation, and adequate protein intake during pregnancy. However, lower levels of strong agreement were observed for more specific quantitative recommendations, particularly regarding portion sizes for carbohydrates, protein, and fruit and vegetables intake. This variation suggests that while foundational beliefs about nutrition are well established, confidence in endorsing precise dietary portion guidelines for specific patients may be comparatively weaker.<sup>16</sup>

Table 5 describes the self-reported counseling practice of healthcare workers in providing maternal nutrition guidance. The majority of respondents reported routinely delivering general nutrition education, including advising on balanced diets, iron supplementation, and increased nutritional intake during pregnancy. Nevertheless, slightly lower proportions were observed for practices involving detailed portion recommendations, particularly related to carbohydrate and fruit and vegetable intake for breastfeeding mothers. These findings indicate that although general counseling behaviours were widely implemented, the translation of specific quantitative dietary guidance into routine may be less consistent.<sup>16</sup>

**Table 4. Distribution Frequencies of Healthcare Workers Attitude Towards Nutritional Fulfilment During Pregnancy and Lactation (n=337)**

Items	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
	n	%	n	%	n	%	n	%	n	%
1. Pregnant women must have breakfast before doing activities during pregnancy.	268	79.53	68	20.18	1	0.30	0	0.00	0	0.00
2. Pregnant women need good nutrition so that fetal growth is not delayed and they can give birth to a baby with normal weight.	306	90.80	30	8.90	1	0.30	0	0.00	0	0.00
3. In my opinion, a lack of iron intake during pregnancy can cause anaemia or lack of blood.	279	82.79	57	16.91	0	0.00	1	0.30	0	0.00
4. Pregnant women must consume balanced nutrition containing protein, carbohydrates, fat, minerals and vitamins during pregnancy.	305	90.50	32	9.50	0	0.00	0	0.00	0	0.00
5. Pregnant women must increase protein for fetal growth and maintain the health of the mother's pregnancy.	278	82.49	58	17.21	1	0.30	0	0.00	0	0.00
6. In my opinion, fruits and vegetables are good for pregnant women because they are rich in vitamins and minerals.	274	81.31	61	18.10	0	0.00	1	0.30	1	0.30
7. Breastfeeding mothers need a source of carbohydrates such as rice, 6 ladles a day when breastfeeding for 0-12 months.	136	40.36	110	32.64	25	7.42	52	15.43	14	4.15
8. Pregnant and breastfeeding mothers need 4-6 pieces of animal and vegetable protein sources per day during pregnancy and breastfeeding.	194	57.57	121	35.91	16	4.75	4	1.19	2	0.59
9. Pregnant and breastfeeding mothers need 4 medium-sized glasses of cooked and drained vegetables and fruit a day during pregnancy and breastfeeding.	160	47.48	132	39.17	24	7.12	18	5.34	3	0.89
10. The highest source of iron is chicken liver	173	51.34	125	37.09	11	3.26	23	6.82	5	1.48

**Table 5. Distribution Frequencies of Healthcare Workers Practice Towards Nutritional Fulfilment During Pregnancy and Lactation (n=337)**

Items	Yes		No	
	n	%	n	%
1. I provide education about nutrition to pregnant and breastfeeding mothers.	321	95.25	16	4.75
2. I help pregnant and breastfeeding mothers choose a balanced diet.	311	92.28	26	7.72
3. I always advise pregnant women to have breakfast before doing any activities during pregnancy.	325	96.44	12	3.56
4. I always advise pregnant women to eat more than non-pregnant women.	286	84.87	51	15.13
5. I provide education to pregnant women about the importance of good nutrition so that fetal growth is not delayed and mothers can give birth to babies with normal weight.	331	98.22	6	1.78
6. I always advise pregnant women to take iron supplements to prevent anaemia.	332	98.52	5	1.48
7. I recommend pregnant women to consume vitamins and minerals such as Vitamin C, Folic Acid, Iron, Calcium, and Zinc every day.	329	97.63	8	2.37
8. I advise pregnant women to consume balanced nutrition, including protein, carbohydrates, fats, minerals, and vitamins during pregnancy.	335	99.41	2	0.59
9. I advise pregnant women to increase their protein intake for fetal growth and to maintain a healthy pregnancy.	330	97.92	7	2.08
10. I provide information about the benefits of fruits and vegetables that are rich in vitamins and minerals for pregnant women.	331	98.22	6	1.78
11. I provide information to pregnant women about foods containing preservatives that should be avoided during pregnancy.	321	95.25	16	4.75
12. I advise breastfeeding mothers to fulfil their carbohydrate needs, such as 6 ladles of rice a day, while breastfeeding for 0-12 months.	259	76.85	78	23.15
13. I recommend pregnant and breastfeeding mothers to fulfil their animal and vegetable protein needs by 4 pieces a day.	305	90.50	32	9.50
14. I recommend pregnant and breastfeeding mothers to consume 4 medium-sized glasses of cooked and drained vegetables and fruits a day.	294	87.24	43	12.76
15. I advise pregnant women to take one iron supplement tablet per day during pregnancy.	332	98.52	5	1.48

Table 6 reveals the chi-square test has no significant association between profession and knowledge ( $p=0.402$ ), but significant relationships were found between profession with attitudes ( $p=0.043$ ) and practices ( $p=0.002$ ). Training attendance was significantly associated with attitudes ( $p=0.015$ ) but showed a marginal significance with practices ( $p=0.057$ ).

**Table 6. Bivariate Analysis: Significant Associations with KAP**

Variable	Knowledge		Attitude		Practice	
	$\chi^2$	p	$\chi^2$	p	$\chi^2$	p
Profession	6.188	0.402	13.013	0.043*	21.371	0.002**
Training Attendance	1.701	0.192	5.954	0.015*	3.634	0.057

$\chi^2$  = Chi-square test statistic from Pearson's chi-square test assessing the association between categorical variables

p = probability value indicating statistical

\*p<0.05 indicates statistical significance

\*\*p<0.01 indicates strong statistical significance

Binary logistic regression models were constructed including four independent variables: age, education level, professional background, and training attendance. The regression model for knowledge outcomes (Table 7) showed no statistically significant model ( $\chi^2=11.520$ ,  $p=0.567$ ). The model explained only 5% of variance (Nagelkerke  $R^2=0.050$ ) and correctly classified 75.07% of cases. No variables emerged as significant independent predictors of knowledge levels. The relatively high classification rate should be interpreted cautiously, as it largely reflects the high baseline prevalence of good knowledge among respondents.

**Table 7. Multivariate Logistic Regression for Knowledge Outcomes**

Predictor	p-value
All variables	NS

Model Statistics:  $\chi^2=11.520$ ;  $p=0.567$ ; Nagelkerke  $R^2=0.050$ ; Classification Accuracy: 75.07%

\*p<0.05;\*\*p<0.01:\*\*\*p<0.001

The attitude prediction model (Table 8) was statistically significant ( $\chi^2=27.107$ ,  $p=0.012$ ), explaining 10.5% variance (Nagelkerke  $R^2=0.105$ ) and correctly classifying 62.13% of cases. However, no individual predictors reached statistical significance, though training showed a positive trend (OR=1.529, 95% CI: 0.687-3.405,  $p=0.298$ ). These relatively low explanatory values indicate that important structural and contextual determinants of counseling practices may not have been captured in the current model.

**Table 8. Multivariate Logistic Regression for Attitudes Outcomes**

Predictor	OR	95% CI	p-value
Training	1.529	0.687-3.405	0.298

Model Statistics:  $\chi^2=27.107$ ;  $p=0.012$ ; Nagelkerke  $R^2=0.105$ ; Classification Accuracy: 62.13%

\*p<0.05;\*\*p<0.01:\*\*\*p<0.001

Table 9 reveals the practice prediction model demonstrated the strongest performance ( $\chi^2=35.039$ ;  $p=0.001$ ), explaining 13.5% of variance (Nagelkerke  $R^2=0.135$ ) and correctly classifying 65.9% of cases. Profession emerged as the most significant predictor (overall  $p=0.004$ ). Midwives, nutritionist, and public health officer having higher odds of good practice compared to doctors. Education level was also significantly, with master's degree holders showing lower odds of good practices.

**Table 9. Multivariate Logistic Regression for Practices Outcomes**

Predictor	OR	95% CI	p-value
Profession (reference: Doctor)			
Midwife	6.664	2.166-20.504	<0.001***
Nutritionist	3.952	1.315-11.876	0.014*
Public Health Officer	4.483	1.829-10.987	0.001**
Education Level (reference: Diploma III)			
Master's Degree	0.080	0.008-0.778	0.030*

Model Statistics:  $\chi^2=35.039$ ;  $p=0.001$ ; Nagelkerke  $R^2=0.135$ ; Classification Accuracy: 65.9%

\*p<0.05;\*\*p<0.01:\*\*\*p<0.001

## **DISCUSSION**

This study highlights the critical role of healthcare workers in delivering nutritional fulfilment services for pregnant and lactating women. Table 2. shows that health workers in Bandung demonstrated good knowledge regarding maternal nutrition (75.07%), their positive attitudes (61.13%) and practical counseling behaviours (62.61%) were notably lower, displaying a persistent knowledge-attitude-practice (KAP) gap consistent with findings from other developing countries.<sup>14</sup>

The most notable finding in Table 4. was a substantial lack of knowledge regarding specific portion recommendations, with fewer than half of respondents (49.85%) correctly identifying daily fruit portions for pregnant women and fewer knowing appropriate staple food portions for breastfeeding mothers (77.15%). These gaps directly corresponded to lower attitudinal endorsement and practical implementation rates. Only 40.36% “strongly agreed” with the recommendation of six ladles of rice daily for breastfeeding mothers, and merely 76.85% reported actually providing this advice in practice. Similarly, just 47.78% “strongly agreed” with consuming four medium-sized glasses of vegetables and fruits daily, with 87.24% reporting this practice. These deficits mirror the findings of Rizk et al., who also observed that daily recommended serving sizes received the lowest scores among healthcare providers.<sup>17</sup>

This pattern suggests that healthcare workers’ uncertainty about quantitative dietary guidelines significantly undermines their confidence and consistency in counseling, despite their good understanding of broader nutritional principles. However, it is important to interpret this finding alongside the multivariate results, where knowledge did not emerge as a significant independent predictor of counseling practice. The logistic regression model for knowledge was not statistically significant and demonstrated limited explanatory power, suggesting having knowledge alone may not be sufficient to ensure good counseling behaviour. This finding is consistent with Sunguya et al., who reported that nutrition training improves not only knowledge but also practical skills and counseling competence. Their review suggests that improvement in practice occurs when knowledge is reinforced through structured training and practical application. Therefore, knowledge may be a necessary foundation, but training and system support are required to translate knowledge into effective counseling practice.<sup>18</sup>

The persistent gap between theoretical knowledge and practical application observed in this study highlights the need for strengthened nutrition training. Our study's sociodemographic findings also revealed that only 15.13% of healthcare workers had attended training on nutrition for pregnant and breastfeeding mothers in the last year. This means that nearly 85% of healthcare workers at PHCs/Puskesmas in Bandung have not received any recent training in this critical area, which likely contributes to their lower correct response rates for specific portion-size and dietary recommendations. Furthermore, the analyses results in Table 6 show that nutrition training was positively associated with attitudes ( $p=0.015$ ) and showed a marginal association with practices ( $p=0.057$ ) in bivariate testing. Although it did not emerge as a significant independent predictor in multivariate models. Nevertheless, extensive evidence supports training effectiveness.

Research indicates that up-to-date nutrition training is essential for enhancing healthcare workers’ knowledge, attitudes, and practices in maternal and child health. Shakshir et al. found that targeted training courses significantly improve clinicians’ ability to deliver nutrition care.<sup>14</sup> Hennop et al. emphasize the importance of regular refresher programs to ensure that all healthcare workers possess the competence and confidence needed for effective maternal and child nutrition counseling.<sup>19</sup> Similarly, Nguyen et al. demonstrated that strengthening health system interventions particularly workforce training can markedly elevate the quality of nutrition services.<sup>20</sup> Rizk et al. further underscore the value of ongoing nutrition education programs for healthcare providers to achieve better patient outcomes.<sup>17</sup> However, within the Indonesian PHCs/Puskesmas setting, maternal nutrition counseling is primarily delivered by nutritionist, who are widely recognized as the main providers of nutrition education.<sup>21</sup> Midwives, as frontline of antenatal care, typically deliver integrated maternal health education that includes nutrition counseling as part of routine services.<sup>22</sup> In contrast, physicians tend to focus on clinical management and complications, with limited emphasis on comprehensive dietary counseling.<sup>23</sup> Therefore, differences observed across professions should be interpreted within the context of role delineation and scope of practice, rather than as direct performance comparisons.

Given that only 15.13% of respondents reported receiving recent nutrition training, strengthening continuing professional education is essential. Evidence suggests that in-service nutrition training improves healthcare workers knowledge, counseling skills, and practice behavior. Furthermore, training interventions are most effective when tailored to the specific context of healthcare workers. Therefore, profession-specific

capacity-building approach may be more appropriate than generalized training strategies, as they enhance practical counseling quality while aligning with scope-of-practice boundaries.<sup>18</sup>

Multivariate analysis in Table 9 identified professional background as the strongest predictor of maternal nutrition counseling practices. Midwives showed 6.664 times higher odds of good practices compared to doctors ( $p < 0.001$ ), nutritionists demonstrated 3.952 times higher odds ( $p = 0.014$ ), and public health officer showed 4.483 times higher odds ( $p = 0.001$ ). However, these associations should be interpreted cautiously given the modest overall model performance (Nagelkerke  $R^2 = 0.135$ ), indicating that the regression model explained only a limited proportion of variance in counseling practices. Important determinants such as workload, patient volume, supervision quality, organizational support, and availability of counseling tools were not captured in this study and may substantially influence practice behaviours.

These odds may also be partially explained by the nutrition education content across each profession's education program. While midwives' educational preparation typically includes substantial nutrition content and counseling skills, evidence shows that medical education often lacks sufficient nutrition education, with many medical schools providing fewer than 20 hours of nutrition across the entire curriculum.<sup>24,25</sup> Our study also found that higher degree holders showed lower practice odds compared to lower degree holders.

Given strong profession-practice associations in our findings, training intervention should be tailored to each profession group. Doctors may benefit from training focused on practical counseling techniques, while nurses may need more comprehensive nutrition content. In Table 1 shows the low level of training participation (15.13%) and the limited impact of one-time training showed the need for ongoing professional development with continuous training programs. This study has several limitations. The study used self-reported data on attitudes and practices that may be subjected to social desirability bias. The relatively low explained variance in multivariate models (Nagelkerke  $R^2 = 0.135$ ) suggests there are additional structural and contextual predictors that should be explored. The study assessed training attendance but not training quality, duration, or curriculum content.

Future research should prioritize longitudinal intervention studies to evaluate the long-term training effectiveness, direct observation of actual counseling practices, and qualitative research exploring barriers and facilitators. Additionally, investigations into systemic and cultural factors influencing counseling behaviours are essential to design context-appropriate and sustainable maternal nutrition interventions.

## CONCLUSION

This study identified gaps in healthcare workers' knowledge, attitudes, and practices (KAP) for specific practical knowledge, particularly in practical components such as portion recommendations. Although professional background was significantly associated with practice outcomes in multivariable models, its explanatory contribution was modest, suggesting that other unmeasured factors likely influence counseling performance. Therefore, professional background should be interpreted as a statistically significant associated factor rather than a strong predictor. Differences across professions should be interpreted in the context of their distinct roles and training. Midwives and nutritionist demonstrated better practice scores, likely because nutrition counseling is part of their routine duties, rather than reflecting inherently higher competence.

The low proportion of respondents who had received relevant training (15.13%) highlights a substantial continuing professional development gap. Targeted, role-appropriate training interventions may help strengthen practical counseling competencies and enhance the quality of maternal nutrition services during pregnancy and lactation, thereby supporting broader stunting prevention efforts.

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## CONFLICT OF INTEREST

Authors declare no conflict of interest to disclose.

## DECLARATION USE AI

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) solely for language editing and improving readability. All scientific content, interpretation of findings, and conclusions were developed by the authors. The authors carefully reviewed and revised the generated text and assumed full responsibility for the final manuscript.

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