

Development and Validation of the Ayurvedic Nutritional Assessment Scale

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Research Article

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Abstract

Introduction

The bodies as well as the diseases are formed by the food; happiness and misery are dependent on the wholesome and unwholesome foods and hence an adequate nutritional level is an essential pillar for the well being. Before prescribing any form of dietary or lifestyle changes it is essential to understand the condition and requirement of the person, hence an assessment beforehand helps in better prescription.

The aim of the current study was to develop and validate a nutritional assessment scale , with an applicability in Ayurvedic facilities for research and clinical practice.

MATERIALS AND METHODS

The development and validation of the Ayurvedic nutritional assessment scale was done in 3 phases. First phase included literature review for item selection and consensus with experts, second phase tool development and validation and final phase the empirical evaluation was done in which the tool was applied in the field trial.

RESULTS

Total items in the questionnaire were 74 , the scale was found valid in content validity and construct validity and reliable for internal consistency

1. Introduction

An adequate nutritional level is an essential pillar for the well being. Various factors like the environment, lifestyle, mental and physical health etc affects the nutritional status both positively and negatively.

The bodies as well as the diseases are formed by the food; happiness and misery are dependent on the wholesome and unwholesome foods¹. Food has been mentioned as one of the pillars of human life or Trayopstambh², and also considered as the best sustainer of life (*Vrittikaranam Sreshtam*)³

Before prescribing any form of dietary or lifestyle changes it is essential to understand the condition and requirement of the person, hence an assessment beforehand helps in better prescription. A combination of factors like including physical, environmental , mental can result in impaired nutritional levels and thus hampering the overall well being⁴. Many screening tools, anthropometric measurements, biomarkers, and conditions have been proposed to identify people at nutritional risk. Three of the main screening tools devised are the Nutritional Risk Screening 2002 (NRS 2002)⁵ ([Kondrup 2003](#)), the Malnutrition Universal Screening Tool (MUST)⁶ ([Elia 2003](#)), the Mini Nutritional Assessment (MNA)⁷ ([Vellas 1999](#)). The Subjective Global Assessment (SGA)⁸ ([Detsky 1987](#)) is an assessment tool that aims at predicting clinical outcome⁹ ([Van Bokhorst 2014](#)). However , there is no such tool till now which can assess the nutritional status as a holistic manner considering the principles of Ayurveda. Subjective global

Assessment served as the basis for development of Ayurvedic nutritional assessment scale. SGA as such was not eligible to be used as a screening tool in Ayurveda due to various shortcomings like it does not captures the information regarding the basic Ayurvedic nutritional aspects like Agni . The Ayurvedic nutritional assessment scale is one of the first to be developed for Ayurvedic nutritional assessment.

Hence, the aim of the current study was to develop and validate a nutritional assessment scale , with an applicability in Ayurvedic facilities for research and clinical practice.

1.1 Need of the Study

The modern scales of assessment and screening of nutritional status are not in line with the Ayurvedic principles. Hence a scale with Ayurvedic principles considering the basics of Ayurvedic nutrition like Agni (Digestive fire), increase/decrease of Dosha and Dhatu is the need of the hour.

2. Materials And Methods

The development and validation of the Ayurvedic nutritional assessment scale was done in 3 phases. The phases are as follows - First phase , the preliminary phase included literature review for item selection and consensus with experts , academicians and clinicians . In the second phase tool development and validation was done , this phase included identification of the domains and framing questions and sub-questions for the assessment of the each domain. Second phase also included selection of type of response and pre- testing of the questionnaire with expert evaluation (Face validity) and raters reviewed all the questionnaire items for readability, clarity and comprehensiveness and come to some level of agreement as to which items should be included in the final questionnaire (Content validity) . Then the reliability assessment was done for internal consistency and split half reliability after which the items were revised. In the final phase the empirical evaluation was done in which the tool was applied in the field trial . Sample size was calculated based on the rule of minimum. After that the tool was tested for construct validity. The study was conducted at All India Institute of Ayurveda and the ethical permission was provided by the the institutional ethical committee of All India Institute of Ayurveda. Study was also registered in CTRI (REF/2018/02/017458)

2.1 PHASE I- Preliminary phase

2.1.1 Literature review for the “ Ayurvedic Nutritional Assessment Scale”

ANA Scale has three 4 main sections namely Agni assessment , anthropometric assessment ,Dhatu kshaya vruddhi assessment and dietetic rules compliance assessment.

In section 1 for Agni assessment the Agni is assessed based on the Anna Abhilasha (Appetite) , Abhyavaran Shakti (ability of food intake) and Jaaran Shakti (Digestive capability) questions/ items were taken on the basis of Agni mentioned in Charak Samhita¹⁰ and Jaran Lakshana as mentioned in

Vagbhatta¹¹ , For second section all the symptoms of Dhatu Kshaya and Vruddhi were taken from Charak Samhita¹² and Sushruta Samhita¹³. The anthropometric assessment was based on modern parameters of assessing nutritional status, anthropometric methods include weight, height, body mass index (BMI), fat folds, mid arm circumference, waist circumference and hip to waist ratio. Fourth section was planned to assess the compliance to dietetic rules based on the “Ashta aahar vidhi visheshayatana” as mentioned in Charak Samhita.

After the items in each section were collected, items were arranged in a sequence and sent for experts review.

2.2 PHASE -

2.2.1 Generation of items, domains and questions

The questionnaire consists of all the parameters that reflects and affects the nutritional status as per Ayurveda. There are 4 domains in the questionnaire. There are total 77 questions in total : Anthropometric- 05, Agni- 04, Dhatu Kshaya and Vruddhi (59) - Rasa - 14, Rakta- 05, Mamsa- 05, Meda- 11, Asthi -06 , Majja- 02 , Shukra- 06, Artava- 06, Oja- 04 and dietetic rules compliance - 09 (Table 1)

2.2.2 Selection of Type of response, response scale and Scoring

The scoring of section 1 was done based on the range of the anthropometric measurements reflecting the normal and abnormal status. In the section 2 and 3 scoring was based on the likert’s scale ranging from 0 to 3; 0 being no complaint and 3 being severe complaint or symptom. In the section 4 , 0 meant no compliance and 3 meant good compliance. The Dhatu scores are calculated by subtracting the vruddhi score from the Kshaya score for example if the patient has Rasa kshaya score 5 and vruddhi score as 3 then the total score for Rasa will be 2 in favour of Kshaya. The final scoring of the questionnaire is based on the score in each component like as Agni component, Rasa component , Rakta component etc.

This type of scoring helps the assessor to identify the Dhatu involved and whether the intervention is to cure the kshaya or the vruddhi. The lower the Dhatu score the better the nutritional status.

Table 1- showing No. Of items taken for each section

Section	Subsection	Number of question
Anthropometry	-	5
Agni	-	4
Dhatu Kshaya & vruddhi assessment	09 (Rasa, Rakta, Mamsa, Meda, Asthi , Majja, Shukra , Artava, Oja)	56
Dietetic rules	-	9

2.2.3 Content validity

The items were arranged in a sequence and were sent to 10 experts for readability, clarity and comprehensiveness and come to some level of agreement . For testing the content validity average congruency percentage (ACP) (Popham,1978) and content validity index was calculated (CVI) (Martuza ,1977) . The panels of content experts were asked to review the relevance and suitability of the dependable parameter of each question on a 5- point likert scale (1-strongly agree, 2-agree, 3-Neutral, 4-Disagree, 5-Strongly disagree) for the calculation of CVI. For each question response 1,2,3 was considered as relevant and 4,5 were considered irrelevant and then the proportion was calculated.

2.2.4 Internal Consistency

It is defined as the ability of an instrument to create reproducible results. It is based on the correlations between different items in the same test. Internal consistency was tested using Crohnbach's coefficient Alpha and equivalence was tested using split half reliability. The final questionnaire was administered to 250 subjects to test the reliability.

3. Phase II- Empirical Evaluation

3.1 Factor Analysis - Construct validity

It is used to identify the factors or dimensions into which the larger number of variables can be reduced¹⁴. The Kaiser-Meyer-Olkin (KMO) test for sampling adequacy was applied to examine the adequacy of the sample size taken for factor analysis. Factor analysis was done in two stages exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). There were total 250 participants in the EFA and 100 participants in CFA with response rate of 100%, It was done using SPSS 2016. The sample size was calculated using the minimum sample size rule ¹⁵

3.2 Study and administration of the questionnaire

The study consisted of 3 different analysis for which total sample size was 600(reliability -250, EFA-250 and CFA- 100) . The participants were both genders living in and around Delhi NCR. The participant characteristics is given in Table 2.

3.3 Execution of the test

Consent was read to the patients in the language of their preference (Hindi or English) explaining the rationale and the importance of the study. The questionnaire also collects the basic demographic details of the participants

4. Results

4.1 Design

The questionnaire was prepared using the statements and references from the Ayurveda classics and other relevant sources. Currently the questionnaire is for interview purpose hence available in English language only.

4.2 Content validity

The format for the content validation was sent to 10 experts of Ayurveda , response rate was 60%. ACP (Average congruency percentage) was found to be 91.5% , which is valid and appropriate.

For calculation of Content validity Index (CVI) scores , SPSS was used . I-CVI was calculated and items below 0.5 were to be removed , it was found to be >0.7 for all the items. Scale Content validity (S-CVI) - S-CVI/Uni 90% of the items achieved relevance rating by all the experts . S-CVI/Avg was calculated to be 0.82

4.3 Reliability

In the current study for reliability the internal consistency was tested and the homogeneity was tested using split half method. For internal consistency cronbach's coefficient alpha was calculated which was found to be .883 and cronbach's alpha based on the standardised items was 0.894. Scale is considered reliable if the value of alpha is above 0.7¹⁶. Table 2 shows the result from spss , for internal consistency

Table 2 - Showing results for internal consistency

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.883	.894	46

Cronbach's Alpha	Part 1	Value	.803
		N of Items	23 ^a
	Part 2	Value	.837
		N of Items	23 ^b
	Total N of Items		46
Correlation Between Forms			.602
Spearman-Brown Coefficient	Equal Length		.751
	Unequal Length		.751
Guttman Split-Half Coefficient			.748

a. The items are: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23.

b. The items are: 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46.

4.4 Construct validity

4.4.1 Exploratory factor analysis

Principal component analysis (PCA) was done in the Spss. After running the PCA, all the items showed commonalities above 0.3 and the total variance of 74.6% (above 60-70% is acceptable).

Further the values of component matrix were segregated. Components having correlation value above 0.3¹⁷ were retained and others were removed. 18 items were found to have value lower than 0.3

Sample Size

The sample size was calculated using the minimum sample size rule¹⁸. The most commonly used method for sample size is the rule of minimum according to which the minimum sample size should be 100 (Gorsuch, 1983 and Kline, 1979) and the ratio of variable to sample should be 5:1 (Bryant and Yarnold, 1995, David Garson, 2008). The sample size for EFA was 250 (table 3). Before running the PCA, Sample adequacy was tested by KMO and Bartlett's test (Table 4). Value between 0.8-0.5 is acceptable, our sample gave value of 0.588 and the approximate chi square and significance were adequate to proceed further for PCA.

Table 3- Showing Sample size information for EFA and CFA

	Total	Male	Female	p-value
Reliability	n1=250	140	110	0.001
EFA	n2= 250	115	135	0.001
CFA	n3= 100	76	24	0.014
Total Number of participants	N = 600	331	269	
Age (in Years)	Mean(SD)	Mean(SD)	Mean(SD)	P-value
Reliability	41.3(7.6)	38.2(7.6)	44.4(7.6)	0.001
EFA	35.7 (1.1)	41(1.1)	30.4(1.1)	
CFA	39.9(1.2)	36.4(1.2)	43.4(1.2)	

Table 4- Showing KMO and Bartlett's test for Sample adequacy EFA

KMO measure of sampling adequacy	.588
Bartlett's Test of Sphericity	
	1.170
Approx Chi square	2775
Degree of freedom	.000
Significance	

After principal component analysis 18 items found having low values in the component matrix were removed and then the PCA was run again . Total variance then found was 68% which was acceptable to move further for CFA

4.4.2 Confirmatory factor analysis

CFA was done using IBM SPSS AMOS 24. Results were as follows - $\chi^2 = 336.4$, χ^2/df 3.397, $p < 0.001$; comparative fit index (CFI)¹⁹ = 0.95;Incremental Fit index (IFI) = 0.562; Tucker Lewis index (TLI) = 0.247; Goodness of fit index (GFI) = 0.90; Root mean square error of approximation (RMSEA)²⁰= 0.221.

All the factors were found to be significant. Image 1 shows path diagram of CFA in AMOS-SPSS

Sample size

Sample size for confirmatory factor analysis was 100 based on the rule of minimum sample size. Before running the PCA, Sample adequacy was tested by KMO and Bartlett's test (Table 5) our sample gave value of 0.712

Table 5 - Showing KMO and Bartlett's test for Sample adequacy CFA

KMO measure of sampling adequacy	.714
Bartlett's Test of Sphericity	
Approx Chi square	6.261
Degree of freedom	1035
Significance	.000

5. Discussion

The sections/dimensions of the final Ayurvedic nutritional assessment scale were constructed similar to the initial concept for the development of tool. The first factor *Agni* consisted of four items reflecting the strength of the Agni- Avara, Madhyama and Pravara and the state of Dosha related with Agni like Samagni, Teekshnagni, Mandagni and the Vishamagni. These are the commonest character of *Agni* that affect the nutrition. It is said that all the diseases start from abdomen²¹ and that deranged state of Agni causes Kshaya (under nutrition) and Vrudhhi (Over . nutrition) in the body²² .

The second factor Anthropometry consisted of 5 items , these items reflects the condition of Mamsa and Meda Dhatu, items include - weight , height , mid arm circumference , waist to hip ratio and fat folds. These are the parameters which are frequently used for the anthropometric measurements in nutritional assessments.²³

The Clinical assessment or the sections related to the Dhatu Kshaya and Vruddhi included 56 items under under 9 headings - Rasa , Rakta , Mamsa, Meda, Asthi, Majja, Sukra, Artava and Oja. The questions were included in the form " *if you have experienced any of these symptoms in the past 4 weeks*" followed by the extent of the symptom in grading 0 to 3 (*0 (or leave blank) = No or Do not have symptom, symptom does not occur 1 = Yes or Minor or mild symptom , 2 = Moderate symptom, occurs occasionally, 3 = Severe symptom, frequently occurs*).

What we eat and how we eat decides what nutrients we will get when the food will be assimilated , hence the questionnaire includes , a section to assess the compliance to dietetic rules. This section includes 9 questions based on the rules mentioned in Charak Samhita ²⁴ . . Ayurvedic nutritional assessment scale is consistent with the criteria that 4-6 items are required to measure 1 factor ²⁵ for example items like dry skin, dry hair, palpitations on little efforts, tastelessness etc. were included for Rasa Kashaya. The variance of the items selected through EFA was 68% which satisfies the criterion of 60%²⁶. The

Cronbach's alpha of Ayurvedic nutritional assessment scale was good and the split half showed good result.

6. Conclusion

The developed scale has 4 sections and 77 items. The developed questionnaire appears to be acceptable tool for assessing the nutritional status. The nutritional status thus assessed can be used for further measured intervention based on Ayurvedic principles.

Declarations

Future scope Further inter-rater and test-retest could be done for measuring the ultimate reliability. Also the study can be performed on the larger sample

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Availability of data and materials - Central Library, All India Institute of Ayurveda,

Departmental Library, Department of Swasthavritta, All India Institute of Ayurveda

Competing interests- None

Authors' contributions - Dr. Mukta did the field work and collected the data , Dr. Shivakumar Harti reviewed the data , Both authors did the statistical work and wrote the manuscript

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