DEVELOPMENT AND VALIDATION OF A STANDARDIZED TOOL FOR ASSESSING THE MEDHO SARA (EXCELLENCE OF ADIPOSE TISSUE) WITH SPECIAL CONSIDERATION TO SNIGDHATA (UNCTUOUSNESS) EVALUATION.

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KEYWORDS
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Snigdhata
Prakriti
Dhatu
Sara Purusha Lakshana
Phonation
Body Fat Percentage

INTRODUCTION

As per the basic principles of the Ayurvedic medical system, the importance of Sara (excellence of tissues)(Amara, 1989) determination lies in exploring Bala (strength) of an individual Dhatu (tissues).(Agnivesha, 2011b) Since the Bala of individual Dhatu collectively provides Bala of Sharira (strength of the body). Sara of respective Dhatu, when of excellent quality, promotes certain specific physical and socio-psychological characteristic features in Shareeera (body) collectively termed as Sara Purusha Lakshana (signs of excellent body tissue). (Agnivesha, 2011b) Although every person is formed of the same fundamental entities (Dosha (body humour), Dhatu (tissue) and Mala (waste materials)) variations are still observed from person to person in the structural as well as functional aspects, depending upon numerous factors. Therefore, a physician faces practical difficulty in diagnosing Sara, due to a lack of objective parameters.

Medho Sara (adipose tissue excellence) is among the eight Sara mentioned by Ayurveda. In Medho Sara’s assessment Snigdhata (unctuousness) is one such subjective parameter mentioned in its Lakshana (clinical features) which can be decidedly used to assess the same. (Agnivesha, 2011b) Snigdhata refers to unctuousness and oily(Vaghbata, 2005) and is the contribution of Jala Mahabhuta (the water element). (Agnivesha, 2011a) It promotes lustre to Varna (complexion), Swara (voice), Netra (eyes), Kesha (scalp hairs), Loma (body hairs), Nakha (nails), Danta (teeth), Oshta (lips), Mutra (urine), Purusheha (faeces), Sweda (sweat). (Agnivesha, 2011) An adequate amount of body fat/ adipose tissue is required to carry out certain physiological functions in the body, (Shah & Braverman, 2012)like promoting lustre to hair, lips, nails etc. Body fat percentage is one such scientific quantitative method of calculating the amount of body fat as a proportion of body weight. (Blaak, 2001) So, the main theme of this work was to analyze the relation between Medho Sara norms and Body fat percentage. Recent studies have shown Body Fat percentage to influence phonational behaviour.(Barsties et al., 2013a) Therefore, the determination of the consistency of voice parameters (frequency, intensity, Maximum Phonation Time) was selected as an objective parameter to be

ABSTRACT

This study aimed to create a uniform assessment methodology for evaluating the Medho Sara (excellent level of adipose tissue), specifically emphasising analysing Snigdhata (unctuousness). Medho Sara is one of the eight types of Sara described in the Ayurveda, and Snigdhata is a subjective factor that enhances the overall quality of adipose tissue. The study utilised a cross-sectional survey approach to evaluate the correlation between Medho Sara norms and body fat percentage. A cohort of 253 individuals were enrolled, and their physical attributes, vocal parameters, and body fat percentage were assessed. The findings indicated that most of the subjects fell into the Madhyama Sara category, and there was a notable association between Snigdhata Oshtha, Snigdha Purisha, Bruhat Shareera and body fat percentage.

The study emphasises the significance of Snigdhata in assessing Medho Sara and its correlation with body fat percentage. The results indicate that a sufficient quantity of adipose tissue is essential for specific physiological processes, such as enhancing the shine and appearance of hair, lips, and nails. The study highlights the importance of having a uniform instrument to evaluate Medho Sara, as it is crucial for the diagnosis and treatment of different health issues.
AIMS AND OBJECTIVES: To develop parameters to assess Snighdha in Medho Sara individuals.

MATERIALS AND METHODS:

**Survey Method:** Self-administered questionnaire

**Sampling Frame:** By convenient sampling, the participants were selected from the patients attending “Utsaha OPD” of KAHER’s Shri BM Kankanawadi Ayurveda Mahavidyalaya, Belagavi.

**Sample Size:** The sample size was estimated using MacCor Sample Size calculator software (Sample Size Calculator for - appetite for -). Considering a total population of 600 with a confidence level of 95% and confidence interval of 4.8% the sample size thus obtained is 246.

**Inclusive Criteria:** Participants, who had no confirmed mental illness, not associated with speech, language, hearing, respiratory, or any other motor/sensory deficits, irrespective of sex, between the age group of 16-30 years and were willing to participate in the study by providing written consent, were taken for this study.

**Exclusion Criteria:** Participants with endocrine abnormalities and female participants with a history of pregnancy and lactation were excluded from the study.

**Socio-demographical study:** It is done by questionnaire approach, which has been done to observe the distribution of Medho Sara in society. It contains name, age, sex, religion, occupation, education, residence, dietary habit, sleep habit, income grade and addictions. Besides this, these disciplines were also tested for their Prakriti (Ayugonomic), (Wallace, 2020)

**Assessment of Physical Characteristics:** The physical characteristics of Medho Sara like Snigdha Varma, Snigdha Swara, Snigdha Netra, Snigdha Kesha, Snigdha Loma, Snigdha Nakha, Snigdha Dana, Snigdha Oshtha, Snigdha Mutra, Snigdha Purisha, Snigdha Shwasthvara, Snigdha Shwasthvaraka, and Snigdha Aasishnuta (intolerance to physical exertion) (Sushruta, 2004) are examined through questionnaire and clinical assessments. (Lee & Gallagher, 2008)

**Experimental Study:** The speech recording process of each participant was done to determine Snigdha Swara using PRAAT software. (Paul Boersma and David Weenink, n.d.) Body Fat Percentage was assessed using TANITA BC-1000 plus. (Tanita | BC-1000 Body Composition Scale, n.d.)

**Preparation of the Participants:** Every individual was instructed to:
1. Not to strain their voice by screaming; eating chilled, oily or fried foods.
2. Do not engage in smoking, alcohol, or caffeine. (Taking Care of Your Voice | NIDCD, n.d.)
3. Avoid using any cosmetic items like moisturizer, fairness cream, eyeliner, kajal, conditioners, nail polish, soap, oil etc. at least for a day. (Ravnik et al., 2010) After having assured this, further assessments were carried out.

**Phonation Recording:** The participant was advised to sit comfortably in a quiet location. Standard recording protocols were employed that comprised a condenser microphone situated 45 degrees off from the front of the mouth and a 4 cm mouth-to-mouth distance. (Sundberg, 1995) In this investigation, the Philips HearLink IT with Mic SHM7410U model was chosen, which contained all the functions required for speech recording. (Philips SHM7410U/10 - Singular.Com.Cy, n.d.) Audio recordings are recommended to be produced on a computer with 16 bits of resolution and a signal sample rate of no less than 20 K Hertz. (Digital Audio Basics: Audio Sample Rate and Bit Depth, n.d.) The respondents were asked to phonate the vowel /a/ and hold it as stable as they could, in their regular voice, until they were ordered to stop. The subjects were taught to produce phonation at the physiologic bounds, without harming the voice during phonation at the extreme ranges. The participant accomplishes this job three times. (Maslan et al., 2011) The PRAAT software, using a manufacturer-defined algorithm, gathers fundamental frequency, intensity and MPT (Maximum Phonation Time) information from the sample and develops the voice range profile. The above-mentioned factors, were extracted from the data and taken into consideration the terms of their relevancy in reflecting voice range profile above other parameters. (Sondhi et al., 2015)

**Measurement of Body Fat Percentage:** The participant was asked to tread barefoot on the TANITA BC-1000 plus and the appropriate values were recorded using Healthy Edge Plus Software. (Healthy Edge Lite Software (BC-1000 & BC-1500); n.d.)

**Statistical Analysis:** The statistical analysis of data was performed using (IBM SPSS) statistics software version 22.0, the responses were summarised and outcomes were analysed with relevant statistical tests including Fisher’s Exact, Spearman’s Correlation, Mann Whitney U test and Kruskal Wallis test to elicit the relationship between subjective and objective parameters of the study. Medho Sara was computed by points scored for each character and the percentage score was classified as follows: 0-33 % score as Avara Sara (poor); 33 - 66 % score as Madhyama Sara (Moderate) > 66 % score as Pravara Sara (Excellent). (29)

**OBSERVATION AND RESULT:** In the present study out of 253 participants, the majority were female 159 i.e. 62.8% and of the age group between 16 to 20 years 107 subjects (42.3%), 73 subjects each belonged to the age group of 21-25 and 26-30. Prakriti-wise distribution shows that a maximum of subjects was constituted with Kaphavata (40.7%) followed by Kaphapitta (24.9%), Vatakapha (18.2%), Vata (10.7%), Pittavata (4.3%) and Pittakapha (1.2%).

**Physical Characteristics of Medho Sara based distribution showed that the maximum number of subjects belong to the Madhyama Sara Categorgy 72.7% followed by Avarasara 14.6% and only 12.7% of subjects belong to Pravara.** Subjects fall under the Healthy range of Body fat percentage was 111 (43.9%) followed by Under fat 86 (34.0%), Overfat 36 (14.2%) and very less in the Obese category 20 (7.9%). Pitch-based voice distribution showed that the maximum subjects had an Average pitch of 238 subjects (94.1%) followed by a high pitch of 14 subjects (5.5%) and 1 participant (0.4%) had a Low pitch score and Intensity-based voice distribution showed that the maximum subjects have Average intensity in 195 subjects (77.1%) followed by Low intensity in 31 (12.3%) and only 27 subjects (10.7%) have High-intensity score. Maximum Phonation Time-based voice distribution showed that the maximum subjects have an Average MPT of 227 subjects (89.7%) followed by Low MPT in 26 subjects (10.3%).

**Chart 1: Voice Parameters in Different Genders and Voice Parameter Norms**

<table>
<thead>
<tr>
<th>Vowel</th>
<th>Voice parameters in Genders</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>No=253</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pitch Mean</td>
<td>257.5</td>
<td>217.25</td>
</tr>
<tr>
<td></td>
<td>Loudessness Mean</td>
<td>81.25</td>
<td>85.85</td>
</tr>
<tr>
<td></td>
<td>MPT Mean</td>
<td>11.57</td>
<td>11.95</td>
</tr>
</tbody>
</table>

**Voice Parameter Norms**

- Low
- Medium
- High

<table>
<thead>
<tr>
<th>Pitch Range</th>
<th>Loudness Range</th>
<th>MPT Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>54.50%</td>
<td>77.50%</td>
<td>80.75%</td>
</tr>
<tr>
<td>64.50%</td>
<td>55.70%</td>
<td>43.50%</td>
</tr>
<tr>
<td>32.30%</td>
<td>60.70%</td>
<td>10.30%</td>
</tr>
</tbody>
</table>

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The crosstab between Prakruti and Madhyama Sara (Table 1) denotes an almost equal distribution of all Prakruti in the Madhyama Sara category. Fisher's Exact showed a significant difference between Medho Sara and Prakruti at Fisher's exact value = 18.428, p=0.05. A Spearman’s Rank Order correlation was run to determine the relationship and there was no correlation between them at r = -0.011, p=0.05.

**Table 1: Medho Sara to prakruti**

<table>
<thead>
<tr>
<th>Prakruti</th>
<th>Medho sar</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vata</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>Pitta</td>
<td>28.3%</td>
<td>33.9%</td>
</tr>
<tr>
<td>Vata</td>
<td>36.4%</td>
<td>45.12%</td>
</tr>
<tr>
<td>Pitta</td>
<td>0%</td>
<td>3%</td>
</tr>
<tr>
<td>Kapha</td>
<td>6.5%</td>
<td>22%</td>
</tr>
<tr>
<td>Vata</td>
<td>0%</td>
<td>17%</td>
</tr>
<tr>
<td>Kapha</td>
<td>23.9%</td>
<td>34.9%</td>
</tr>
<tr>
<td>Vata</td>
<td>0%</td>
<td>17%</td>
</tr>
<tr>
<td>Kapha</td>
<td>11%</td>
<td>33%</td>
</tr>
<tr>
<td>Total</td>
<td>53%</td>
<td>195%</td>
</tr>
</tbody>
</table>

Correlation between physical characteristics of Medho Sara with Body Fat Percentage (Table 2) showed Characteristic features like Snigdha Oshtha, Snigdha Purisha and Bruhat Shareera have a correlation, which was significant at r = -0.128, p = 0.043; r = -0.0132, p = 0.035; r = 0.631, p = 0.000 respectively.

**Table 2: Correlation between physical characteristics of Medho Sara with body fat percentage**

<table>
<thead>
<tr>
<th>Parameters for</th>
<th>Body fat percentage</th>
<th>N</th>
<th>r</th>
<th>P</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snigdha Varna</td>
<td>253</td>
<td>0.004</td>
<td>0.953</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Snigdha Swara</td>
<td>253</td>
<td>0.029</td>
<td>0.642</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Snigdha Netra</td>
<td>253</td>
<td>0.012</td>
<td>0.844</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Snigdha Kesha</td>
<td>253</td>
<td>0.055</td>
<td>0.385</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Snigdha Loma</td>
<td>253</td>
<td>0.073</td>
<td>0.250</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Snigdha Nakha</td>
<td>253</td>
<td>0.086</td>
<td>0.172</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Snigdha Danta</td>
<td>253</td>
<td>0.036</td>
<td>0.571</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Snigdha Oshta</td>
<td>253</td>
<td>0.128</td>
<td>0.043</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Snigdha Mutra</td>
<td>253</td>
<td>0.052</td>
<td>0.381</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Snigdha Pureesha</td>
<td>253</td>
<td>0.132</td>
<td>0.035</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Snigdha Sweda</td>
<td>253</td>
<td>0.079</td>
<td>0.212</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Bruhat Shareera</td>
<td>253</td>
<td>0.631</td>
<td>0.000</td>
<td>HS</td>
<td></td>
</tr>
<tr>
<td>Ayasa Asahishnu</td>
<td>253</td>
<td>0.082</td>
<td>0.192</td>
<td>NS</td>
<td></td>
</tr>
</tbody>
</table>

When tested for correlation between voice parameters and body fat percentage, it showed that the distributions of Fundamental frequency, Intensity and MPT, were not normally distributed. Hence Kruskal Wallis test was applied to test the association between these voice parameters and body fat percentage. The results suggest that there is a statistically significant difference between the underlying distributions of the Frequency scores in different body fat percentages (chi-square = 9.399, p=0.05); however, there is no statistically significant difference between the underlying distributions of Intensity and MPT in different body fat percentage.

**DISCUSSION**

A study to extricate objective parameters for the assessment of Medho Sara through the valuation of Snigdhata was undertaken, so that its determination gets easier and uniform. An analysis showed that the maximum number of subjects belonged to the Healthy range of body fat percentage accounting for 43.9%. It might be attributed to the age group selected for the assay, in which the percentage of body fat commonly falls under the Healthy range,(Silver et al., 1993) unlike those below 16 years and above 40 years, accounting for under-fat and over-fat ranges respectively. Pravara and Madhyama Sara can be brought under the Healthy range of Body Fat percentage, because both of them, being in their normal Pramanatara (quantity) perform Snehana Karma (unctuousness) to the body. The Overfat and Obese range refers to the condition of Sthoulia, (obesity) which may arise through increased Snehana function of Medho Vruddhi (increase in adiposity) (Gunataha (quantitatively) and Karmataha(Vaghbatha, 2008a)(functionally)). Whereas the Under-fat range accounts for the state of Medho Kshaya (decreases adiposity) (Avara Sara), which results in Roukshya (dry), Karshya (rough), Mamsa Kshaya (decrease of muscle tissue) etc.(Vaghbatha, 2008b).

The crosstab between body fat percentage and Gender showed a higher incidence of a Healthy range of body fat percentage in females probably due to the physiological demands of childbirth and other hormonal processes. Moreover, women tend to accumulate a greater amount of adipose tissue in the glutal-femoral region, following a gynoid pattern. In contrast, men tend to store more fat in the visceral/abdominal depot, following an android pattern. This may result in higher phonation frequency than the males, Males have substantially higher intensity and MPT than females, due to testosterone-driven vocal fold enlargement and vocal tract lengthening during adolescence and early adulthood (17-30 yrs). Under fat subjects differed significantly as compared to other groups with lower values of Fundamental frequency min. In contrast, being under fat is assumed to affect frequency via poor blood circulation, poor physical condition, psychological distress, and sometimes decreased muscle tension/tone.(Barsties et al., 2013) It appears that overweight and obese subjects phonate at significantly higher values of Fundamental frequency min. They have greater diaphragmatic movement and weight and therefore have higher respiratory muscle strength.(Padkao & Boonla, 2020) Consequently, more respiratory airflow power is available, potentially resulting in higher subglottal pressure in phonatory airflow parameters as evidenced in the study of Solomon et al.(Solomon et al., 2011) Raising subglottal air pressure generally translates to increased frequency more air which is pushed through the glottis thus expanding the glottal flow wave. Whereas subjects of Healthy BODY FAT PERCENTAGE lie midway between two extreme groups with normal phonational behaviour.

**CONCLUSION**

Although there are many characteristics mentioned in Ayurveda literature for assessment of Medho Sara, all of them are qualitative or subjective, and there is a need to adopt such a method which measures quantitatively, and coincides with our ancient concept of Medho Sara, this study aids to establish objective parameter for the
identification of Meda Sara subjects more easily and its proves that Medho Sara has got a significant association with BODY FAT PERCENTAGE and can be used as a precise parameter for Medho Sara examination. Though voice parameters (Fundamental frequency, Intensity, MPT) were selected to prove as objective parameters to assess Medho Sara, this study didn’t find any significant evidence to support it.

Hence it is concluded that BODY FAT PERCENTAGE is the most reliable objective parameter to examine Medho Sara in a clinical examination.

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