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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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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 *Snigdha Oshta, 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.

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 *Shareera* (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(Vagbhata, 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), *Pureesha* (faeces), *Sweda* (sweat).(Agnivesa, 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

established for measuring *Medho Sara*.

AIMS AND OBJECTIVES: To develop parameters to assess *Snigdhata* in *Medho Sara* individuals.

MATERIALS AND METHODS:

Study Design: A cross-sectional survey study was undertaken, with written informed consent obtained from all study participants. Ethics clearance was acquired from the Institutional Ethics Committee of K.L.E. Academy of Higher Education & Research, Belagavi.

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 Macorr Sample Size calculator software.(*Sample Size Calculator for Market Research Surveys | MaCorr Research*, n.d.) 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.

Exclusive 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 are also tested for their *Prakriti* (Ayurgenomics).(Wallace, 2020)

Assessment of Physical Characteristics: The Physical characteristics of *Medho Sara* like *Snigdha Varna, Snigdha Swara, Snigdha Netra, Snigdha Kesha, Snigdha Loma, Snigdha Nakha, Snigdha Danta, Snigdha Oshta, Snigdha Mutra, Snigdha Purisha, Snigdha Sweda, Bruhatshareera* (large body frame) and *Ayasa Asahishnuta* (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 PLUS Body Composition Scale*, n.d.)

Preparation of the Participants: Every individual was instructed

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.(Ravnbak 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 mike-to-mouth distance. (Sundberg, 1995) In this investigation, the Philips Headphone 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.)

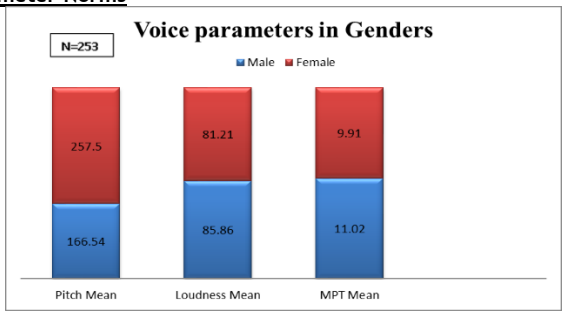
Statistical Analysis: The statistical analysis of data was performed using (IBM SPSS) statistics software version 22.0, the responses were summarised and outcomes were analysed with relevant statistical tests including Fisher's Exact, Spearman's Correlation, Mann Whitney U test and Kruskal Wallis test 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)

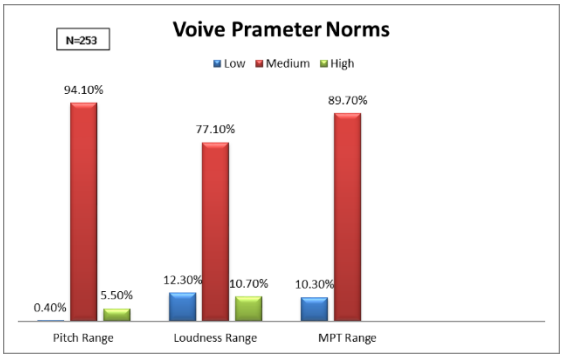
OBSERVATION AND RESULT:

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. *Prakruti*-wise distribution shows that a maximum of subjects was constituted with *Kaphavata* (40.7%) followed by *Kaphapitta* (24.9%), *Vatakapha* (18.2%), *Vatapitta* (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* Category 72.7% followed by *Avarasara* 14.6% and only 12.7% of subjects belong to *Pravasara*. 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 subjects1(0.3%).

Chart. 1 Voice Parameters in Different Genders and Voice Parameter Norms





The crosstab between *Prakruti* and *Meda Sara* (Table 1) denotes an almost equal distribution of all Prakruti in the *Madhyama Sara* category. Fisher's Exact showed a significant difference between *Meda 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_s = -0.011, p>0.05.

Table. 1 *Medho sara* to *prakruti*

Prakruti		Medho sara			Total
		Pravara	Madhyama	Avara	
Vata Pitta	Count	1	25	1	27
	%	28.3%	33.9%	18.8%	100%
Pitta Vata	Count	2	9	0	11
	%	36.4%	45.12%	13.3%	100%
Pitta Kapha	Count	0	3	0	3
	%	0	100%	0	100%
Kapha Pitta	Count	22	40	1	63
	%	34.9%	63.5%	1.6%	100%
Kapha Vata	Count	17	85	1	103
	%	16.5%	82.52%	0.9%	100%
Vata Kapha	Count	11	33	2	46
	%	23.9%	71.7%	4.3%	100%
Total		53	195	5	253

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

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

Parameters for *Medho Sara*	Body fat percentage			
	N	r_s	P	Remark
SnigdhaVarna	253	0.004	0.953	NS
Snigdha Swara	253	0.029	0.642	NS
Snigdha Netra	253	0.012	0.844	NS
Snigdha Kesha	253	0.055	0.385	NS
Snigdha Loma	253	-0.073	0.250	NS
Snigdha Nakha	253	-0.086	0.172	NS
SnigdhaDanta	253	-0.036	0.571	NS
Snigdha Oshta	253	-0.128	0.043	S
Snigdha Mutra	253	0.052	0.381	NS
Snigdha Pureesha	253	-0.132	0.035	S
Snigdha Sweda	253	0.079	0.212	NS
Bruhat Shareera	253	0.631	0.000	HS
Ayasa Asahishnu	253	0.082	0.192	NS

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 *Pramanataha* (quantity) perform *Snehana Karma* (unctuousness) to the body. The Overfat and Obese range refers to the condition of *Sthoulya*, (obesity) which may arise through increased *Snehana* function of *Medho Vruddhi* (increase in adiposity) *(Gunataha* (quantitatively) and *Karmataha*(Vagbhata, 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.*(Vagbhata, 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 gluteal-femoral region, following a gynoid pattern. In contrast, men tend to store more fat in the visceral/abdominal depot, following an android pattern. This review examines variations in regional adipose tissue deposition, mobilisation, and oxidation that may contribute to disparities in body fat distribution between genders.(Blaak, 2001)

The results suggest that there is a highly significant difference between the underlying distributions of the **Frequency** scores of males and females (z = -12.787, p = 0.000); **Intensity** scores of males and females (z = -5.969, p = 0.000); **MPT** scores of males and females (z = -3.721, p = 0.000). For females, endocrinological changes result in more massive vocal folds and consequently 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 $_{min, max.}$ 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., 2013b)It appears that overfat and obese subjects phonate at significantly higher values of Fundamental frequency $_{min,max}$ levels. They have greater diaphragmatic motion 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 through more air which is pushed through the glottis thus expanding the glottal flow wave. Whereas subjects of Healthy BODY FAT PERSENTAGE 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 PERSENTAGE 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 PERSENTAGE is the most reliable objective parameter to examine *Medho Sara* in a clinical examination.

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