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Development of Nutrition Instruments for Women to Prevent Early Stunting: A Systemic Literature Review

Vilda Ana Veria Setyawati[1], Ari Yuniastuti[1]✉, Oktia Woro Kasmini Handayani[1], Eko Farida[1]
[1]Doctor of Public Health Program, Faculty of Medicine, Universitas Negeri Semarang, Indonesia

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Abstract

This study aims to provide an overview of the types of instruments developed and tested for validity based on a questionnaire and the content/variable domains in the instrument. PRISMA was used as a guideline in the systemic literature review of this study. Pubmed is search databases with the keywords "validity" AND "nutrition" AND "instrument" AND "woman." The articles obtained at the outset went through a process of searching, screening, eligibility criteria, data extraction, and data synthesis. So in the end, there were six that studied the types of instruments produced by each study, the method of instrument development, domain, validity, and reliability. Instruments resulting from the study include the Chinese version of the Intention to Eat Low-GI foods questionnaire (CIELQ), Improving Mothers for Better Prenatal Care trial Barcelona (IMPACT BCN), project-level Women's Empowerment in Agriculture Index (pro- WEAI+HN), Nutrition literacy assessment instrument for pregnant women in China (NLAI-P). There are two that are not given a name. Population and sample, women aged 16-50 with late adolescent characteristics, pregnant women, and adult women. Confirmatory factor analysis (CFA) and Cronbach's alpha were used to test the validity and reliability. Nutritional instruments to prevent stunting in women have yet to be developed but to develop these instruments, one can adopt development paths, methods, content domains, validity, and reliability from the results of the literature review in this article.

Introduction

Stunting is a health problem found mainly in developing countries, with a total prevalence of 40% globally. This figure is far from the WHO target of only 20%. Indonesia itself is included in the top 10 countries with the highest stunting (WHO, 2018). Stunting prevention programs are divided into two major groups, namely specific (health) and sensitive (non-health) interventions targeting young women, pregnant women, breastfeeding mothers, infants, and toddlers (Manggala *et al.*, 2018). Outside the target context, in public health science, vulnerable groups are known, namely women of childbearing age, infants, toddlers, and older people. Slices can be taken; women are targets in stunting treatment. The risk for women is more significant because they experience menstruation every month, so they are at risk of anemia. In addition, they are also more at risk of experiencing chronic energy deficiency (CED) due to poor eating behavior due to harmful patterns to maintain appearance (Dagne *et al.*, 2021)(Ananda *et al.*, 2022). Women are targeted for stunting treatment because the impact of nutritional disorders, both anemia and KEK, is very bad for their future (Sparrow *et al.*, 2021). Added to the many cases of early marriage, eating patterns and nutritional disorders will worsen the quality of future generations (Christian and Smith, 2018). They are at risk of giving birth to stunted babies, which will then grow into stunted children. Treatment of stunting

✉ Correspondence Address:
Sekaran, Gunung Pati, Semarang City, Central Java 50229 Indonesia
Email: ariyuniastuti@mail.unnes.ac.id

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is expensive, takes a long time but is not necessarily successful, and reduces endurance (Setyawati, 2022).

The stunting program that has been implemented targeting women so far is in the form of education and iron supplementation, even though this intervention has been implemented since 2014, long before the stunting treatment program was launched (Gattermann *et al.*, 2021)(Salam *et al.*, 2019) (Yilma *et al.*, 2020). Until now, innovations in handling stunting in women have not been implemented. Some of the reasons for the lack of creation are the lack of data on women's health and nutrition profiles because the existing instruments cannot map their data needs.

Questionnaire-based nutrition and health instruments often used as the basis for policy-making in Indonesia and globally are health literacy, 24-hour recall, and food frequency questionnaires. Health literacy is an instrument to determine the level of health literacy in individuals so that it is very general and does not reach women. Even though inadequate literacy in women has an impact on poor health and healthcare (Gibbs *et al.*, 2018) (Ickes, Hurst and Flax, 2015). The 24-hour recall is an instrument to detect the amount and type of individual food intake in the last 24 hours in household size (Xu *et al.*, 2021). However, it is difficult for every individual to provide detailed information about all the food consumed in the last 24 hours. In addition, it isn't easy to get a picture of the consumption trend within a week or a month if one review is reviewed. Also, not all enumerators have sufficient expertise to obtain food intake data. The FFQ is widely used to determine the quality of food intake because it provides data on the type of food consumed to provide information on specific dietary patterns. The FFQ and the 24-hour Recall are relatively inexpensive tools. They are easier to administer and analyze in large sample sizes than other dietary intake assessment methods, such as food records (Vettori *et al.*, 2019). This study aims to provide an overview of the types of instruments developed and tested for validity based on a questionnaire and the content/ variable domains in the instrument.

Method

This research is a systemic literature review written according to the Preferred Reporting Items for Systemic Reviews and Meta-analyses (PRISMA) guidelines to assist reporting in systematic reviews and meta-analyses. PRISMA is concentrated on reporting studies that evaluate the effectiveness of interventions but can also be used as a basis for reporting systematic reviews with purposes other than assessing interventions (e.g., evaluating etiology, prevalence, diagnosis, or prognosis) (Sarkis-Onofre *et al.*, 2021). Mendeley Desktop version 1.19.5 is used for reference management during the article screening process, and Microsoft Excel 2016 is used for data extraction. The systemic literature review consists of a search strategy, articles screening, eligible criteria setting, data extraction, and data synthesis. The articles searched are relevant to the research topic, with the central database being PubMed. The Pubmed database was chosen because it uses the MEDLINE database and includes constant updating; However, citations are not indexed, journal entries are not indexed, and records are considered "out of scope" from partially indexed scientific articles for this database. In addition, the list of articles identified as "gray literature" is not used to enter the further steps. The search is done in 1 string with the keywords below: "validity" AND "nutrition" AND "instrument" AND "woman"

Based on the keywords that have been compiled, 95 research articles were obtained at the beginning. The accepted articles are selected based on their relevance over no more than five years, so 49 articles are included in the criteria for the period. Then filtering was carried out again by selecting articles that were "free full text" so that 29 articles were obtained because 20 articles consisted of only abstracts or full text but were paid. Furthermore, screening was carried out to get articles that examined health instruments in general, so four articles should have been included. Then, another was selected from the existing health instrument articles, which only reviewed nutritional instruments, so nine articles were not used. As a result, 16 articles examine dietary instruments. The

next screening was to select articles that read nutritional instruments but with a population and only women as a sample, so eight articles were included in these criteria. Finally, only articles were selected in English, so the final number of research articles to be reviewed was 6.

All identified research titles and abstracts were independently screened for eligibility criteria for review by the authors. According to the selection criteria, the full texts of the eligible studies were examined. After reviewing the full text of the studies, studies that did not report results of interest (indicated by search keywords) and studies with poor quality (not from reputable international journal databases) were excluded from the final analysis. This study only focuses on research that develops nutritional instruments based on a questionnaire that measures nutritional profiles/domains/variables in women, adolescents, young adults, pregnant women, and adult women. Race, ethnicity, and scope of research (city, regional, or international)

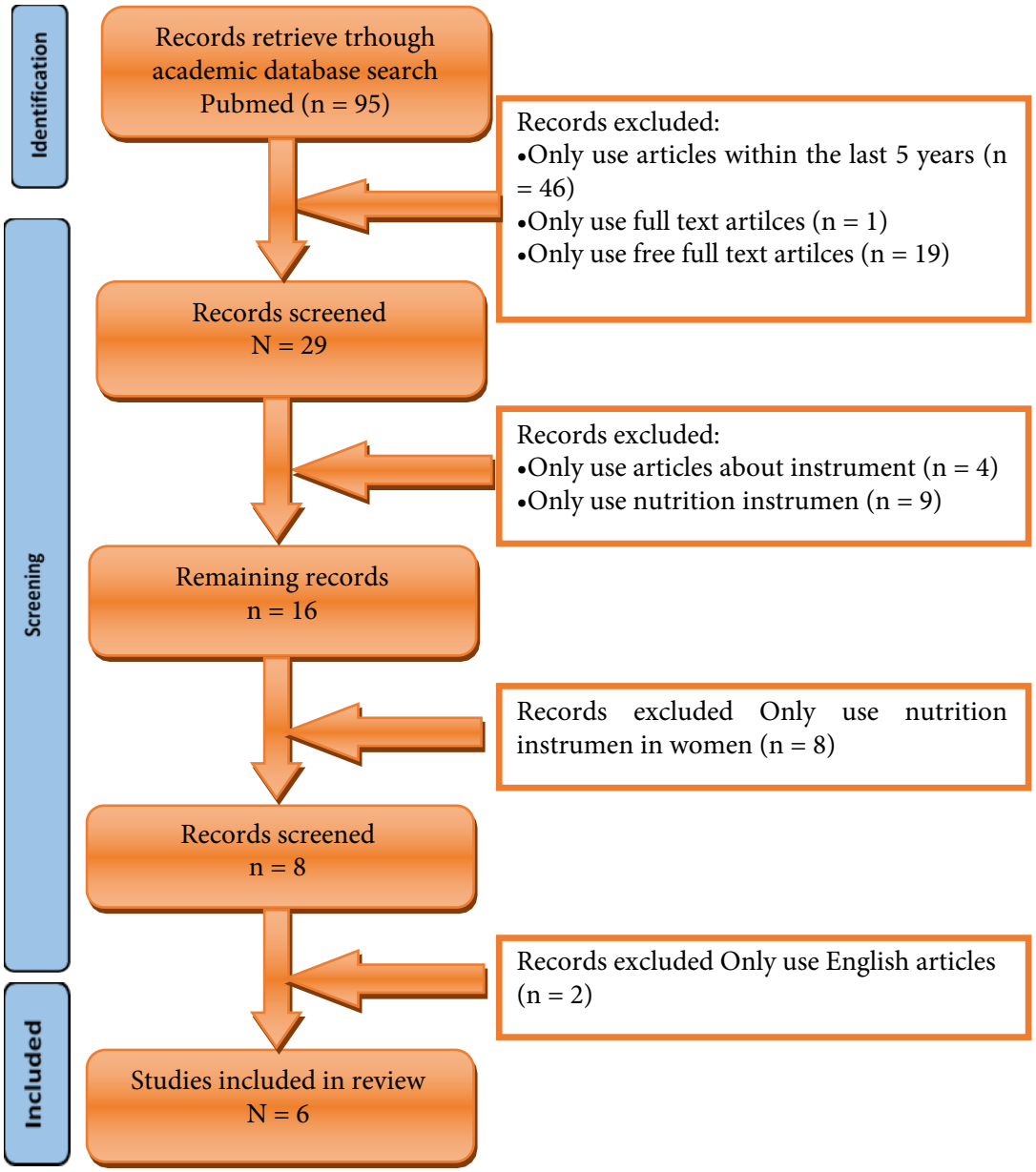

Figure 1. Systemic Literature Review Flow Chart Using the PRISMA Method

were not considered in this study. After going through the results screening process, the data extracted from each article, one by one, was reviewed by the reviewers. The extracted data includes the author and year of publication, title, the research method used in preparing the instrument, population, research sample, name of the instrument resulting from the study, domain/content/variables in the instrument, and type of statistical test used. Thus, at the extraction stage, articles that pass through the eligibility screening and selection process are fully read and re-selected if the study follows the objectives and problems of this study. So that the PRISMA study flow carried out in this study is shown in Figure 1. Data were analyzed through narrative synthesis, extracted from tables, and accounted for bias and other issues that could affect the interpretation of each study's findings, as identified by this review process (Petticrew and Roberts, 2008).

Result and Discussion

It is necessary to develop instruments to measure the nutritional profile of women so that health programs are more specific and able to address nutritional problems. Of the six studies reviewed, two studies have not named the instruments being developed (Mierzejewska *et al.*, 2020) (Savari, Sheykhi and Shokati Amghani, 2020). The naming of the instrument produced in a study indicates the objective or target variable to be obtained from the participants who use it. The Chinese version of the Intention to Eat Low-GI Foods questionnaire (CIELQ) is an instrument to measure the intention/desire to eat foods with a low glycemic index. This instrument was initially developed under Intentions to Eat Low-GI Foods (IELQ) in Canada. The user population is also not restricted by gender. IELQ consists of 7 factors: GI knowledge, instrumental attitude, experiential attitude, subjective norm, descriptive norm, PBC, and behavioral intention. They find that the IELQ has acceptable validity (Cronbach's alpha, 0.53–0.96) and reliability (Cronbach's alpha, 0.78–0.93), explaining 62.9% of the total variance in intention to eat low-GI foods (Watanabe *et al.*, 2015). However, the IELQ cannot be adopted in other countries due to cultural differences, and it is also difficult to measure the intention to consume low-GI foods in rural Chinese women with a history of gestational diabetes mellitus (GDM). Based on the theory of planned behavior (TPB) (Eades, France, and Evans, 2018).

The nutritional instrument for pregnant women in Poland has not yet been named because it is still being developed and validated. Previously, the study did not explain the primary instruments used as a reference for developing new instruments. However, this study emphasizes that the basis is the theory of planned behavior (TPB) (Mierzejewska *et al.*, 2020). The primary explanation for why this instrument was developed is because there have been many studies assessing nutritional knowledge in the general population but very few in pregnant women. Studies on pregnant women should consider specific recommendations such as avoidance of certain foods or additional caloric intake. The few available questionnaires are insufficient to evaluate practical knowledge about the quality and quantity of food intake, i.e., what to eat and what not to eat, according to official recommendations for pregnant women. Few studies address the theoretical aspects of knowledge, for example, dietary sources of certain nutrients and their role during pregnancy or health problems related to inadequate food intake by which microorganisms can cause infection (Kennedy *et al.*, 2017; Suliga, Sobaś and Król, 2017; Papandreou *et al.*, 2019). The primary explanation for why this instrument was developed is because there have been many studies assessing nutritional knowledge in the general population but very few in pregnant women.

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intake by which microorganisms can cause infection (Fernández-Ballart *et al.*, 2010). Therefore, testing the validity and developing a food questionnaire instrument for pregnant women in Canada is necessary.

The Project-level Women's Empowerment in Agriculture Index (pro-WEAI+HN) was developed and validated as a survey module designed to measure women's health and nutrition with several indicators. This module is designed to complement the core pro-WEAI, which diagnoses areas of empowerment, assesses the impact on women's empowerment in agricultural development projects, and focuses primarily on productive employment, particularly agricultural production. Pro-WEAI is an initial project as an instrument to measure women's health. However, no standard measures of women's empowerment focus specifically on nutritional outcomes, are validated in multiple contexts, and address life-cycle-specific health and nutrition needs. Without standardized and topic-specific measures, we are unable to determine whether and how nutrition-sensitive agricultural programs contribute to women's empowerment and whether women's empowerment, in turn, leads to the goals it seeks to achieve (Malapit *et al.*, 2019).

The Nutrition Literacy Assessment tool for Chinese pregnant women (NLAI-P) was developed to measure nutritional literacy in pregnant women in China. The basis for the development of NLAI-P is health literacy which is developed into nutrition literacy (Heckert *et al.*, 2022). In China, pregnant women are still faced with various problems related to nutrition, including inadequate consumption of multiple nutrients, chronically low calcium and vitamin D intake, anemia, vitamin A and vitamin D deficiency, gestational obesity, gestational hypertension, and gestational diabetes mellitus (Jiang *et al.*, 2018; Zhou *et al.*, 2022). In China, pregnant women are still faced with various problems related to nutrition, including inadequate consumption of multiple nutrients, chronically low calcium and vitamin D intake, anemia, vitamin A and vitamin D deficiency, gestational obesity, gestational hypertension, and gestational diabetes mellitus (Gibbs *et al.*, 2016). Therefore, increasing maternal NL during pregnancy is essential to improving maternal health.

The instrument in this study has yet to be given a name but is described in detail. The aim is to measure the factors that influence salt intake behavior in Iranian women responsible for preparing and cooking food in the household (Chenary *et al.*, 2020). The basis for the development of the instrument previously did not exist, but it was explained that it was developed based on the theory of planned behavior (TPB) (Li *et al.*, 2020) (Ipjian and Johnston, 2017). Considering various aspects of salt intake and developing a short scale to assess the psychosocial determinants of salt intake in society can contribute to a better understanding of this behavior and evaluate related interventions. Like many other countries, Iranian women are primarily responsible for cooking at home. Studies with website-based research instruments, applications, or questionnaires are part of research and development research (Hettenhausen, 2011). There are four stages in development research. Four of the six studies studied above are included in level three, namely, developing from previous instruments. In comparison, two studies are included in level four, namely, creating new products that have never existed.

Figure 2. Research and Development Level (Sugiyono, 2020)

Three studies explain the steps for developing the instrument: the Chinese version of the Intention to Eat Low-GI foods questionnaire (CIELQ), the NLAI-P, and an instrument that measures salt intake behavior in Iranian women.

An interesting fact in developing CIELQ

is that there is cross-cultural adaptation. The instrument was initially based in Canada, so it needed to be adapted to the Chinese population due to cultural and linguistic differences. The aim is to make the application to women in China easier to accept and to be able to map the expected data requirements (Watanabe *et al.*, 2015).

The NLAI-P was developed in two phases: Phase 1 establishes NL core items for pregnant women; Phase 2 is carried out to develop, validate, and apply the NLAI-P. The salt behavior instrument is described in three steps, namely Step 1, Item generation; Step 2, Evaluate the content and face validity; Step 3: Evaluate the scale. The three studies above explain the method used to develop this questionnaire-based instrument. The four studies could have described the technique and flow of their preparation in detail. Each study has a specific test in terms of validity and reliability. However, Confirmatory factor analysis (CFA) was used in the five studies to test construct validity and to determine whether the indicators that have been grouped based on their latent variables (constructs) are consistent in the build. One study did not use CFA but used Spearman's rank test and Pearson product-moment to describe the instrument's validity (Merino-Godoy *et al.*, 2022). Other types of validity tests used besides CFA are intra-class correlation coefficient (ICC) for reliability analysis, The Kaiser-Meyer-Olkin (KMO) and Bartlett's test of specify to see an adequate sample, Exploratory factor analysis (EFA), The Kaiser-Meyer-Olkin (KMO) was used to evaluate the relationship structure between possible items, RMSE (root mean square error approximation)

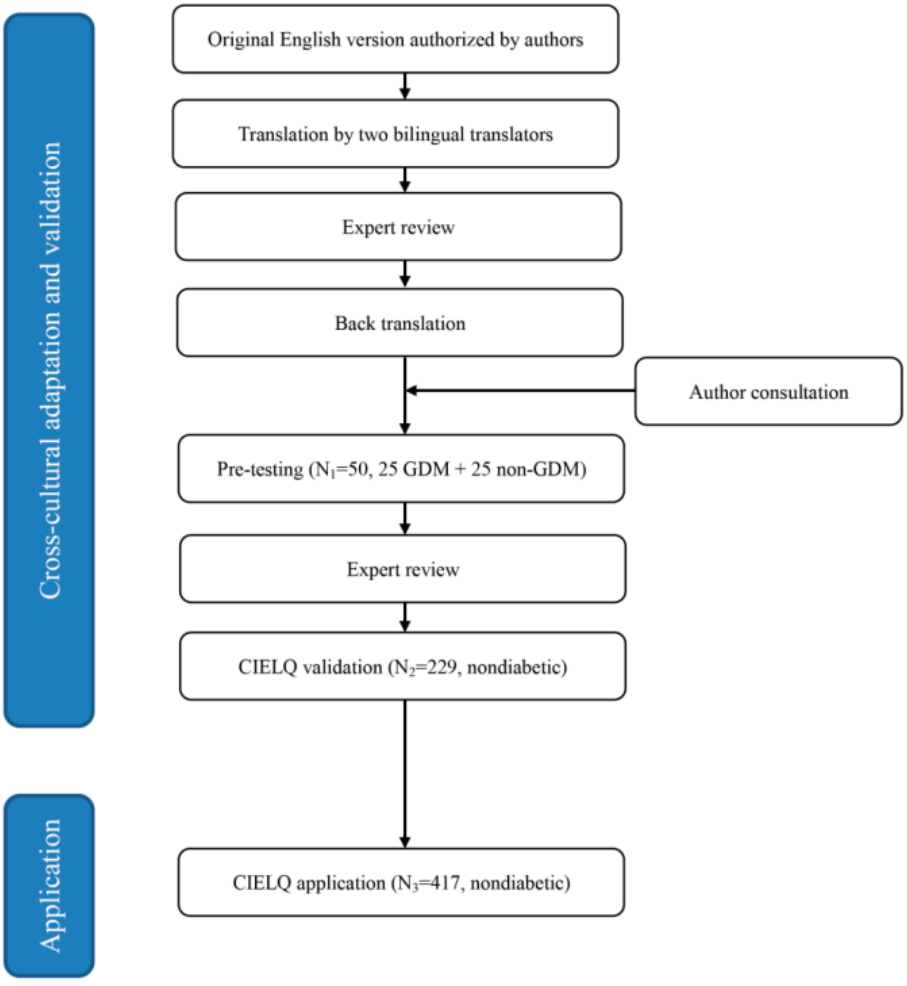

Figure 3. Flow Chart of Cross-Cultural Adaptation and Application in CIELQ Developing (Li *et al.*, 2020)

Table 1. Overview Bibliography, Research Settings/Methods, Participants, Instruments, Content/Domains/Variables, and Statistical Tests

Author and year	Title	Setting	Participant	Instrument	Content/domain/ variables	Statistic test
Li M, Li F, Lin Q, Shi J, Luo J, Long Q et al., 2020 (Li et al., 2020)	Cultural Adaptation, Validation, and Primary Application of a Questionnaire to Assess Intentions to Eat Low-Glycemic Index Foods among Rural Chinese Women	Cross cultural adaptation dan aplikasi instrumen	465 non-diabetic rural women, pregnant women with no history of diabetes in China	A Chinese version of the Intention to Eat Low-GI Foods Questionnaire (CIELQ)	26 items consisting of 7 factors, namely knowledge, instrumental attitude, descriptive attitude, subjective norms, descriptive norms, PBC, and behavioral intention	Intra-class correlation coefficient (ICC) for reliability analysis The Kaiser-Meyer-Olkin (KMO) and Bartlett's test of specify to see if the sample is adequate CFA and SEM for validity
Mierzejewska E, Honorato-Rzeszewicz T, Świątkowska D, Jurczak-Czaplicka M, Maciejewski T, Fijałkowska A et al., 2020 (Mierzejewska et al., 2020)	Evaluation of questionnaire as an instrument to measure the level of nutritional and weight gain knowledge in pregnant women in Poland. A pilot study		50 pregnant women from trimesters 1,2,3 in 3 women and children hospitals	Not yet given a name but adopted from research respondents	Weight gain, the importance of nutrients, quality, and quantity of food intake, which are described in 33 questions	One nutritionist, 1 public health expert, and one dietitian carried out content validity. Exploratory factor analysis (EFA) was used to determine the underlying structure of the ques The Kaiser-Meyer-Olkin (KMO) to evaluate the structure of possible relationships between items Reliability checked by Cronbach's Alpha

Author and year	Title	Setting	Participant	Instrument	Content/domain/ variables	Statistic test
Juton C, Castro-barquero S, Casas R, Freitas T, Ruiz-león AM, Crovetto F et al., 2021 (Juton et al., 2021)	Reliability and Concurrent and Construct Validity of a Food Frequency Questionnaire for Pregnant Women at High Risk to Develop Fetal Growth Restriction	Developed questionnaire	150 pregnant women with a high risk of giving birth to babies with growth restriction (fetal growth restriction)	Improving Mothers for Better Prenatal Care trial Barcelona (IMPACT BCN)	Food group: cereals, legumes, vegetables, fruits, nuts, dairy products, fish, meat, processed meat, olive oil, animal fat, baked goods Nutrients: energy, carbohydrates, proteins, fat, saturated FA, monosaturated FA, Cholesterol, Fiber, Potassium, Calcium, Vitamin C, Vitamin A, Vitamin E, Niacin, Folic Acid, Vitamin B12	Validity using Spearman's rank test, Pearson product-moment, Linear regression models
Savari M, Sheykhi H, Shokati Amghani M, 2020 (Savari, Sheykhi and Shokati Amghani, 2020)	Development and validation of a health and nutrition module for the project-level Women's Empowerment in Agriculture Index (pro-WEAI+HN)	Development of the questionnaire	Twelve thousand one hundred fourteen women from the age of 16 in Bangladesh were included in the GAAP project (ANGeL = 3917, FAARM = 287, Grameen = 380, SELEVER = 1777, TRAIN = 5039, WorldVeg = 714).	Project-level Women's Empowerment in Agriculture Index (pro-WEAI+HN)	Decides on own health and diet Decides on own health and diet during pregnancy Decides on child's diet Diceides on weaning and breastfeeding Decides to seek healthcare	Exploratory factor analysis (EFA) to measure the dimensions/ grouping of variables in a questionnaire Confirmatory factor analysis (CFA) to test whether the indicators that have been grouped based on the latent variable (the construct) are consistent in the build or not RMSE (root mean square error approximation) and CFI (comparative fit index) measure the level of acceptance of the model

Author and year	Title	Setting	Participant	Instrument	Content/domain/ variables	Statistic test
Zhou Y, Lyu Y, Zhao R, Shi H, Ye W, Wen Z et al., 2022 (Zhou et al., 2022)	Development and Validation of Nutrition Literacy Assessment Instrument for Chinese Pregnant Women	Phase 1 of the establishment of NL core items for pregnant women. Phase 2 is carried out for the development, validation, and application of the NLAI-P	699 pregnant women in China	Nutrition Literacy Assessment Instrument for pregnant women in China (NLAI-P)	Basic knowledge and ideas (basic nutrition concept, food and nutrition knowledge, nutrition and disease knowledge, lifestyles, Lifestyles and dietary behavior (dietary behavior, preparation for breastfeeding, gestational weight management, gestational disease management) Basic skill (judgment of nutrition information, and nutrition decision-making; acquisition, understanding, and application of nutrition information)	Explanatory factor analysis (EFA) and Confirmatory factor analysis (CFA) were used to evaluate construct validity. Cronbach's alpha and split-half reliability are used to measure reliability
Chenary R, Karimi-Shahanjarini A, Bashirian S, Roshanaei G, Fazaeli AA,	Developing and Testing an Instrument to Measure the Factors Affecting the Salt Restriction Behaviors among Women	A mixed method study Step 1: Item generation Step 2: Evaluate the content and face validity Step 3: Evaluating the scale	300 married woman	Unnamed but developing and based on a new theory of planned behavior (TBP)	Behavioral belief Outcome evaluation Normative belief Motivation to comply Control belief Perceived power Intention	KMO and Bartlett's values were performed to evaluate the adequacy of the sample size and the roundness of the relationship Confirmatory factor analysis to test construct validity Chronbach alpha for reliability test

and CFI (comparative fit index) measure the level of acceptance of the model.

The validity performed includes content and construct validity. Content validity relates to whether the statement items (items) arranged in a questionnaire or test cover all the material to be measured. This validity relates to whether the statement items (items) organized in a questionnaire or test cover all the material to be measured. This validity relates to whether the research tools have been prepared based on an appropriate and relevant theoretical construct. Questionnaires with high construct validity are always based on definitions or limitations of experts on the concept, not on dictionary/theory definitions. The instrument development study in Poland explained in detail who was involved in the content validity test, including content validity conducted by one nutritionist, one public health expert, and one dietitian (Mierzejewska *et al.*, 2020; Juton *et al.*, 2021).

In all studies, Cronbach's alpha test was found to test reliability. But the same as the CFA, other tests complement the Cronbach alpha test in the research studied. The main objective of the research instrument reliability test is to measure the consistency of the measuring instruments used by quantitative researchers. Reliability is used to determine accuracy in the measurement results for the same sample at different times. In other words, a research instrument, such as a questionnaire, is declared reliable if the instrument can provide consistent scores on each measurement. Thus, these measurement tools (items of statements/ questions) still provide consistent measurement results at different times. In quantitative research, there are two common ways used by many researchers to determine the level of reliability: (1) Test-retest reliability and (2) internal consistency test (Gaete *et al.*, 2021).

Conclusion

Based on keywords chosen to get relevant studies, 6 out of 95 articles were selected after passing the PRISMA stage. Two of the six studies reviewed have yet to name the instruments being developed. The naming of the instrument produced in a study indicates the objective or target variable to be obtained from the participants who use it. The statistical test used in developing the questionnaire instrument is confirmatory factor analysis (CFA) to test construct validity. Meanwhile, Cronbach's alpha is still the first choice for reliability testing. Nutritional instruments to prevent stunting in women have yet to be developed, but to develop these instruments one can adopt the development flow from the results of this literature review.

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