Research Tool

Indian Journal of Extension Education
Vol. 62, No. 1 (January–March), 2026, (153-158)

ISSN 0537-1996 (Print)
ISSN 2454-552X (Online)

Development and Validation of a Nutrition Literacy Scale for Rural Women in India

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HIGHLIGHTS

- A 57-item nutrition literacy scale (NLS RW) was developed and validated for rural women in India (2024–25).
- The scale demonstrated excellent internal consistency (Cronbach's $\alpha = 0.948$) and content validity.
- The tool captures multidimensional aspects of nutrition literacy, including cognitive, functional, interactive, and critical skills.
- Provides a culturally relevant instrument for assessing and improving nutrition literacy in rural communities.

ARTICLE INFO

Keywords: Nutrition literacy, Rural women, Scale development, Psychometrics, Women's health.

https://doi.org/10.48165/IJEE.2026.621RT03

Citation: Kumari, J., Jirli, B., Singh, A. K., Singh, P., Chennamadhava, M., & Paliwal, H. (2025). Development and Validation of a Nutrition Literacy Scale for Rural Women in India. *Indian Journal of Extension Education*, *62*(1), 153-158. https://doi.org/10.48165/IJEE.2026.621RT03

ABSTRACT

Nutrition literacy (NL) is essential for fostering and sustaining healthy dietary behaviours. However, data on NL among rural women in India are limited, and existing measurement tools lack cultural appropriateness for this population. To address this gap, this study conducted during 2024–2025, developed and validated the Nutrition Literacy Scale for Rural Women (NLS-RW), measuring; cognitive, functional, interactive, and critical domains of NL. An initial pool of 100 statements was generated and then refined to 95 items. Relevancy testing with 60 subject matter experts using a five-point scale informed retention decisions was performed based on relevancy percentage (RP), relevancy weightage (RW), and mean relevancy score (MRS). Item analysis with a sample of 64 rural women aged 15–49 years from three districts of Jharkhand (Chatra, Ranchi, and Khunti) was conducted. Reliability was assessed using split-half correlation (Spearman–Brown adjustment) and Cronbach's alpha. Content validity yielded a scale-level content validity index (S-CVI/Ave) of 0.92, indicating excellent content validity. The final scale comprised 57 items and showed excellent internal consistency (Cronbach's $\alpha = 0.948$; Spearman–Brown coefficient = 0.968). The NLS-RW comprehensively captures multiple dimensions of nutrition literacy among rural women.

INTRODUCTION

Women play a pivotal role in ensuring food security at both household and global levels as primary food producers, processors, and distributors. Globally, they contribute nearly half of total food production, and in Asia, they provide approximately 65% of household food supply. In India, 73.2% of rural women engage in agricultural activities (Agriculture Census, 2015–16), and their participation continues to rise due to male migration to urban regions, a trend known as the feminisation of agriculture (Economic Survey, 2017–18).

Despite their central contribution to food production and nutrition management, rural women experience persistent challenges, including limited educational opportunities, inadequate healthcare access, and restrictive socio-cultural norms that negatively influence nutritional well-being. Malnutrition among Indian women remains

Received 23-09-2025; Accepted 08-12-2025

a major public health concern, with 18.7% undernourished and 57.0% anemic (NFHS-5, 2021). Simultaneously, 41.3% of women are overweight or obese, illustrating the double burden of malnutrition (Economic Survey, 2023–24). Dietary patterns reflect further imbalance, as rural diets remain predominantly cereal-based, contributing 65.2% of total caloric intake compared to the recommended 45%, while consumption of protein (11%), vegetables (8.8%), and dairy products (8.7%) falls below recommended levels (ICMR-NIN, 2024). Additionally, increased consumption of ultra-processed foods in urban areas contributes to India's rising obesity and diabetes rates (Economic Survey, 2023–24).

Nutrition challenges stem from financial constraints (Darnton-Hill et al., 2005), limited access to diverse foods (Allen, 2005; Nguyen et al., 2012), cultural dietary beliefs (Briones, 2018), and an often overlooked but critical factor–nutrition literacy. Nutrition literacy refers to the ability to obtain, process, understand, and apply nutrition information to make informed dietary decisions (Zoellner et al., 2009) and includes functional, interactive, and critical domains based on Nutbeam's framework. Higher levels of nutrition literacy associated with healthier dietary practices and a reduced risk of chronic diseases (Carbone et al., 2012; Bauer et al., 2014). However, most existing nutrition literacy assessment tools, such as the Newest Vital Sign (NVS) and the Nutrition Literacy Assessment Instrument (NLit), originate from Western contexts and lack cultural relevance for rural Indian women. They do not reflect regional dietary patterns, food availability, socio-economic constraints, or linguistic diversity, limiting their applicability and accuracy.

The present study develops and validates the Nutrition Literacy Scale for Rural Women (NLS-RW), a context-specific assessment tool designed to measure functional, cognitive, interactive, and critical dimensions of nutrition literacy. It hypothesises that a culturally relevant and scientifically validated scale captures nutrition literacy more accurately than existing tools and supports targeted intervention strategies. By enabling more informed dietary choices, the scale has the potential to improve nutritional outcomes, break intergenerational cycles of malnutrition, and support India's public health priorities, aligning with global goals such as the FAO's advocacy for dietary diversity (2019) and the Global Nutrition Report (2021).

METHODOLOGY

Nutrition literacy in this study was defined following Silk et al. (2008) as the capacity to obtain, process, and understand nutrition information and apply it for appropriate dietary decisions. It was operationalized as a combined ability to acquire, comprehend, communicate, and critically evaluate food and nutrition information across cognitive, functional, interactive, and critical domains. The Nutrition Literacy Scale for Rural Women (NLS-RW) was developed using the summated rating method proposed by Likert (1932) with modifications as suggested by Edwards (1957) and Patil et al. (1996). An initial pool of 100 statements relating to nutrition knowledge, skills, practices, and decision-making was collected from literature, expert inputs, and field observations. After screening based on established criteria for statement construction (Thurstone & Chave, 1929; Edwards & Kilpatrick, 1948), 95 items were retained for expert evaluation.

Expert judgment was obtained from 60 subject specialists who rated each item on a five-point scale from 1 (not relevant) to 5 (most relevant). Relevancy Percentage was calculated as:

$$RP = (FS / N) \times 100,$$

Where, FS represented the frequency of responses marked "relevant" or "most relevant," and N was the number of experts.

Relevancy Weightage was calculated as:

$$RW = [(MR\times5 + R\times4 + SWR\times3 + LR\times2 + NR\times1) / MPS] \times 100,$$

Where, MR = most relevant, R = relevant, SWR = somewhat relevant, LR = less relevant, NR = not relevant, and MPS = maximum possible score (60×5 = 300).

The Mean Relevancy Score (MRS) was computed by dividing the total score by the number of judges, and the Overall Mean Relevancy Score (OMRS) was calculated across all items. Items with RP ≥ 80%, RW ≥ 0.80, and MRS greater than OMRS were retained, yielding 65 items.

Item analysis was conducted among 64 rural women aged 15–49 years from Chatra, Ranchi, and Khunti districts of Jharkhand selected through probability proportional to size (PPS) sampling. The top and bottom 25% scorers were compared using the t-test method described by Edwards (1957), retaining items with $t \geq 1.75$, resulting in a final scale with 59 items.

Reliability was assessed through the split-half method using Pearson's correlation and adjusted using the Spearman–Brown formula

$$R = 2r / (1 + r)$$

Where, r represented correlation between halves.

Cronbach's alpha was computed to determine internal consistency. Content validity was ensured through expert evaluation. Ethical approval was obtained from the Institutional Ethics Committee, and informed consent was collected from all participants prior to data collection.

RESULTS

The development of the Nutrition Literacy Scale for Rural Women (NLS-RW) involved a systematic refinement process from the initial pool of 100 statements to a final set of 57 items. Figure 1 summarizes the sequence from item generation, expert screening,

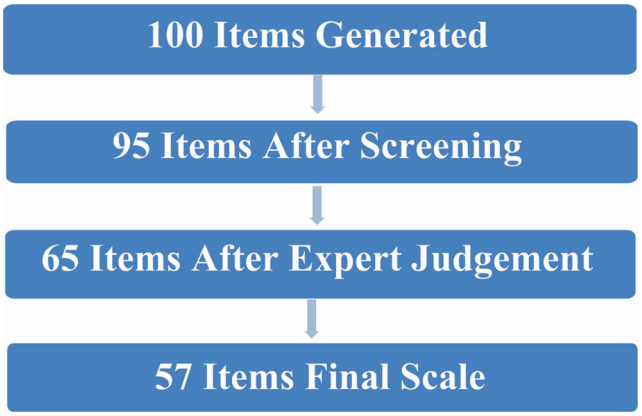

Figure 1. Flowchart of the scale development process for the Nutrition Literacy Scale for Rural Women (NLS-RW)

relevancy evaluation, and item discrimination testing. Of the 95 items screened through expert judgment, 65 met the predetermined cut-off values based on relevancy percentage, relevancy weightage (RW), and mean relevancy score (MRS). Subsequent item analysis using the top- and bottom-quartile comparison further refined the pool which resulted in a final NLS-RW comprising 57 items.

Across these 57 items, RW ranged from 0.81 to 0.92, MRS ranged from 4.03 to 4.62, and t-values ranged between 2.06 and 10.95, indicating that all retained items met the criteria for both content relevance and discriminating power. The items collectively covered seven sub-dimensions of nutrition literacy, reflecting a comprehensive conceptualization of dietary knowledge and behavior. The distribution of items across sub-dimensions was as follows: knowledge and understanding of food and nutrition (14 items), awareness of food safety and hygiene (6 items), understanding determinants influencing nutritional health (17 items), information search and practical meal-planning skills (7 items), interpersonal communication skills (2 items), critical evaluation of nutrition-related information and marketing (4 items), and willingness to act to improve nutrition behaviours (7 items). This balanced representation ensures that the scale captures both knowledge-based and behavior-oriented aspects of nutrition literacy.

A summary of mean RW, MRS, and t-value ranges for each sub-dimension is presented in Table 1, which is further organized into sub-tables (Tables 1A–1D) for improved readability. Table 1A presents items related to knowledge and understanding, Table 1B to food safety and hygiene, Table 1C to determinants of nutritional health, and Table 1D to practical skills, interpersonal communication, critical evaluation, and action-oriented behaviours. Within the determinants of nutritional health sub-dimension, RW values ranged from 0.81 to 0.90, MRS from 4.03 to 4.48, and t-values from 2.06 to 8.51. In the action-oriented sub-dimension, RW ranged from 0.81 to 0.88, MRS from 4.07 to 4.42, and t-values from 3.26 to 5.94. Table 2 provides a concise overview of the number of items under each sub-dimension.

The psychometric analysis demonstrated strong reliability and validity of the NLS-RW. The Cronbach's alpha value of 0.948 indicated excellent internal consistency, suggesting that the items measured a cohesive construct. The Spearman–Brown coefficient (0.968) and Pearson correlation coefficient (0.938) further confirmed

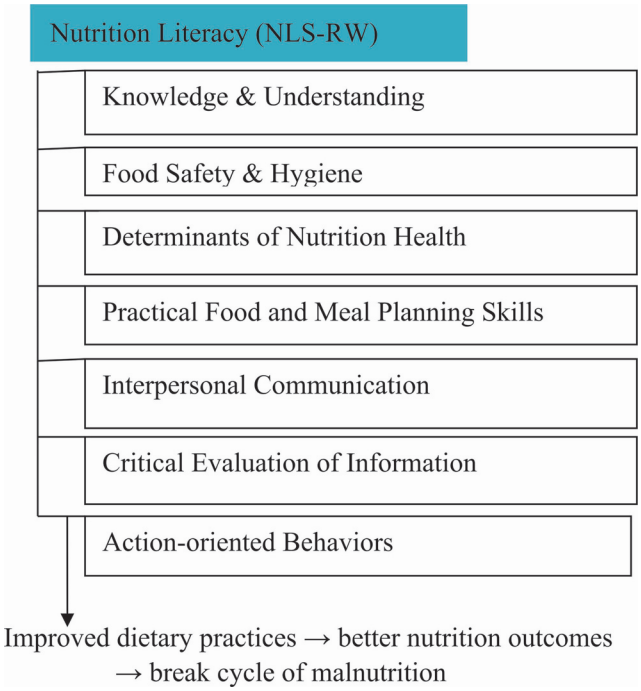

Figure 2. Conceptual Model

Table 1. Summary of retained items with mean RW, MRS, and t-value range

Item Example	RW Range	MRS Range	t-value Range
Knowledge & Understanding of Food and Nutrition (n = 14)			
Example: Vegetables and fruits provide vitamins and minerals	0.82–0.92	4.03–4.62	2.06–10.95
Food Safety & Hygiene (n = 6)			
Example: Boiling is a healthy cooking method	0.82–0.86	4.08–4.30	3.43–7.75
Determinants of Nutritional Health (n = 17)			
Smoking harms health; Sunlight improves Vitamin D absorption	0.81–0.90	4.03–4.48	2.06–10.95
Skills, Interpersonal Communication, Critical Evaluation & Action (n = 20 total)			
Practical food planning & selection (7)	0.81–0.86	4.03–4.30	3.74–6.43
Interpersonal communication m (2)	0.83–0.85	4.13–4.23	3.07–4.43
Critical evaluation of marketing info (40	0.83–0.89	4.15–4.47	4.45–9.60
Action & behaviour (7)	0.81–0.88	4.07–4.42	3.26–5.94

Table 2. Summary of Items by Sub-dimension

Sub-Dimension	Number of items	Interpretation
Knowledge & understanding	14	Awareness of essential nutrition concepts
Food safety & hygiene	6	Understanding of clean and safe food practices
Determinants of health	17	Ability to link nutrition, lifestyle & health
Practical nutrition skills	7	Hands-on food planning and preparation
Interpersonal communication	2	Sharing and discussing nutrition
Critical evaluation	4	Judging marketing and media claims
Action & behavior	7	Readiness to adopt healthy choices

high split-half reliability and internal stability of the scale. Content validity was supported through expert evaluation, with a scale-level content validity index (S-CVI/Ave) of 0.92, indicating excellent agreement among experts regarding item relevance. The consistently high t-values across items also confirmed good discriminatory capacity between respondents with higher and lower nutrition literacy.

Overall, the results indicate that the NLS-RW is a valid, reliable, and multidimensional tool for assessing nutrition literacy among rural women, with items that are both psychometrically sound and contextually appropriate for rural Indian settings.

DISCUSSION

The present study develops and validates a nutrition literacy scale tailored to rural women, structured across four domains: cognitive, functional, interactive, and critical. The final 57-item tool demonstrates strong psychometric properties, with excellent reliability and satisfactory validity, confirming its utility in assessing the multidimensional nature of nutrition literacy in rural contexts. The high relevancy weightages and mean relevancy scores across items reflect strong expert consensus regarding the appropriateness of the statements. This finding is consistent with previous work emphasizing the need for culturally grounded and contextually appropriate nutrition literacy instruments (Shitu et al., 2018; Gupta et al., 2022; Shelar et al., 2022; Vavilala et al., 2024; Singh et al., 2025). It also aligns with conceptualisations of Kickbusch et al. (2006) and Sørensen et al. (2012), who define nutrition literacy as extending beyond knowledge acquisition to include practical skills, interpersonal communication, and critical evaluation. The present tool integrates these dimensions, thereby expanding the scope of measurement compared to earlier unidimensional scales.

Reliability measures further reinforce the strength of the scale. The Cronbach's alpha coefficient of 0.948 far exceeds the recommended threshold of 0.70 (Nunnally & Bernstein, 1994), while the Spearman–Brown coefficient (0.968) and Pearson's correlation (0.938) indicate strong internal stability. These findings are comparable to those reported for global tools such as the Newest Vital Sign (Diamond, 2007) and the Nutrition Literacy Assessment Instrument (Gibbs et al., 2016), suggesting that the present scale meets international standards of methodological rigor while retaining contextual relevance.

The focus on contextual adaptation is a major contribution of this research. Expert validation ensured that the scale captured locally relevant concerns such as food hygiene, breastfeeding, dietary diversity, and the use of indigenous foods. Prior studies highlight that generic constructs often fail to reflect the realities of rural populations (Velardo, 2015; Vidgen & Gallegos, 2014). In India, for instance, Chakrabarti et al. (2019) observe that limited nutrition awareness constrains household and child health outcomes, while Ghosh-Jerath et al. (2016) note that women in Jharkhand, despite access to diverse local foods, often lack adequate dietary knowledge. Johri et al. (2016) further demonstrate that improving women's nutrition literacy directly enhances maternal and child health indicators. The present scale addresses these documented gaps by offering a structured and standardized assessment tool grounded in rural women's experiences.

The multidimensional nature of the instrument also deserves emphasis. By including domains related to interpersonal communication and critical evaluation of marketing and media claims, the tool reflects the socially embedded nature of nutrition decision-making. Similar findings are reported by Aihara and Minai (2011) and Zoellner et al. (2011), who stress the role of interactive and critical skills in empowering women to negotiate household food choices and resist misleading influences. The results suggest that nutrition literacy should not be viewed solely as an individual cognitive attribute but as a socially mediated competence.

At the same time, certain limitations should be acknowledged. The sample size, though sufficient for preliminary validation, is restricted to three districts of Jharkhand and may limit generalizability to broader geographic or cultural contexts. Self-reported responses may also introduce social desirability bias. Additionally, the study did not incorporate objective outcome measures such as dietary intake or biochemical indicators, which could further strengthen validation. Future research may consider larger, multi-state samples, longitudinal evaluations, and triangulation with behavioral or clinical indicators.

Despite these limitations, the study holds important practical implications. The scale can be used by health educators, frontline workers, and policymakers to diagnose literacy gaps, design tailored educational interventions, monitor program effectiveness, and prioritize resource allocation. It also offers valuable guidance for integrating nutrition literacy into community-based programs and schemes such as Integrated Child Development Scheme (ICDS), Prime Minister's Overarching Scheme for Holistic Nourishment (POSHAN Abhiyaan), and women's self-help group initiatives. Overall, the tool establishes a strong foundation for advancing research, program design, and policy interventions aimed at strengthening nutrition outcomes in rural communities.

CONCLUSION

By capturing cognitive, functional, interactive, and critical dimensions of nutrition literacy, the NLS-RW provides a culturally sensitive and comprehensive tool tailored to rural Indian contexts. Its application can facilitate the identification of literacy gaps, inform targeted interventions, and support policy actions aimed at strengthening community nutrition initiatives, promoting dietary diversity, and enhancing the effectiveness of government health programs, and self-help group–based nutrition campaigns. While the tool reflects rigorous validation, further testing across diverse socio-cultural regions is recommended to enhance generalizability. The NLS-RW holds significant potential for future research by enabling longitudinal evaluation of nutrition education strategies and assessing the impact of interventions on behavioral and health outcomes. Overall, the NLS-RW offers a robust foundation for advancing nutrition education and addressing the persistent double burden of malnutrition among rural women in India.

DECLARATIONS

Ethics approval and informed consent: Informed consent was sought from the 60 subject matter specialist and 64 women judges (for relevancy testing) of the statements/ items regarding the study during the course of the data collection.

Conflict of interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The authors declare that during the preparation of this work, they thoroughly reviewed, revised, and edited the content as needed. The authors take full responsibility for the final content of this publication.

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APPENDIX

Final List of Items Included in the Nutrition Literacy Scale for Rural Women (NLS-RW)

Instructions: Respondents rate each statement on **a 5-point Likert scale:**

5 – Strongly Agree | 4 – Agree | 3 – Neutral | 2 – Disagree | 1 – Strongly Disagree

Higher scores indicate greater nutrition literacy.

Sub-Dimension 1: Knowledge and Understanding of Nutrition (14 items)

1. Vegetables and fruits are rich sources of vitamins and minerals.
2. No single food provides all the nutrients needed for good health.
3. Green leafy vegetables improve eye health and blood health.
4. Iodine deficiency can lead to goiter.
5. Calcium is essential for healthy growth and bone development.
6. Pregnant and lactating women need extra food and health care.
7. Obesity increases the risk of high blood pressure, heart disease, diabetes, and cancer.
8. Foods high in fiber help reduce constipation.
9. Early and exclusive breastfeeding for the first six months is essential for newborn health.
10. Milk is a rich source of essential nutrients for all age groups.
11. Iron-rich foods like green leafy vegetables, legumes, and meat prevent anemia.
12. Immunization of children and pregnant women is important.
13. Adequate water intake helps maintain good health.
14. A balanced diet includes grains, fruits, vegetables, milk, meat, and eggs.

Sub-Dimension 2: Food Safety and Hygiene (6 items)

15. Boiling is a healthy cooking method.
16. Properly cleaned and cooked green leafy vegetables are safe for infants.
17. Wash vegetables before chopping to conserve nutrients.
18. Cooking at very high temperatures may destroy nutrients.
19. Contaminated food can cause illness.
20. Eggs and meat should be thoroughly washed and cooked.

Sub-Dimension 3: Determinants of Nutritional Health (17 items)

21. Smoking harms health.
22. Excessive consumption of oil, red meat, ghee, butter, and cheese can lead to obesity and heart disease.
23. Milk provides quality protein and calcium and is essential for whole family.
24. Alcohol and tobacco should be avoided during pregnancy and breastfeeding.
25. Combining cereals with pulses improves protein quality in a meal.
26. Green leafy vegetables aid digestion.
27. Regular physical activity, yoga, and exercise keeps one physically and mentally fit.
28. Breastfeeding lowers the risk of infections in infants.
29. A diet rich in calcium, iron and essential nutrients is vital for growth.
30. Refined flour (*maida*) and hydrogenated fats (*dalda*) are unhealthy.
31. Soft drinks and soda are harmful to health.
32. Sunlight helps maintain Vitamin D levels.
33. Parboiled or unpolished rice is healthier than polished rice.
34. Artificial food colors and flavors may be harmful.
35. Oral rehydration solution (ORS) helps manage dehydration during diarrhea.
36. Too much sugar is harmful to health.
37. Fasting for long periods may affect health.

Sub-Dimension 4: Practical Meal-Planning and Selection Skills (7 items)

38. Selecting safe food is important for a healthy diet.
39. I eat a variety of foods to ensure balanced diet.
40. I prepare the right amount of food to avoid wastage.
41. I prepare, process and store food in a clean and hygienic way.
42. I check freshness and quality before buying fruits and vegetables.
43. I prefer fresh, locally available vegetables and fruits.
44. I use whole grains, nuts, and oilseeds in meals.

Sub-Dimension 5: Interpersonal Communication (2 items)

45. I discuss nutrition-related information with others.
46. I encourage my friends and family to eat healthy foods.

Sub-Dimension 6: Critical Evaluation of Nutrition Information (4 items)

47. I buy food products that are properly packed and certified.
48. I check expiry dates on food packets before buying.
49. I check certification logos such as FSSAI on food products.
50. I check if promotional messages are misleading.

Sub-Dimension 7: Action and Behavior (7 items)

51. I limit intake of fried, salty, and sugary foods.
52. I prefer home-cooked meals over processed ones.
53. I include vegetables in every meal.
54. I encourage children to eat food from all food groups.
55. I wash hands before preparing food.
56. I drink safe and clean water every day.
57. I prefer steaming and pressure cooking over deep frying.