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Development And Psychometric Validation of Questionnaire to Assess Medovaha Srotas Dushti

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Abstract Background:
Medovaha Srotas is well known in Ayurvedic Literature for not just being a pathway through which meda dhatu (adipose tissue) gets transported and metabolized, but it also has significant role in the pathogenesis of obesity. When the vitiation takes place in these srotas that is Medovaha Srotas Dushti it indicates the pathogenesis of everything related to metabolism i.e., from obesity (sthoulya) to diabetes mellitus (Madhumeha) and dyslipidemia (Medoroga). Currently, Ayurvedic parameters are not standardized to diagnose Medovaha Srotas Dushti. A classical Ayurvedic questionnaire will be an important addition to routine clinical practice, as well as in research.

Objective*: This study aims to develop and validate a questionnaire on Medovaha Srotas Dushti which is based on symptoms of Medovaha Srotas Dushti mentioned in Charaka Viman Sthan and Nidan Sthana.*

Materials and Methods*: This is a study, which includes– 1) Item generation: Extraction of items through classical texts and expert consensus, 2) Pretesting: Pretesting was conducted on 30 patients for confirming comprehensibility, clarity, and ease of language. 3) Face Validity: Face Validity Ratio was calculated for each item. 4) Content validity testing: undertaken by panel of Ayurvedic experts using Content Validity Index (I-CVI) and Scale Validity Index (S-CVI). 5) Pilot Testing: The final questionnaire was then administered in 100 individuals. 6) Reliability Testing: Reliability of questionnaire was assessed using Cronbach's Alpha. 7) Construct Validity: This was then confirmed through Exploratory Factor Analysis. Questionnaire was of binary score format, recording symptom presence.*

Results: *The final questionnaire comprised 13 items. The CVI values of all items were acceptable (>0.62). The internal consistency was high (Cronbach's alpha = 0.81), and hence the study pointed to strong reliability.* ***Conclusion:*** *The developed assessment tool for Madhovaah srotas dushti is valid and reliable. It may be deployed for diagnostic reinforcement, prakriti-vikriti mapping and further research in Ayurvedic preventive and lifestyle medicine.*

Keywords: *Cronbach's alpha, Medovaha Srotas, Questionnaire Validation, Srotodushti.*

1. INTRODUCTION

Ayurveda, describes in detail different *srotas* through which *rasa*, *rakta*, *dhatus*, and *malas* are transported and metabolized. The balance and homeostasis of body functioning are maintained by these channels.[1] *Medovaha Srotas* is the only channel responsible for *meda dhatu* (fat tissue), involved in metabolism, nourishment, and lubrication of the body. It is considered as the *moola sthana* (anatomical roots) of *Medovaha Srotas* in classical Ayurvedic texts, and this includes *Vrikka* (Kidney or associated structures) and *Vapaavahana* (Omentum), along with other organs.[2,3] Vitiation of these channels, known as *Medovaha Srotas Dushti*, is believed to be an etiopathological factor for conditions ranging from obesity (*Sthoulya*), diabetes mellitus, to metabolic syndromes and lipid disorders.[4,5] According to classical texts, *Medovaha Srotas Dushti* is mentioned in Charak *Vimansthan*, *Charaka Sutrasthan*, *Charaka Nidansthan*. *Charaka* explained that *Medovaha Srotas Dushti* symptoms are same as *Prameha purvaroopa* mentioned in *Charak Nidansthan*.[6]

In today's context, with the epidemic of obesity and metabolic disorders rising globally, India has become a serious nexus for these lifestyle diseases on the global stage. Components of metabolic dysfunction are assessed in conventional medical systems using tools like BMI, lipid profiles, and insulin resistance.[7] However, these parameters do not encompass the multi- dimensional pathophysiology as mentioned in Ayurveda, particularly the *srotodushti* and *dosha-dhatu* imbalance.[8] Despite its importance, there is no validated or standardized scale to measure the *dushti* of *Medovaha Srotas* based on the classical symptomatic complexes described in Ayurvedic

literature. The diagnostic questionnaires specifically tailored to evaluate individual *srotas* are largely unavailable. The creation of such tools would aid in making classical Ayurvedic diagnostic systems more comprehensible and integrative with modern scientific research.[9] A validated questionnaire is a cost-effective and efficient resource for initial clinical screening, data collection in research settings, and personalized treatment planning. These tools derived directly from Ayurvedic textual description and validated using modern statistical techniques such as Content Validity Index, Cronbach's alpha for reliability, and Factor analysis for construct validity, can serve as a bridge between traditional wisdom and scientific rigor.[10]

2. LITERATURE REVIEW

The *Srotas* are an important dimension in Ayurvedic physiology that acts as a channel for the movement of and circulation of *rasa*, *rakta*, *dhatus* and *malas*.[1] Of the thirteen *srotas*, *Medovaha Srotas* is associated with *Meda* (adipose tissue), with *Moolsthana* in *Vrikka* (kidneys) and *Vapaavahana* (omentum), as well as fat metabolism and systemic lubrication.[2] Charaka equates the *medovaha srotas dushti lakshanas* with *prameha purvarupa* which are analogous to prediabetes and metabolic syndrome features like dyslipidemia and visceral obesity.[6,7] These symptoms manifest as Matting of hairs, sweetness in mouth, burning sensation in hands and feets, Numbness in hands and feets, Dryness in mouth/palate/throat, thirst Lassitude, Dirt in body, smearing in body orifices, crawling of bees and ants sensation in body and urine, Morbidities in urine, Fleshy smell of body, Frequent sleep, drowsiness.[3] Following which Ayurveda considers the formation of *Sthoulya* and *Madhumeha* as the principal consequences of *Medovaha Srotas Dushti*, because it is frequently used in naming Metabolic syndrome and Diabetes.[4,5] Srotas dushti is described in texts with elaborate textual descriptions and has no proper diagnostic scale, it is so far based to the personal judgment and interpretation of the individual doctor. Biomarkers of *srotodushti* in early stages are likely to precede biochemical evidence of metabolic derangements and hence validated instruments are useful for the purpose of screening and personalized management so that appropriate interventions may be taken to halt the disease process and the course of its consequences.[9]

In the present study, the use of psychometric techniques like CVI, CVR, Cronbach's Alpha and Factor Analysis in the measurement provide for soundness of science which is not divorced from classic ideas. It is vital to develop and validate such tools to incorporate Ayurveda diagnostics into mainstream healthcare to increase replicability, research potential, and screening for lifestyle disorders at early stage.[10]

3. METHODOLOGY

The mixed methods study design was used, the details of which are depicted in Figure 1. The steps involved in validation of questionnaire are given below:

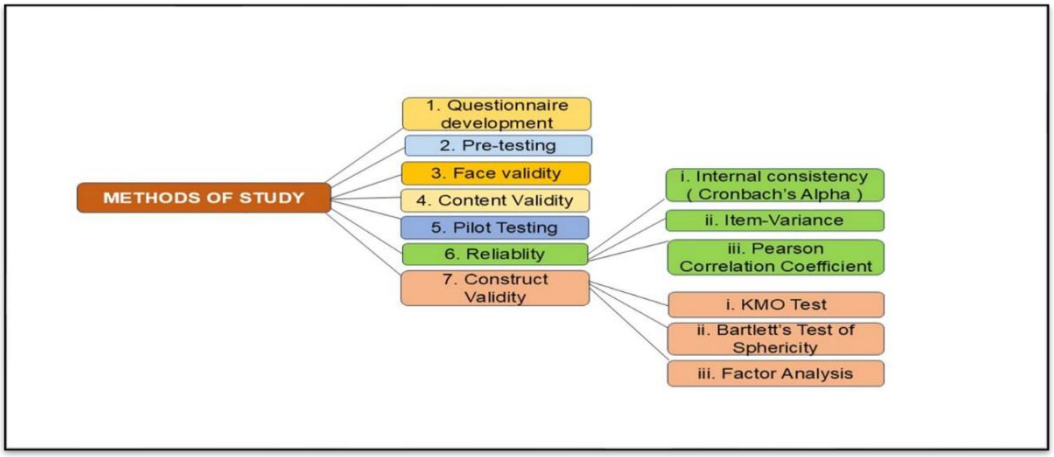

Figure 1: Diagram depicting varied stages of the questionnaire development and validation

3.1 Development of Questionnaire: The questionnaire was confirmed as a closed- ended tool; this structure is considered vital for standardized administration and uniformity of responses.[11] Thirteen items were generated in to capture the clinical features of *Medovaha Srotas Dushti*, with each item being reflective of classical Ayurvedic symptomatology. The main reference for selection of items was *Charaka Samhita*, *Sutrasthana and Vimansthana* which provides a reference that *Medovaha Srotas Dushti Lakshanas* are same as *Prameha Purvaroopa*.[1,2] *Charaka Nidansthana* provides the description of *Prameha Purvaroopa* in 4th adhyaya.[6] These lakshanas manifest as Matting

of Hairs, Sweetness in Mouth, Burning Sensation in Hands and Mouth, Numbness in Hands and Feet, Dryness in Mouth, Palate, and Throat, Thirst, Lassitude, Dirt in Body, Smearing in Body Orifices, Crawling of Bees and Ants sensation in Body and Urine, Morbidities in Urine, Fleshy Smell in Body, Frequent Sleep, Drowsiness.[4,5,8] These features were studied in detail by formulating different questions of the questionnaire. The questionnaire took shape in 13 questions based on these few steps. Each item response was binary (Yes / No).[4] For these, each answer was rated as a 1-for-Yes and 0-for-No. For all items, the responses received were summarized to obtain the total score by adding individual item scores. *Medovaha Srotas Dushti* was considered present based on the final score, i.e., more than 70% symptoms answered as Yes by the subject. The *Medovaha Srotas Dushti Questionnaire* was finalized and then it was used for subsequent study.[12,13] The initial draft of the questionnaire was discussed with postgraduate scholars of *Kriya Sharir* for conceptual clarity, clinical relevance, and inclusion as per basic Ayurvedic concepts. It was further discussed with experts in Kriya Sharir to remove all the ambiguous/overlapping items,[9] making sure that they are easily interpretable and non-biased to depict *Medovaha Srotas* pathology. This feedback was then considered through various iterations. This questionnaire underwent expert validation, where the content was evaluated by senior faculties and experts from departments of *Kriya Sharir*. The final items were based on consensus within the focus group discussion, and then subjected to a pre-testing on 30 patients, for clarity, item response, and feasibility. This stepwise process helped in maintaining classical thought along with scientific rigor necessary for clinical validation of the tool.
[11,16]

3.2 Face Validity: We also assessed face validity about the general clarity, readability, and appearance of the questionnaire.[17] Confirm the face validity of each item in a sample calculating the face validity percentage.[18]

3.3 Pre-testing: Pretesting was carried out on 30 subjects who were chosen from the OPD.[19] All items had positive responses. From the perspective of participants, all items were extremely easy to read, and no confusion emerged regarding any interpretation.[17]

3.4 Content Validity: A structured content validation form was created to determine the content validity of the questionnaire.[20] The 5 different experts from the field of *Kriya Sharir* were provided the preliminary questionnaire together with the validation form. Expert Review: The experts gave detailed instructions about how to evaluate each item in terms of clarity, spelling and grammar, semantic precision, clinical relevance, and comprehensibility.[21] These variations were corrected using a systematic process to adjust the language and relevance of items without affecting its Ayurvedic content.[22] Content Validity Assessment: The experts were then requested to give scores for each item in relevance, clarity and representativeness of the underlying concept Medovaha Srotas Dushti.[13,14] We rated each item on a 4-point Likert scale: 1 = Not Relevant, 2 = Somewhat Relevant, 3 = Quite Relevant, 4 = Highly Relevant**;** Each item was evaluated for content validity statistically by calculating Item-Level Content Validity Index (I-CVI). In addition, the mean of Scale-Level Content Validity Index (S-CVI/Ave) was used to calculate average content validity for all items. [14,15] The weightage scores tabulated and calculated served to ensure that all the items are a combination of relevance and representation for *Medovaha Srotas Dushti*. [21,22]

3.5 Pilot Testing: The final validated questionnaire was digitized in Google Form to pilot for sample size 100 subjects of age group 31–60 years.[19] A purposive/convenience sampling strategy was utilized to recruit research participants.[23] This specific age range was selected based on Ayurvedic principles, considering that *srotas* are typically less prone to vitiation before the age of 31, and are often more susceptible to degeneration after 60 years, which could skew the findings related to *Medovaha Srotas Dushti*.[4,8] A one-time assessment of the participants' *Medovaha Srotas* status was carried out using the developed tool. Participants with major systemic disorders—including hypertension, coronary artery disease, metabolic disorders such as diabetes mellitus, thyroid dysfunction—as well as pregnant women and lactating mothers were excluded from the study.[7] The exclusion criteria were carefully established to eliminate conditions known to exhibit regressive or secondary effects on *Medovaha Srotas*, thereby avoiding potential confounding variables that could compromise the objectivity and specificity of the tool's assessment.[24]

3.6 Reliability: 3.6.1 Item analysis: A detailed item analysis and reliability testing procedure of the developed Medovaha Srotas Dushti Questionnaire was done to assess its psychometric robustness.[11] Statistical Computing was done using MS Excel and Python (factor_analyzer, pandas, numpy). Each item variance and mean variance was calculated using formulas in MS Excel. From variance, Cronbach's alpha was calculated. [18,25]

3.6.2 Internal Consistency: Cronbach's alpha was used for measuring the internal consistency of the questionnaire, calculated in MS Excel based on the data collected during the pilot study using the equation: [18,26]

Cronbach's α = (k/(k-1)) * (1 – SUM (variance row)/total variance)

3.6.3 Item Correlation: Pearson correlation coefficient (r) was also calculated for each pair of items across all 100 pilot sets to examine how well individual items correlated with one another.[20] This was useful in identifying whether the linear correlation between two items (in some groups of items) was weak or strong and in what direction. [20,27]

3.7Construct Validity: Construct validity was checked using Exploratory Factor Analysis (EFA).[28] Before extracting, Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity were conducted to ensure the sampling adequacy and suitability for factor analysis.[21,28] Factor extraction was carried out with Principal Axis Factoring (PAF) with Kaiser normalization and factors extracted were limited by the number of those which had an eigenvalue greater than one according to Kaiser's criterion.[21,29] The data was better interpreted after varimax rotation.[29,30] These analyses provide support for a multidimensional account of the tool and validated that the items of questionnaire appropriately cluster around meaningful latent factors representing *Medovaha Srotas Dushti* construct.[22,30]

4. RESULTS:

Results of the tool development and validation process are presented in figures from [Fig.– 4.10]. Relevant graphical representations are depicted in the diagram.

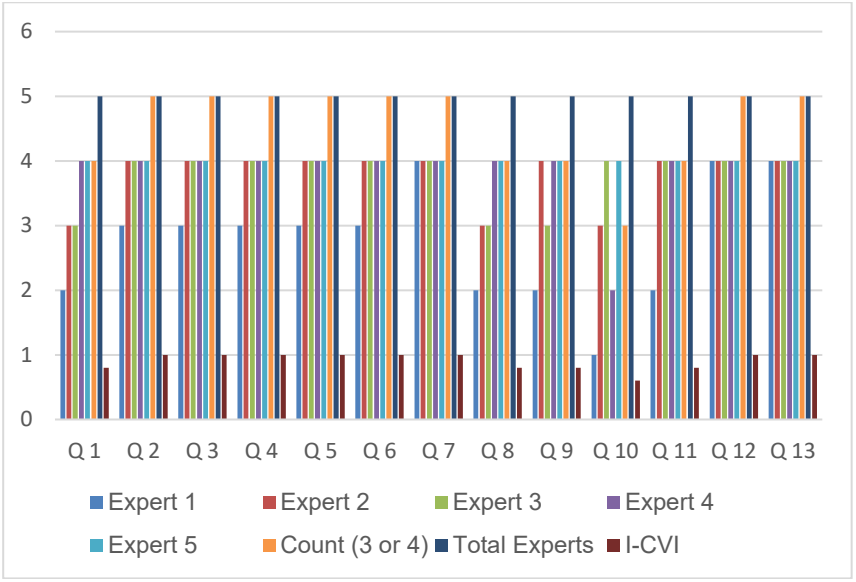

Figure 4.1: Bar Chart representing I-CVI

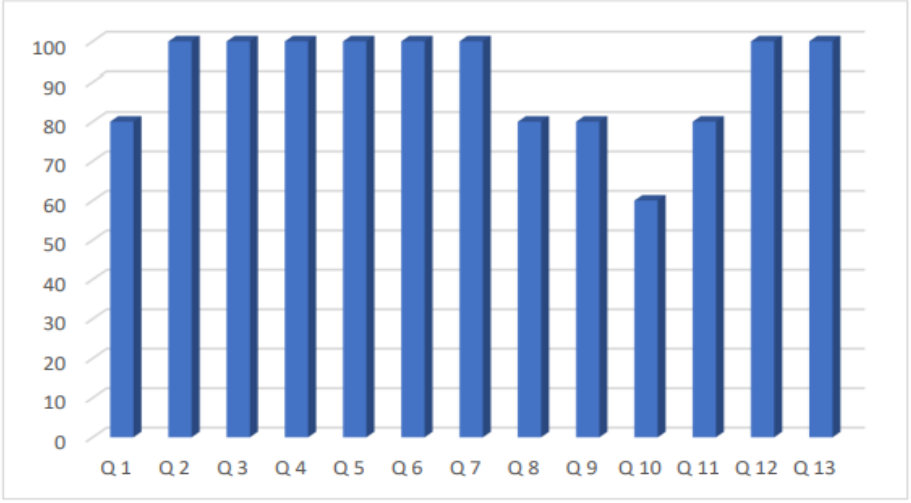

Figure 4.2 Bar chart representing face validity

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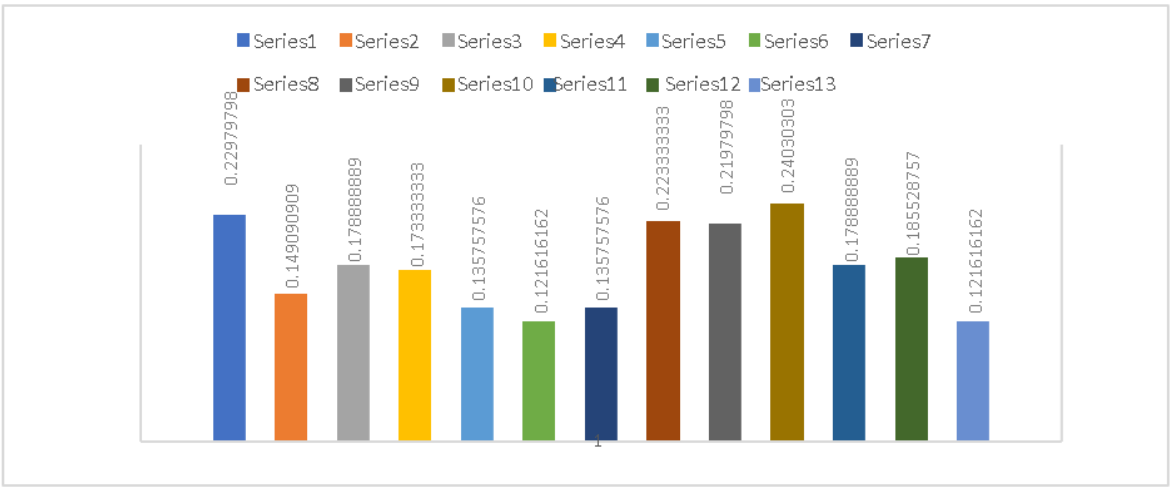

Figure 4.3: Bar Chart representing item variance for each question

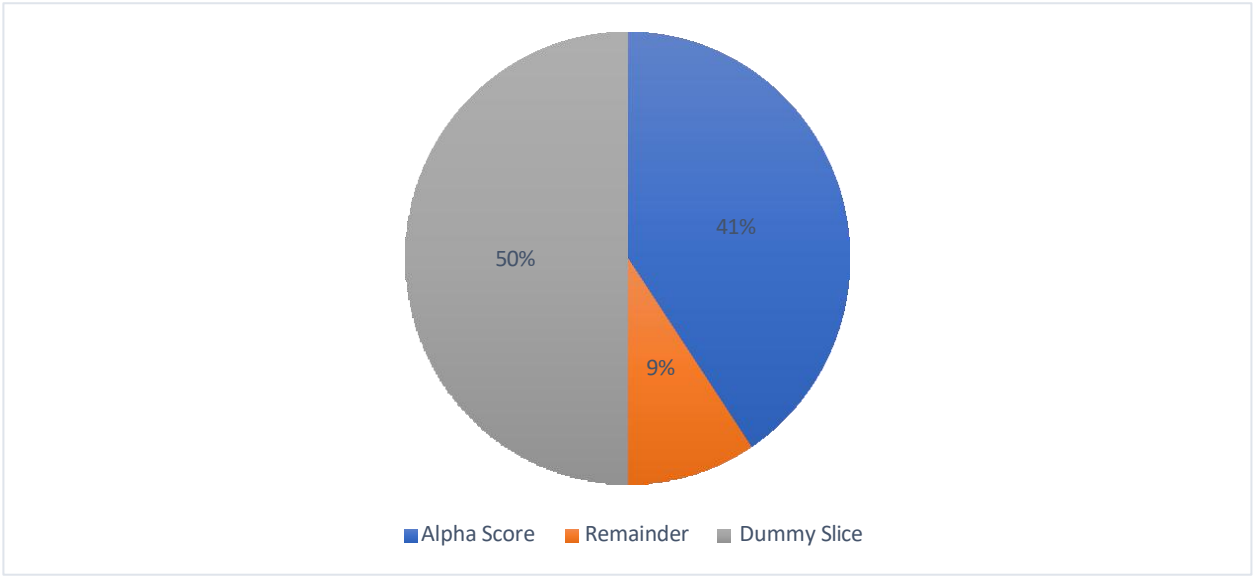

Figure 4.4: Pie Chart representing Cronbach's Alpha

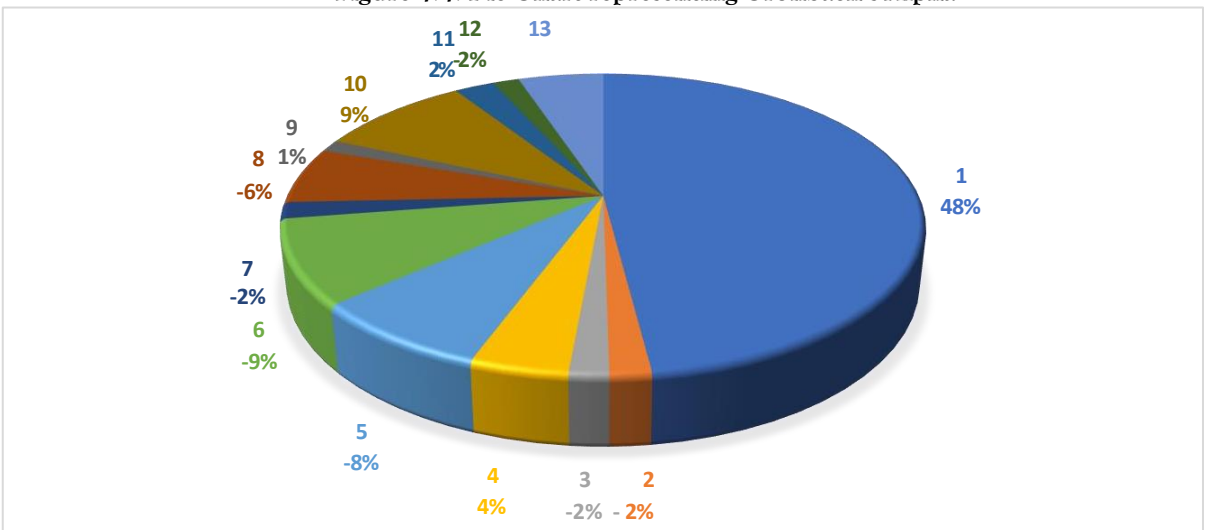

Figure 4.5: Pie chart representing Pearson Correlation Coefficient for each item of Questionnaire

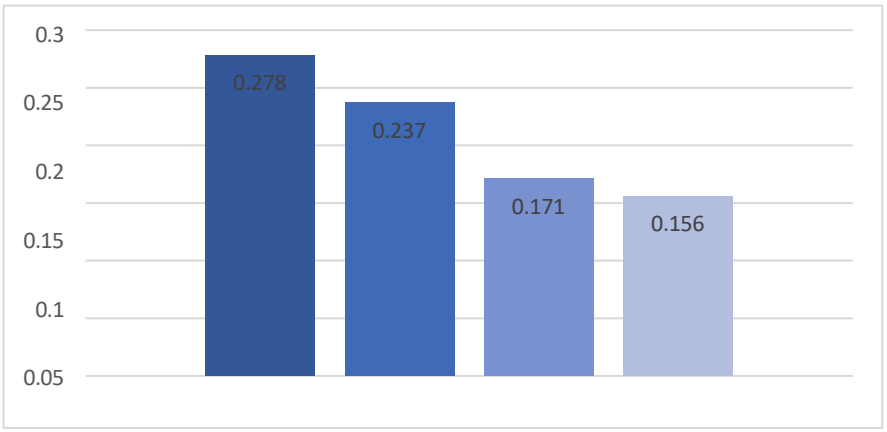

Figure 4.6: Bar diagram representing positive correlation of items

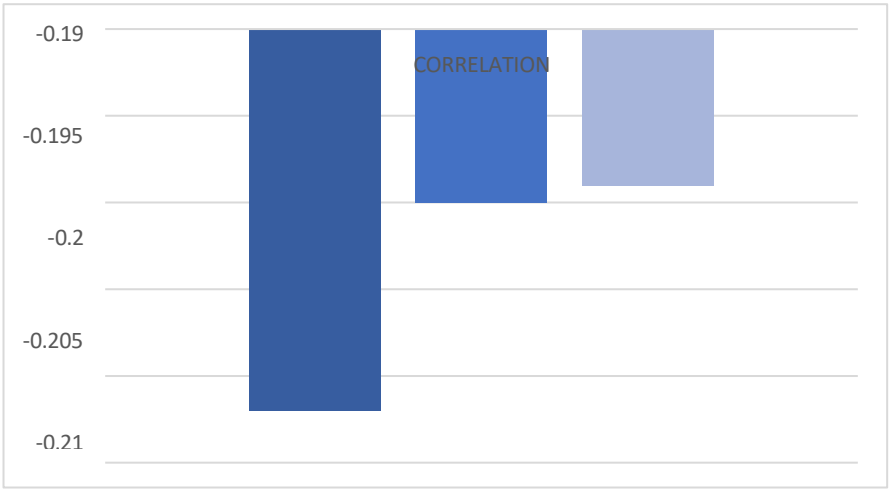

Figure 4.7: Bar diagram representing negative correlations of items

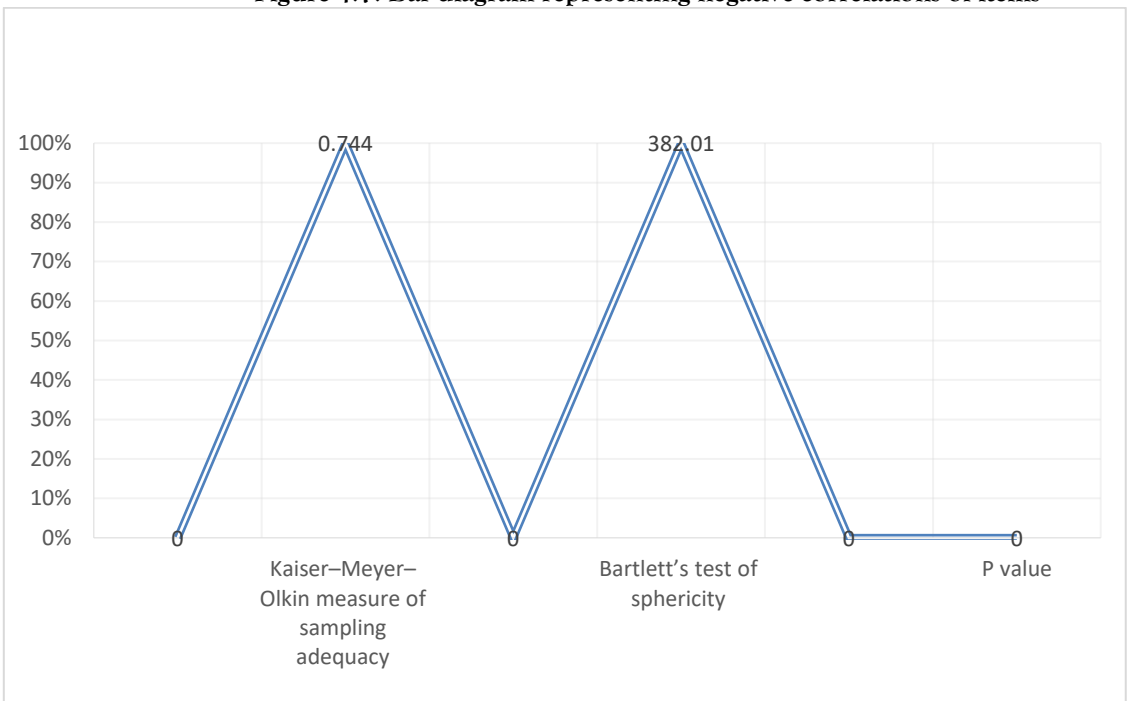

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Figure 4.8: Stacked line representing KMO, Bartlett's test and p values

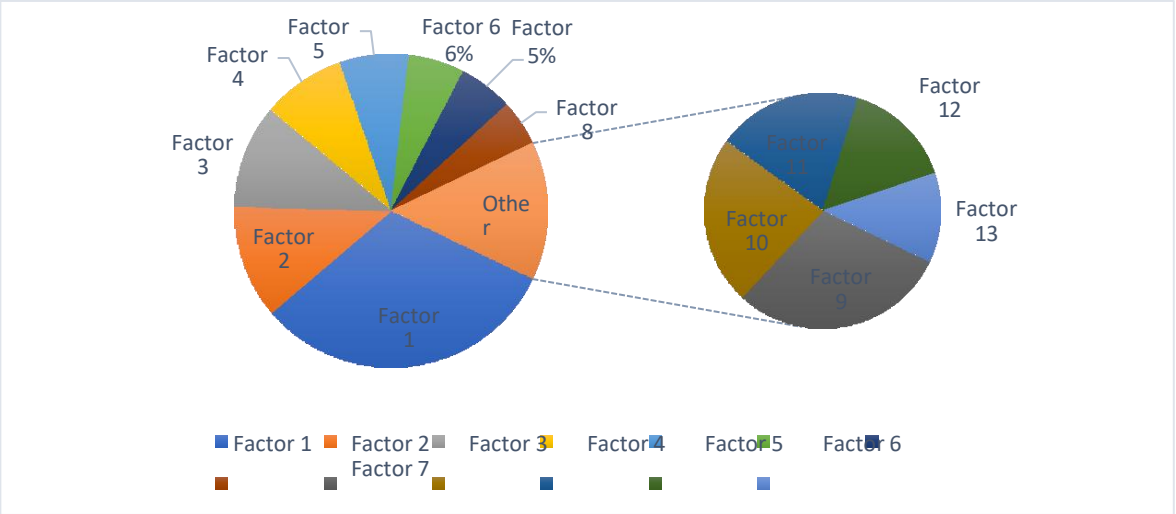

Figure 4.9: Pie of Pie diagram representing factor analysis of each item

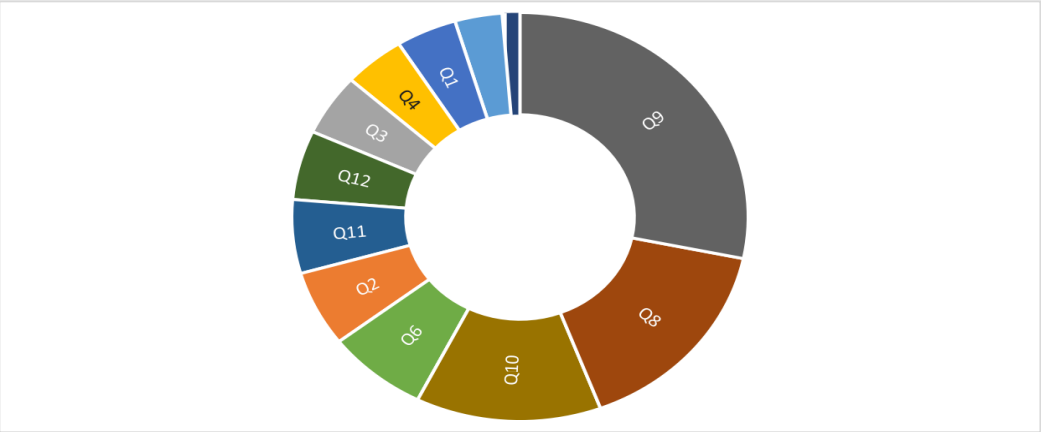

Figure 4.10: Sunburst diagram representing factor loadings and item communalities

5. DISCUSSION

Till recent, no questionnaire has been developed to assess Medovaha Srotas Dushti (vitiation of channels carrying fat tissue) specifically mentioned in Ayurvedic classics. With the help of responses from 100 patients whose age was in the range of 31–60 years, validation process applied to psychometric properties included item generation, questionnaire development, pretesting, face validity, content validity, internal consistency, item-level variance and inter- item correlation along with Exploratory Factor Analysis (EFA).

5.1 Face Validity: For face validity, expert judgment was carried out by a team of five subject matter experts in Kriya Sharir. The appropriateness of each item was rated on a 4-point scale (1 = Not Relevant, 4 = Highly Relevant) with respect to clarity, relevance and how well the item reflected specific symptoms of Medovaha Srotas Dushti. Thus, items rated 3 or 4 were deemed acceptable. For each item, the face validity consensus surpasses 60%, summarized between items in a range from 60 to 100% (Table 2), and with strong consensus (> Face validity of the Overall tool reached 90.77%, suggesting that items were conceptually and clinically relevant to expert reviewers.(Shown in figure 4.2)

5.2 Content Validity: Content validity was examined by Item-Level Content Validity Index (I- CVI) and Scale-Level Content Validity Index (S-CVI/Ave). Of these, ten achieved a perfect I- CVI score of 1.0 and questions 1, 8 and 9 had scores of 0.80 indicating high but not unanimous agreement. Although question 10 I-CVI (0.60) also fell under the common threshold of 0.78, it was accepted in consideration of its classical and clinical significance

in the concept of Srotodushti according to Ayurvedic literatures (Charaka Samhita, Nidana Sthana). The S-CVI/Ave calculated to be 0.9077 with a recommended cutoff of 0.80 for scale level excellent content validity which also confirmed the items as whole together measure the construct adequately. (Shown in figure 4.1)

5.3 Item-Level Response Variance: Item response variance varied between 0.1216 and 0.2403 with an average item response variance of 0.1538. With variances being the highest for questions 9(0.2403), 8 (0.2233) and 7 (0.2198), it suggests that these have strong discriminatory potential against missing value, questions 5, 6, and 12 showed little variance (0.1216–0.1358), which can be explained either with high agreement/consensus level among respondents or due to low variability in symptom perception. Such analysis is important to inform items that might need reframing in subsequent iterations to improve sensitivity. (Shown in figure 4.3)

5.4 nternal Consistency and Reliability: Regarding internal consistency of questionnaire, it was evaluated by Cronbach's Alpha= 0.813 that show a good reliability and homogeneity between items. George & Mallery, 2003 reported that an alpha of 0.8 to.9 numbers as good internal consistency. These findings imply that each item measures the construct of Medovaha Srotas Dushti uniformly, without too much overlapping between one another as expected. (Shown in figure 4.4)

5.5 Inter-Item Correlation Analysis: Most values were between 0 and 0.3, showing poor to moderate positive correlations. Categories related to Series 4, 8, 10 and 13 were highly correlated in all items overall indicating more coherence with the construct. The negative correlations observed in Series 1 and 6 could indicate interpretational ambiguity, or experiences of symptoms in an opposite direction. Given these findings, there may be a need for future refinement of these items to improve their clarity and directionality. (Shown in figure 4.5, 4,6 & 4.7)

5.6 Construct Validity/ Exploratory Factor Analysis: Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity was conducted to evaluate the factor structure of the questionnaire. The KMO value as 0.744 and the result of Bartlett's test ($\chi^2 = 382.01$, $p = 0.760$)). The exploratory factor analysis of the *Medovaha Srotas* symptom questionnaire resulted in 13 factors with eigenvalues from 4.113 to 0.228, explaining a total variance of 100%. In fact, this was not due to the items confounded by a single factor (factor 1 alone explained 31.64% of variance), while the core dimension captured in first five factors accounted for 69.74% of variance. The other causes accounted for smaller amounts of variance, but were still significant indicative of symptoms (clusters) that are relatively less consequential (important). Typically, a 5-factor solution of Medovaha Srotas symptom questionnaire was obtained by the factor analysis: eigenvalues >1.0 and scree slope suggested we should retain five factors, item loadings varied between 0.043 and 0.97, communalities ranged from 0.221 to 1.005. Large loadings on many items indicate that the underlying constructs are well-represented, and the total of communalities shows that most have a substantial amount in common with their factors. (Shown in figure 4.8, 4.9 & 4.10) The multidimensional architecture of structures with the classical concept of *Medovaha Srotas* provides evidence for the construct validity and clinical applicability of this questionnaire. These results support the hypothesis that the questionnaire items are clustering to form consistent subscales, where each is reflective of a particular aspect of *Medovaha Srotas Dushti*, thereby confirming their construct validity. After validating the Medovaha Srotas Dushti Questionnaire on 100 patients, the responses were analyzed to explore how symptoms naturally grouped together. These groupings not only made statistical sense but also aligned well with Ayurvedic understanding. Here's how each domain emerged and what it reveals:

5.7 Metabolic and Nutritional Imbalance: Specifically, the domain of Sweetness in Mouth (question 2), Excessive Thirst (question 6), Frequent Sleep (question 13) and Drowsiness (question 14) consistently loaded on a factor. These are *purvarupa* of *prameha* in Ayurveda, simulating the early metabolic syndromes. In terms of the statistics used by the developers to assess these new scales, as they show strong inter-item correlations and suitable response variance this indicates that they measure a single concept. The co-presence of these symptoms clinically again points towards and altered fat metabolism and disruption in metabolic homeostasis.

5.8 Sensorial and Neurological Symptoms: This content area includes the items of Burning in Hands and Mouth (question 3), Hand and Foot Numbness (question 4), Dry Mouth/Palate/Throat (question 5) and Feeling of Ants Crawling (question 10). This vata or meda involved activity gives the subtle symptoms through the *pipilika sanchara* found in Ayurvedic resources. Highly loaded items with high communality were indicative of the factors; others, such as crawling sensation, had higher variance but low inter-item correlation. This domain collectively focuses on the neurological and sensorial presentations of *Medovaha Srotas* vyapat,

adding to the understanding of patient morbidity

5.9 Hygienic and Secretory Changes: The following domain: Matting of Hairs (question 1), Sensation as if one had dirt on ones' body (question 8), Discharge from orifices (question 9), Foul body odour (question 12). These outward signs are manifestations of disrupted elimination or sequestration of endogenous and exogenous metabolic toxins. Factor-analysis found that all the points loaded cohesively, indicating their diagnostic importance in Ayurveda. This area highlights the significance of body form changes (external and secretory), which is essential to know, so that these subtle striking physical features can be recorded while examination for derangement in *Medovaha Srotas.*

6. CONCLUSION

The *Medovaha Srotas Dushti* Questionnaire serves as a well-thought-out and systematically developed tool for assessment of adipose tissue vitiation, which is described in the classical texts of Ayurveda. The findings of the present study have demonstrated that this questionnaire is scientifically valid and clinically relevant.

The tool exhibited very good face and content validity as well, with most experts agreeing strongly on item clarity and relevance throughout the validation process. The high Content Validity Index (S-CVI/Ave = 0.9077) and the internal consistency (Cronbach's Alpha
= 0.813) are good, therefore it seems that the items represent a consistent measure of the concept as intended of *Medovaha Srotas Dushti*

The real utility of this questionnaire is it captures the various dimensions of meda vitiation in a structured and clear manner. The domain-wise interpretation resulted in three major symptom- clusters, i.e., (a) metabolic variation; (b) sensory or neuropsychiatric symptoms; and (c) hygienic/secretion related changes. These not only have an anecdotal importance in classical Ayurvedic but also are clinically relevant even today, particularly for early diagnosis of conditions like metabolic syndrome, and diabetes with obesity. The questionnaire is straightforward to apply, non-intrusive and may be carried out throughout a huge spread of settings. This questionnaire is particularly useful to the Ayurvedic practitioner and researcher who can rely upon these early signs for detection of subtle imbalances before disease manifests.

In summary, questionnaire is not merely a tool of questions; it is a finely crafted blend of Ayurvedic wisdom with scientific researching techniques. This may not be as powerful for analyzing subtle pathological changes in the body, especially as it relates to meda dhatu. Its varied and pervasive utility will not only emerge with further application but also for Ayurvedic clinical practice, preventive healthcare, and integrative health research.

7. Competing Interests:

The authors declare no competing financial interests.

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