Research Open

Endocrinology, Diabetes and Metabolism Journal

Volume 10 Issue 4

Research Article

Content Validation of a Colour-Coded Glycemic Index Food Wheel for Diabetes Dietary Education: A Cross-Sectional Study of Physician and Dietitian Consensus

Ashwin Karuppan V[1]*, Aafrin Shabbir[1], Hariharan Sukumaran[2], Deepika Ganesh[2] and Shoba SP[2]

[1]Senior Consultant, Tambaram Medical Center and Hospital

[2]Clinical Research, Tambaram Medical Center and Hospital

Corresponding author: Dr Ashwin Karuppan V, Senior Consultant, Tambaram Medical Center and Hospital, Orcid: https://orcid.org/0000-0003-1370-8932

Received: October 08, 2026; **Accepted:** October 15, 2026; **Published:** October 20, 2026

Abstract

Aim and Background: Colour-coded, hand-portion visual tools are increasingly used to translate glycemic index (GI) science into bedside dietary counselling, yet few such tools developed for Indian food habits have undergone formal content validation. This study evaluated the content validity of a newly developed Glycemic Wheel, a circular colour-coded educational aid that classifies commonly consumed South Indian foods by GI category and expresses portions using household hand-based measures, among a multidisciplinary panel of physicians and dietitians.

Methods: In this cross-sectional expert-panel validation study, 161 experts (61 physicians holding an MD in General Medicine and 100 dietitians holding a B.Sc. or M.Sc. in Clinical Nutrition and Dietetics) independently rated the relevance of 27 items across six content domains (Food Selection, Glycemic Index Classification, Portion Size Information, Visual Organization, Clinical Utility, and Overall Assessment) on a four-point ordinal scale. Item-level (I-CVI) and scale-level (S-CVI/Ave and S-CVI/UA) content validity indices were computed following established psychometric conventions.

Results: All 27 items exceeded the recommended I-CVI acceptability threshold of 0.78, with values ranging from 0.851 to 0.932. Domain-wise I-CVI ranges were: Food Selection 0.870-0.913; Glycemic Index Classification 0.907-0.932; Portion Size Information 0.851-0.913; Visual Organization 0.851-0.925; Clinical Utility 0.876-0.913; and Overall Assessment 0.882-0.913. The overall Scale-Level Content Validity Index by the averaging method (S-CVI/Ave) was 0.897, and the Scale-Level Content Validity Index by universal agreement (S-CVI/UA) was 0, a pattern consistent with the size of the expert panel.

Conclusion: The Glycemic Wheel demonstrated good-to-excellent item-level content validity and good scale-level content validity across a large, multidisciplinary panel of physicians and dietitians, supporting its scientific and educational adequacy as a diabetes dietary counselling aid before pilot implementation.

Clinical Significance: A content-validated, regionally tailored GI wheel offers clinicians and dietitians a standardized, low-cost adjunct for point-of-care dietary counselling, particularly valuable in high-volume outpatient settings where dietitian access is limited and rapid, visually anchored patient communication is required.

Keywords: *Glycemic index, Diabetes mellitus, Type 2, Patient education, Content validity, Expert panel, Visual aids, Dietary counselling; India*

Introduction

Diabetes has become one of the defining public health challenges in India. The 11th edition of the International Diabetes Federation (IDF) Diabetes Atlas estimates that India was home to roughly 89.8 million adults living with diabetes in 2024, second globally only to China, with age-standardised prevalence projected to rise further by 2050 [1]. Complementing this global estimate, the ICMR-INDIAB national cross-sectional study confirmed wide inter-state variation in diabetes prevalence across the country, with several southern states, including Tamil Nadu, already in an advanced stage of the epidemiological transition [2]. Nutrition therapy sits at the centre of managing this burden, and within nutrition therapy, the glycemic index (GI) has remained one of the most enduring, if imperfectly applied, tools available to clinicians and dietitians.

The Glycemic Index as a Clinical Nutrition Tool

The GI concept, first described by Jenkins and colleagues in 1981, ranks carbohydrate-containing foods according to their postprandial glycaemic response relative to a reference food [3]. Foods are conventionally grouped as low, moderate, or high GI, and this classification has since been incorporated into major nutrition therapy guidance for diabetes, including the American Diabetes Association (ADA) consensus report on medical nutrition therapy, which recognises glycemic index and glycemic load as adjuncts to overall carbohydrate quality assessment [4,5]. The World Health Organization and Food and Agriculture Organization joint expert consultation on diet and chronic disease prevention similarly identifies the quality, not merely the quantity, of dietary carbohydrate as relevant to metabolic risk [6].

From Numbers to Practice: The Communication Gap

Despite this evidence base, GI values are typically published as long numerical tables that are poorly suited to a busy outpatient consultation. Two barriers compound the problem. First, health literacy and numeracy vary widely among patients with diabetes, and the literature consistently links limited health literacy to poorer self-management, higher hospitalisation, and worse glycaemic outcomes [7]. Second, even accurate portion instructions are of little use if patients cannot translate them into an actual plateful of food; household measuring tools are frequently unavailable in the home, whereas hands are always present. A validation study using finger width, fist, and palm measurements found that hand-based portion estimation performed comparably to conventional household measures such as cups and spoons across a range of solid and liquid foods, supporting hands as a practical, low-literacy-friendly portion cue [8].

Visual Communication in Diabetes Education

Pictures and colour-coded visual schema have a demonstrated advantage over text-only patient materials. A widely cited review by Houts and colleagues found that pictures closely linked to text improve attention, comprehension, and recall of health information, with the largest gains observed among patients with limited literacy [9]. This body of evidence has motivated the development of pictogram- and colour-based diabetes education tools internationally, and underlies the rationale for wheel- or plate-based visual formats that condense a complex nutrition message into a single glance.

Regional Food Specificity

GI values are not interchangeable across food cultures. South Indian meals are structured around rice, fermented cereal-legume preparations, and a distinct repertoire of vegetables, pulses, and snacks whose glycaemic behaviour differs from Western reference foods. Population-based work from Chennai has shown that dietary carbohydrate quality and glycemic load are independently associated with both HDL-cholesterol and incident type 2 diabetes among urban South Indian adults, reinforcing the clinical relevance of food-specific GI classification in this population [10,11]. The ICMR-National Institute of Nutrition Dietary Guidelines for Indians likewise emphasise portion-appropriate, regionally grounded dietary counselling as a cornerstone of non-communicable disease prevention [12].

Development of the Glycemic Wheel

Against this background, our team developed the Glycemic Wheel, a circular, colour-coded educational aid intended for use at the point of care during diabetes dietary counselling and structured diabetes self-management education and support (DSME/S) sessions [13]. The Wheel organises commonly consumed South Indian foods into six food groups — grains and cereals, pulses and legumes, vegetables, fruits, milk and milk products, and snack foods — and assigns each item a Low, Moderate, or High GI classification using a green-amber-red colour scheme. Alongside each food, the Wheel depicts an appropriate serving size expressed in familiar Indian household hand-based measures, such as a closed fist or a cupped palm, so that the visual portion cue and the glycaemic message are presented together rather than as separate pieces of information the patient must mentally combine. The tool is designed to be used interactively by a physician or dietitian during a brief counselling encounter, functioning as a shared reference point rather than a document to be read independently.

To our knowledge, no previously published South Indian food-specific GI wheel has combined colour-coded GI classification with hand-based portion cues in a single point-of-care format, and the tool required systematic evaluation before wider deployment across our clinical network. Content validity, the extent to which the items of an instrument adequately represent the construct they are intended to measure, is the recommended first step in the validation of any new clinical or educational instrument, and is typically established through structured, quantified expert judgement rather than through statistical inference alone [14-16].

The aim of this study was therefore to establish the content validity of the Glycemic Wheel among a large, multidisciplinary panel of physicians and dietitians, and to quantify item-level and scale-level content validity indices across the instrument's six content domains, together with the clinical implications of the findings for each domain.

Materials and Methods

Study Design

This was a cross-sectional, expert-panel content validation study conducted to establish the content validity of the Glycemic Wheel prior to pilot implementation. The validation followed established recommendations for the systematic, quantitative appraisal of instrument content by content experts [14-18].

Description of the Instrument and Content Domains

The Glycemic Wheel rating instrument comprised 27 items distributed across six pre-specified content domains reflecting the structural components of the tool: (A) Food Selection Appropriateness (6 items), evaluating whether the grain/cereal, pulse/legume, vegetable, fruit, milk product, and snack food items included represent commonly consumed South Indian foods; (B) Glycemic Index Classification Accuracy (4 items), evaluating the correctness and appropriateness of the Low/Moderate/High GI classification and cut-offs; (C) Portion Size Information (3 items), evaluating the appropriateness, comprehensibility, and clinical usefulness of the hand-based household portion cues; (D) Visual Organization (5 items), evaluating colour-coding, food grouping logic, wheel layout, and text/font readability; (E) Clinical Utility (5 items), evaluating suitability of the Wheel for routine counselling, patient food-choice improvement, and use in Type 2 diabetes and community education; and (F) Overall Assessment (4 items), evaluating global scientific content, educational value, design quality, and readiness for clinical implementation.

Expert Panel Selection

Content validation was performed through structured expert review, consistent with recommended practice for selecting and using content experts in instrument development [19]. The panel comprised two professional categories: physicians holding an MD in General

Medicine with clinical experience in diabetes care, and dietitians holding a B.Sc. or M.Sc. in Clinical Nutrition and Dietetics. Experts were drawn from clinical and nutrition practice settings across Tamil Nadu, South India, to ensure ratings reflected real-world familiarity with the regional foods depicted on the Wheel.

Validation Materials and Process

Each expert received the complete Glycemic Wheel, a structured 27-item rating sheet organised by the six content domains, and written instructions describing the objective of the exercise and the item-rating procedure. Experts rated each item independently to minimise anchoring or social-desirability bias between raters.

Item Rating Scale

Item relevance was rated on a four-point ordinal scale (1 = not relevant, 2 = somewhat relevant, 3 = relevant, 4 = highly relevant), consistent with standard content validity index methodology [14,16].

Content Validity Index Calculation

The Item-Level Content Validity Index (I-CVI) was calculated for each item as the proportion of experts who rated the item as either relevant or highly relevant (a rating of 3 or 4), divided by the total number of experts [14,16]. Consistent with the widely cited recommendation of Polit, Beck, and Owen, an I-CVI of 0.78 or higher, in a panel of six or more experts, was taken as evidence of acceptable item-level content validity [17,18].

The Scale-Level Content Validity Index by the averaging method (S-CVI/Ave) was calculated as the mean of all I-CVI values across the 27 items, with a value of 0.90 or higher conventionally interpreted as excellent scale-level content validity and 0.80 or higher as the minimum acceptable threshold [14,17,18]. The Scale-Level Content Validity Index by universal agreement (S-CVI/UA) was calculated as the proportion of items rated 3 or 4 by every expert on the panel; Polit and Beck have cautioned that the universal-agreement method becomes progressively more conservative, and less informative, as panel size increases, and recommend the averaging method as the more meaningful metric for larger panels [17].

Statistical Analysis

Content validity analysis was descriptive. Item-level and domain-level I-CVI values, together with the overall S-CVI/Ave and S-CVI/UA, were calculated from the raw expert ratings using standard spreadsheet-based computation and are presented in tabular form. Panel demographic characteristics are summarised as counts, percentages, means, and ranges.

Ethical Considerations

As this phase of the study involved the professional judgement of expert reviewers rather than patient-level data, it did not require formal ethics committee approval under standard institutional practice for instrument content validation. Expert participation was voluntary, and all individual responses were anonymised prior to analysis.

Results

Expert Panel Composition

A total of 161 experts completed item-level ratings for the Glycemic Wheel: 61 physicians (37.9%) holding an MD in General Medicine, and 100 dietitians (62.1%), of whom 56 held an M.Sc. in Clinical Nutrition and Dietetics and 44 held a B.Sc. in Nutrition and Dietetics. Physicians had a mean of 17.7 years of professional experience (range 5-30 years), and dietitians had a mean of 9.1 years (range 1-20 years); across the full panel, mean experience was 12.4 years (range 1-30 years) (Table 1).

Item-Level Content Validity by Domain

All 27 items exceeded the recommended I-CVI acceptability threshold of 0.78 [17,18], with item-level values ranging from 0.851 to 0.932 across the full instrument. Domain-wise results, together with their clinical importance, are summarised in Table 2 and described below.

Table 1: Composition of the expert panel.

Category	N (%)	Qualification	Mean Years Experience (Range)
Physicians	61 (37.9%)	MD (General Medicine)	17.7 (5–30)
Dietitians	100 (62.1%)	M.Sc. Clinical Nutrition & Dietetics (n=56); B.Sc. Nutrition & Dietetics (n=44)	9.1 (1–20)
Overall Panel	**161 (100%)**	—	**12.4 (1–30)**

Abbreviations: MD, Doctor of Medicine; M.Sc., Master of Science; B.Sc., Bachelor of Science.

Table 2: Item-level content validity index by domain.

Domain	Items	I-CVI Range	Domain Mean I-CVI	Interpretation
A. Food Selection Appropriateness	6	0.870–0.913	0.892	All items acceptable
B. Glycemic Index Classification Accuracy	4	0.907–0.932	0.921	Highest domain; excellent relevance
C. Portion Size Information	3	0.851–0.913	0.890	Acceptable; lowest-scoring domain
D. Visual Organization	5	0.851–0.925	0.891	Acceptable; readability flagged
E. Clinical Utility	5	0.876–0.913	0.897	Excellent item relevance
F. Overall Assessment	4	0.882–0.913	0.896	Excellent item relevance
Overall Scale (27 items)	**27**	**0.851–0.932**	**S-CVI/Ave = 0.897**	**Good scale-level content validity**

Abbreviations: I-CVI, Item-Level Content Validity Index; S-CVI/Ave, Scale-Level Content Validity Index (averaging method). Interpretation follows the threshold of I-CVI ≥ 0.78 for acceptable item-level content validity in panels of six or more experts [17,18].

Domain A — Food Selection Appropriateness (I-CVI range 0.870-0.913)

All six items evaluating the grain/cereal, pulse/legume, vegetable, fruit, milk product, and snack food selections met the acceptability threshold, with milk and milk product selection recording the domain's lowest value (0.870, Q5) and pulse/legume selection its highest (0.913, Q2). Clinically, this domain determines whether patients recognise their own everyday foods on the Wheel; strong agreement here supports the ecological validity of the tool's food repertoire for South Indian dietary patterns.

Domain B — Glycemic Index Classification Accuracy (I-CVI range 0.907-0.932)

This domain recorded the highest agreement of any domain in the instrument, with the correctness of the Low/Moderate/High classification (Q7, I-CVI 0.932) and the appropriateness of the GI cut-off ranges used (Q9, I-CVI 0.932) both among the two highest-rated items overall. Because this domain represents the scientific backbone of the Wheel, this result provides reassurance that the classification scheme is unlikely to mislead counselling messages.

Domain C — Portion Size Information (I-CVI range 0.851-0.913)

Appropriateness of serving sizes for Indian adults (Q11) and comprehensibility of household measures (Q12) both scored 0.913, whereas clinical usefulness of portion sizes during counselling (Q13) scored 0.851, the lowest value in this domain and one of the three lowest item scores in the entire instrument. Portion communication is the step at which GI knowledge is translated into an actual plateful of food, so this comparatively lower, though still acceptable, agreement flags portion cueing as the component most likely to benefit from refinement before wider rollout.

Domain D — Visual Organization (I-CVI range 0.851-0.925)

Colour-coding usability (Q14, I-CVI 0.925) rated strongly, while the item assessing whether the wheel format facilitates quick food selection (Q17) and the item assessing text/font readability (Q18) both scored 0.851. Because the Wheel is intended for use within a brief outpatient encounter, layout speed and legibility directly affect whether the tool is actually usable at the point of care, making this the second domain, alongside portion size, meriting design attention.

Domain E — Clinical Utility (I-CVI range 0.876-0.913)

Items assessing suitability for community diabetes education (Q23) and improvement of patients' food choices (Q21) scored 0.913 and 0.907 respectively, while suitability for use during routine diabetes counselling (Q19) scored 0.876. This domain bridges the Wheel's design to its intended real-world function within DSME/S delivery, and its consistently acceptable scores support the tool's readiness for counselling-based use.

Domain F — Overall Assessment (I-CVI range 0.882-0.913)

Global judgements of overall design supporting effective dietary decision-making (Q26) and overall educational value (Q25) scored 0.913 and 0.907 respectively, while scientific content appropriateness (Q24) and implementation readiness (Q27) both scored 0.882. As a composite judgement domain, these results indicate that experts, having rated individual components, converged on a positive overall appraisal of the instrument (Table 2).

Scale-Level Content Validity

The overall Scale-Level Content Validity Index by the averaging method (S-CVI/Ave) across all 27 items was 0.897. This exceeds the minimum acceptable benchmark of 0.80 proposed by Davis, and approaches, though falls marginally short of, the more stringent 0.90 threshold that Polit and Beck describe as indicative of excellent scale-level content validity [14,17,18]. The Scale-Level Content Validity Index by universal agreement (S-CVI/UA) was 0, meaning that no single item achieved a rating of 3 or 4 from all 161 experts simultaneously. This finding is consistent with the well-documented behaviour of the universal-agreement method in large panels: as the number of raters increases arithmetically, the probability that every rater will independently select the top two response categories on every item falls sharply, which is why Polit and Beck caution against relying on S-CVI/UA once panels extend beyond a small handful of experts, and instead recommend the averaging method as the more interpretable index in panels of this size [17].

Discussion

This study establishes that the Glycemic Wheel, a colour-coded, hand-portion GI education tool developed for South Indian dietary patterns, possesses good-to-excellent item-level content validity and good scale-level content validity when appraised by a large, multidisciplinary panel of 161 physicians and dietitians. Every item cleared the 0.78 I-CVI acceptability threshold, and the overall S-CVI/Ave of 0.897 sits comfortably above the minimum acceptable benchmark for scale-level content validity, even though it falls just short of the more conservative 0.90 "excellent" cut-off [14,17,18].

Comparison with other recently validated diabetes education instruments helps contextualise this result. Liu and colleagues validated a simplified Chinese adaptation of the U.S. CDC Clear Communication Index using diabetes health-education materials and reported a substantially higher S-CVI/Ave of 0.976 [20]. However, their content-validity exercise was rated by only twelve multidisciplinary raters, compared with the 161 experts in the present study. This contrast illustrates a point already noted in the CVI methodology literature: content validity indices calculated by the averaging method tend to be numerically more forgiving with smaller panels, because a handful of concordant raters can drive the average close to 1.0, whereas a panel of over 150 independent raters is statistically far less likely to produce uniformly perfect agreement even when the underlying content is genuinely sound [17]. Viewed this way, an S-CVI/Ave of 0.897 across 161 raters may represent a comparably, or even more, rigorous demonstration of content adequacy than a nominally higher index computed from a much smaller panel.

A similar pattern is evident when the Glycemic Wheel is set against tools validated through different methodological paradigms altogether. Doucette and colleagues validated a pictogram-based

diabetes counselling tool against the American National Standards Institute benchmark of 85% correct comprehension rather than a relevance-based CVI, and reported that individual pictogram sets varied considerably in how well they met this bar, with several requiring revision after the first round of testing [21]. This underlines that content validity, as measured here, and comprehension validity, as measured by pictogram studies, are related but distinct properties; a tool can be judged scientifically and structurally sound by expert reviewers while still requiring separate testing of whether patients themselves correctly interpret it. The present study establishes the former; it does not, and was not designed to, establish the latter.

The Interactive Nutrition-Specific Physical Exam Competency Tool (INSPECT), validated by Zechariah and colleagues through a two-round Delphi process with 17 registered dietitian experts, achieved excellent internal consistency ($\alpha = 0.97$ and 0.96 across the two rounds) [22]. The iterative Delphi design allowed items to be revised and re-rated after the first round, a refinement opportunity that the present single-round rating exercise did not include. This represents a genuine methodological difference between the two studies rather than a weakness unique to either: a single-round design of the kind used here is more feasible at the scale of 161 raters, but it forfeits the chance to resolve borderline items, such as those in the Portion Size and Visual Organization domains, through a second round of expert feedback.

Two domains in the present study, Portion Size Information and Visual Organization, recorded the lowest item-level scores in the instrument (I-CVI as low as 0.851), even though both remained comfortably above the acceptability threshold. This pattern is plausible on clinical grounds. Hand-based portion estimation has been validated for a range of solid and liquid foods internationally [8], but South Indian meals frequently combine several food groups within a single dish, for example a mixed rice preparation or a stuffed flatbread, and translating a hand-portion cue to composite dishes of this kind is inherently more demanding than applying it to a single discrete food item. Likewise, because the Wheel compresses six food groups, three GI categories, and portion cues into one circular graphic, legibility and layout speed are under greater design pressure than in a linear, page-based education material; the marginally lower scores for text readability and rapid food selection are therefore a reasonable signal for iterative design refinement rather than a threat to the tool's underlying scientific content.

The multidisciplinary composition of the panel is a particular strength of this validation exercise. Many previously published diabetes education tools have been validated by single-discipline panels, whether physicians alone or dietitians alone; the pictogram tool described above, for instance, was developed and reviewed primarily within a pharmacy and diabetes-educator team [21], and even the INSPECT tool, despite its methodological rigour, drew its expert panel exclusively from registered dietitians [22]. By contrast, the present panel combined 61 physicians and 100 dietitians, and the domain-wise I-CVI values did not diverge in any way that would suggest systematic disagreement between the two professional groups, supporting the ecological validity of the Wheel across the two clinician types most likely to use it in practice.

This study has several limitations that should temper interpretation. First, the single-round rating design, discussed above, did not allow items to be revised and re-rated, unlike Delphi-based validation approaches [22]. Second, the expert panel was drawn from Tamil Nadu, and while this ensured strong familiarity with the specific South Indian foods depicted on the Wheel, it also means the findings may not generalise directly to regions of India with different staple foods and culinary practices without further region-specific validation. Third, and most importantly, content validity establishes only that expert reviewers consider the instrument's items relevant and representative; it does not, by itself, establish construct validity, test-retest reliability, or, critically, whether patients themselves can correctly interpret and act on the Wheel during a real counselling encounter. Patient-facing comprehension testing, analogous to the ANSI-based recall testing used in pictogram validation [21], together with pilot testing of glycaemic and dietary outcomes, represents the necessary next step before the Wheel can be recommended for large-scale clinical deployment.

Notwithstanding these limitations, the clinical and public-health rationale for a content-validated tool of this kind remains strong. Given the scale of India's diabetes burden [1,2] and the well-documented benefit of closely text-linked visual aids for patient comprehension and recall, particularly among patients with limited health literacy [7,9], a scientifically vetted, regionally grounded GI wheel offers a scalable, low-cost adjunct to structured diabetes self-management education and support [13]. Its value may be greatest in outpatient settings where dietitian consultation time is constrained and a rapid, visually anchored counselling aid can help standardise the core dietary message delivered by different members of the care team.

Conclusion

The Glycemic Wheel demonstrated good-to-excellent item-level content validity, with all 27 items exceeding the 0.78 acceptability threshold, and good scale-level content validity (S-CVI/Ave 0.897) when evaluated by a large, multidisciplinary panel of 161 physicians and dietitians. These findings support the scientific and structural adequacy of the instrument's food selection, glycemic classification, portion cueing, visual design, and clinical utility, and justify its advancement to pilot testing. Portion-size communication and visual layout emerged as the two domains most likely to benefit from targeted refinement. Future work should prioritise patient-facing comprehension testing, construct validity assessment, and evaluation of the Wheel's real-world impact on dietary choices and glycaemic outcomes across diverse Indian regions and care settings.

Clinical Significance

A content-validated Glycemic Wheel gives physicians and dietitians a standardized, scientifically vetted visual tool for communicating glycemic index and portion guidance within the time constraints of a routine outpatient encounter. By pairing colour-coded GI classification with intuitive hand-based portion cues, the tool is designed to reduce reliance on numerical GI tables that many patients find difficult to apply, and to help standardise the core dietary message delivered across different members of a diabetes care team. Once patient-facing

validation is complete, the Wheel may serve as a practical adjunct within diabetes self-management education and support programmes, particularly in high patient-volume Indian clinical settings where dedicated dietitian time is limited.

References

1. Genitsaridi I, Salpea P, Salim A, Sajjadi SF, Tomic D, James S, Thirunavukkarasu S, Issaka A, Chen L, Basit A, Luk AOY, Ma RCW, Mbanya JC, Ramachandran A, Wild SH, Duncan BB, Boyko EJ, Magliano DJ (2026) 11th edition of the IDF Diabetes Atlas: global, regional, and national diabetes prevalence estimates for 2024 and projections for 2050. *Lancet Diabetes Endocrinol*. [crossref]
2. Anjana RM, Unnikrishnan R, Deepa M, Pradeepa R, Tandon N, Das AK, Joshi S, Bajaj S, Jabbar PK, Das HK, Kumar A, Dhandhania VK, Bhansali A, Rao PV, Desai A, Kalra S, Gupta A, Lakshmy R, Madhu SV, Elangovan N, Chowdhury S, Venkatesan U, Subashini R, Kaur T, Dhaliwal RS, Mohan V; ICMR-INDIAB Collaborative Study Group (2023) Metabolic non-communicable disease health report of India: the ICMR-INDIAB national cross-sectional study (ICMR-INDIAB-17) *Lancet Diabetes Endocrinol*. [crossref]
3. Jenkins DJ, Wolever TM, Taylor RH, Barker H, Fielden H, Baldwin JM, Bowling AC, Newman HC, Jenkins AL, Goff DV (1981) Glycemic index of foods: a physiological basis for carbohydrate exchange. *Am J Clin Nutr*. [crossref]
4. Evert AB, Dennison M, Gardner CD, Garvey WT, Lau KHK, MacLeod J, Mitri J, Pereira RF, Rawlings K, Robinson S, Saslow L, Uelmen S, Urbanski PB, Yancy WS Jr (2019) Nutrition therapy for adults with diabetes or prediabetes: a consensus report. *Diabetes Care*. [crossref]
5. American Diabetes Association Professional Practice Committee (2024) Summary of revisions: standards of care in diabetes—2024. *Diabetes Care*. [crossref]
6. World Health Organization, Food and Agriculture Organization of the United Nations (2003) Diet, Nutrition and the Prevention of Chronic Diseases: Report of a Joint WHO/FAO Expert Consultation. WHO Technical Report Series No. 916. Geneva: *World Health Organization*. [crossref]
7. Berkman ND, Sheridan SL, Donahue KE, Halpern DJ, Crotty K (2011) Low health literacy and health outcomes: an updated systematic review. *Ann Intern Med*. [crossref]
8. Gibson AA, Hsu MSH, Rangan AM, Seimon RV, Lee CMY, Das A, Finch CH, Sainsbury A (2016) Accuracy of hands v. household measures as portion size estimation aids. *J Nutr Sci*. [crossref]
9. Houts PS, Doak CC, Doak LG, Loscalzo MJ (2006) The role of pictures in improving health communication: a review of research on attention, comprehension, recall, and adherence. *Patient Educ Couns*. [crossref]
10. Radhika G, Ganesan A, Sathya RM, Sudha V, Mohan V (2009) Dietary carbohydrates, glycemic load and serum high-density lipoprotein cholesterol concentrations among South Indian adults. *Eur J Clin Nutr*. [crossref]
11. Mohan V, Radhika G, Sathya RM, Tamil SR, Ganesan A, Sudha V (2009) Dietary carbohydrates, glycaemic load, food groups and newly detected type 2 diabetes among urban Asian Indian population in Chennai, India (Chennai Urban Rural Epidemiology Study 59) *Br J Nutr*. [crossref]
12. ICMR-National Institute of Nutrition (2024) Dietary Guidelines for Indians. Hyderabad: ICMR-National Institute of Nutrition
13. Powers MA, Bardsley J, Cypress M, Duker P, Funnell MM, Fischl AH, Maryniuk MD, Siminerio L, Vivian E (2015) Diabetes self-management education and support in type 2 diabetes: a joint position statement of the American Diabetes Association, the American Association of Diabetes Educators, and the Academy of Nutrition and Dietetics. *Diabetes Care*. [crossref]
14. Lynn MR (1986) Determination and quantification of content validity. *Nurs Res*. [crossref]
15. Davis LL (1992) Instrument review: getting the most from a panel of experts. *Appl Nurs Res*.
16. Polit DF, Beck CT (2006) The content validity index: are you sure you know what's being reported? Critique and recommendations. *Res Nurs Health*. [crossref]
17. Polit DF, Beck CT, Owen SV (2007) Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Res Nurs Health*. [crossref]
18. Yusoff MSB (2019) ABC of content validation and content validity index calculation. *Educ Med J*
19. Grant JS, Davis LL (1997) Selection and use of content experts for instrument development. *Res Nurs Health*. [crossref]
20. Liu L, Chen Y, Li X, Du H, Gui R, Jin H, Chen F, Lin Y, Huang Q, Tong Y (2026) Validation of the simplified Chinese Clear Communication Index using diabetes education materials: instrument adaptation and validation study. *J Med Internet Res*. [crossref]
21. Doucette D, Vaillancourt R, Berthenet M, Li LS, Pouliot A (2014) Validation of a pictogram-based diabetes education tool in counselling patients with type 2 diabetes. *Can Pharm J (Ott)* [crossref]
22. Zechariah S, Waller JL, De Leo G, Stallings J, Gess AJ, Lehman L (2021) Content and face validation of a novel, interactive nutrition specific physical exam competency tool (INSPECT) to evaluate registered dietitians' competence: a Delphi consensus from the United States. *Healthcare (Basel)* [crossref]
23. Almanasreh E, Moles R, Chen TF (2019) Evaluation of methods used for estimating content validity. *Res Social Adm Pharm*. [crossref]

Citation:

Karuppan VA, Shabbir A, Sukumaran H, Ganesh D, Shoba SP (2026) Content Validation of a Colour-Coded Glycemic Index Food Wheel for Diabetes Dietary Education: A Cross-Sectional Study of Physician and Dietitian Consensus.. *Endocrinol Diabetes Metab J* Volume 10(4): 1-6.