A CROSS-SECTIONAL STUDY TO UNDERSTAND NIDANAS OF STHOULYA WITH RESPECT TO BODY COMPOSITION ANALYSIS

Jyothsna CA [1]*, Shashirekha SD [2], Prasanna Kulkarni [3], Priyanka BV [4], Kiran M Goud [5]
[1] Research Scholar, Sri Kalabhyraveshwaraswamy Ayurvedic Medical College
Hospital and Research Centre, Bangalore, Karnataka, India
[2] Associate Professor, Department of Swasthavritta, Sri Kalabhyraveshwaraswamy Ayurvedic Medical College
Hospital and Research Centre, Bangalore, Karnataka, India
[3] Professor & HOD, Department of Swasthavritta, Sri Kalabhyraveshwaraswamy Ayurvedic Medical College
Hospital and Research Centre, Bangalore, Karnataka, India
[4] Professor & HOD, Department of Samhita and Siddhanta, Sri Kalabhyraveshwaraswamy Ayurvedic Medical College
Hospital and Research Centre, Bangalore, Karnataka, India
[5] Professor, Department of Panchakarma, Sri Kalabhyraveshwaraswamy Ayurvedic Medical College
Hospital and Research Centre, Bangalore, Karnataka, India

*Corresponding author
E-mail: jyothsna.c.arunkumar@gmail.com

ABSTRACT

Obesity is a global health concern with multifaceted causes and far-reaching consequences. This study explores the etiological factors (nidanas) of Sthoulya as described in Ayurvedic literature and correlates them with contemporary body composition parameters using a cross-sectional study and stratified random sampling involving 100 subjects. Body composition analysis (BCA) was conducted using measuring parameters such as body fat percentage, BMI, visceral fat, muscle mass, etc. Correlation coefficients were calculated to identify relationships among these variables. The purpose of this study is to correlate Ayurvedic nidanas with Body Composition Parameters, explore the relationships and correlations among weight, fat percentage, bone density, visceral fat and BMI and investigate the impact of lifestyle factors, including dietary habits, on body composition metrics. In this study, we correlated Ayurvedic nidanas with BCA components. Noteworthy correlations were observed, which included the association of sweets, milk, chips and other fried items with higher fat percent levels. Anupa mamsa (chicken meat), rice boiled with milk, and paya (boiled milk) correlated with higher muscle mass. Salty snacks, baked foods, cheese, cold items (sheeta aahara) and 'having more quantity of food' - atibhojana were linked to higher visceral fat levels. This correlation and understanding of the relations provide insights into the interplay between Ayurvedic concepts and modern scientific parameters, contributing to a comprehensive understanding of obesity. The study emphasizes the significance of considering holistic factors, including dietary habits and lifestyle, in addressing obesity and designing personalized interventions for better health outcomes.

Keywords: Nidhanas of sthoulya, sthoulya, Obesity, BCA, Muscle mass, Fat percentage.

INTRODUCTION

Obesity is a chronic health condition characterized by an excessive accumulation of body fat, often leading to adverse effects on one's overall health and well-being.[1] Obesity is a multifactorial condition influenced by a combination of genetic, environmental, and lifestyle factors. The prevalence of obesity has risen significantly worldwide, posing a major public health challenge[2]. This condition is associated with an increased risk of various health issues, including heart disease, type 2 diabetes, certain cancers, and musculoskeletal disorders. Additionally, obesity can have a substantial impact on mental health, contributing to conditions such as depression and anxiety[3]. The primary contributors to obesity include unhealthy dietary patterns, sedentary lifestyles, genetic predisposition, and environmental factors. Poor eating habits, characterized by consuming high-calorie, low-nutrient foods and a lack of physical activity, often contribute to weight gain. Hence, obesity is a significant health concern with far-reaching consequences.[4]

Sthoulya, a term rooted in Ayurveda, refers to obesity or excessive weight gain, highlighting the ancient Indian system's holistic approach to health and well-being. In Ayurveda, the concept of Sthoulya, or obesity, is often associated with an imbalance in the Kapha dosha, leading to specific nidanas or causative factors related to mamsavriddhi (muscle tissue growth) and medovriddhi (adipose tissue growth). Understanding these nidanas within the context of Kapha dosha provides insights into the Ayurvedic approach to managing obesity.

Sthoulya definition

A person having the pendulous appearance of sphika (hip), udara (abdomen) and stana (chest) due to excess deposition of meda along with mamsa dhatu and also having an unequal or abnormal distribution of meda with reduced zeal towards life is called Atisthula

In short, it can be defined as "A person who due to extensive growth of fat and flesh is unable to work and disfigured with pendulous buttocks, belly and chest is called Atisthula, and the condition is termed as Ati Sthaulya.[5]

Sthoulya nidanas

The causative factors known for a disease are called Nidana for that particular disease.

Ayurveda acharyas have described many etiological factors of Sthaulya roga in the Samhitas, which are related to all aspects of life and affect the body from outside and inside. The hereditary component (beeja dosha) besides dietetic (aaharaja), regimen (viharaja) and psychological factors (manasikabhavas) in the causation of Sthaulya is described by Charaka Samhita.[6] Except these factors, other components which may vitiate Meda and Shleshma are mentioned by Acharya Sushruta and Vagbhatta.[7] Dhatwagni-mandya is the leading cause besides other components in etiopathology of Sthaulya according to Ashtanga Samgraha.

Table 1: Nidanas according to different Acharyas [8]

Aaharaja Nidanas	CH	SU	AS
Atibhojana (Overeating)	+	+	+
Guru Aharasevana (Excessive consumption of heavy food)	+	-	-
Madhur Aharasevana (Consumption of sweet food)	+	-	-
Sheeta Aharasevana (Excessive consumption of cold items)	+	-	-
Snigdha Aharasevana (Excessive consumption of oily or unctuous food)	+	-	-
Navanna Sevana (Usage/consumption of fresh rice)	+	-	-
Nava Madyasevena (Usage of freshly prepared alcoholic beverages)	+	-	-
Gramya Rasa sevana (Usage of Domestic animal's meat and soups)	+	-	-
Paya Vikara Sevana (Excessive usage of milk and milk products)	+	-	+
Dadhi Sevana (Excessive consumption of curd)	+	-	-
Sleshmala Aharasevana (Kapha increasing food)	+	+	-
Guda Vikara Sevana (Usage of Jaggery's and its products or its preparation)	+	-	-
Mamsa Sevana (Excessive use of meat)	+	-	-
Pistanna sevana (Use of flours)	+	-	-
Viharaja Nidanas	**CH**	**SU**	**AH**
Avyayaam (Sedentary lifestyle)	+	+	-
Avyavaya (No coitus)	+	-	-
Divaswapa (Day time sleep)	+	+	-
Sukha Shaiya (Sitting for a long time)	+	-	+
Svapna Prasangat (Good deep sleep)	+	-	-

CH- Charaka Samhita, SU- Sushruta Samhita and AH- Ashtanga Hridaya

Medavriddi and Mamsavriddi Nidana and Samprapti

In persons who indulge in foods which cause Kapha vriddi, who are habituated to overeating food and often, who do not do any physical exercise and sleep during daytime etc., the food remains undigested and attains more madhura: this rasa dhatu circulating throughout the body produces more of medas (fat) and mamsa vriddi, this leads to various symptomatology like severe hunger, thirst, etc. As this invades quickly, it obstructs the srotases, and hence, dhatus don't get sufficient nourishment, making the person obese (Sthaulya).[9]

Body Composition Analysis
Body composition analysis refers to the quantitative assessment of the different components that constitute the human body. Unlike traditional scales that measure overall body weight, body composition analysis breaks down the body into its fundamental constituents, primarily lean body mass (muscle, bones, organs) and body fat. This nuanced approach offers a more accurate reflection of an individual's health and fitness status [10].

Significance of BCA
Precision in Health Assessment, Fitness Monitoring and Goal Setting, Health Risk Assessment and Customized Interventions.[11]

Body Composition Analyzer

Body composition analyzers are sophisticated tools designed to provide detailed insights into the distribution of different body tissues, including fat, muscle, and bone. These analyzers employ various methods to measure and analyze critical parameters, allowing for a comprehensive assessment of an individual's body composition [12].

Here are some essential parameters commonly measured by body composition analyzers [13]:
Body Fat Percentage, Body Mass Index (BMI), Body Water Percentage, Visceral Fat Level, Muscle Mass Distribution, Bone Mass, Basal Metabolic Rate (BMR) and Metabolic Age.

MATERIALS AND METHODS

Source of Data
Data is collected from the Human Subjects using a vetted Questionnaire. Assessment of Nidanas of Sthoulya according to Meda vriddi, Mamsa vriddi and Kapha vriddhi using a questionnaire with respect to Body Composition Analysis.

Aims and Objectives

To explore and analyze the nidanas (causes) of Sthoulya (obesity) as described in Ayurvedic literature and their correlation with contemporary Body Composition Parameters to provide a comprehensive understanding of obesity's etiological aspects from an integrative Ayurvedic and modern scientific perspective.

1. To correlate Ayurvedic nidanas with Body Composition Parameters
2. To explore the relationships and correlations among weight, fat percentage, bone density, visceral fat and BMI.
3. To investigate the impact of lifestyle factors, including dietary habits, on Body Composition Metrics.

Method of Collection of Data

The study was initiated after receiving the Institutional Ethics Committee Clearance (IEC NO. SKAMC AND RC/IEC/ 04/2023). Consent was taken from volunteers. The questionnaire was discussed with academics to select appropriate questions.

Both close-ended and open-ended questions were distributed to volunteers of both genders.

Study design: It is a cross-sectional study.

Sample source: The study was conducted in Shri Kalabhyraveshwara Ayurvedic Medical College, Hospital and Research Centre, Bengaluru, Karnataka, India.

Sampling method: The subjects were selected using a stratified random sampling method.

Sample size: The study was conducted on 100 subjects to assess nidanas related to Sthoulya using a questionnaire compared to the assessment and collection of data Body Composition Analysis.

Inclusion criteria
- Students, healthy individuals and patients of Sthoulya.
- Individuals of either gender, caste, religion, occupation and economic status.
- Age group: 18-60 years.

Exclusion criteria
- Patients aged less than 18 years and more than 60 years
- Pregnant women and lactating mothers
- Patients with metals inside their body
- Patients with regular medications and supplements for their chronic illness.
- History of intake of steroids for more than one month in the past year.
- Secondary obesity (due to diseases or hormonal imbalance).

Programming Method: Python Programming Language.

RESULTS AND DISCUSSION

Table 2: Distribution of subjects based on gender

Number of subjects	Gender	Percentage
32	Male	32%
68	Female	68%

Table 3: Distribution of subjects based on Age

Age	Number of subjects	Percentage
18-19	14	14%
20-21	41	41%
22-23	40	40%
24 and above	5	5%

Table 4: Distribution of subjects based on BMI

Grade	1	2	3
BMI	25-30	30-35	35-40
Number of subjects	65	30	5

Table 5: Distribution of Male subjects based on body fat percentage

Body Fat Percentage in Males	Number of subjects (Males)	Percentage
<7% (under fat)	0	0
7-20% (healthy)	0	0
20-25% (overfat)	9	9%
25-59% (obese)	23	23%

Table 6: Distribution of Female subjects based on body fat percentage

Body Fat Percentage in Females	Number of Females subjects	Percentage
<21% (under fat)	0	0
21-33% (healthy)	0	0
33-40% (over-fat)	28	28%
40-50% (obese)	40	40%

Table 7: Distribution of Subjects based on Body Visceral Fat

Body Visceral Fat	Number of subjects	Percentage
<9 (standard)	56	56%
9-14 (high)	40	40%
>14 (very high)	4	4%

Table 8: Distribution of male subjects based on muscle mass

Body Muscle Mass	Number of Male subjects	Percentage
<33.4 (low)	0	0
33.4-39.4 (normal)	0	0
39.5-44.1 (high)	0	0
>44.2 (very high)	32	32%

Table 9: Distribution of Female subjects based on Muscle Mass

Body Muscle Mass	Number of Female subjects	Percentage
<24.4 (low)	0	0
24.4-30.2 (normal)	0	0
30.3-35.2 (high)	10	10%
>35.3 (very high)	58	58%

Table 10: Distribution of Male subjects based on Body Bone Mass

Body Bone Mass	Number of Male subjects	Percentage
<1	0	0
1-2	0	0
2-3	11	11%
>3	21	21%

Table 11: Distribution of Female subjects based on Body Bone Mass

Body Bone Mass	Number of Female subjects	Percentage
<1	0	0
1-2	9	9%
2-3	57	57%
>3	2	2%

Table 12: Distribution of subjects based on Body Water Percent

Body Water Percentage	Number of subjects	Percentage
35-40%	40	40%
41-45%	54	54%
46-60%	5	5%
61-70%	0	0

Table 13: Distribution of subjects based on body weight

Body Weight	Number of subjects	Percentage
50-60 kg	8	8%
61-70 kg	32	32%
71-80 kg	25	25%
81-90 kg	21	21%
91 kg and above	14	14%

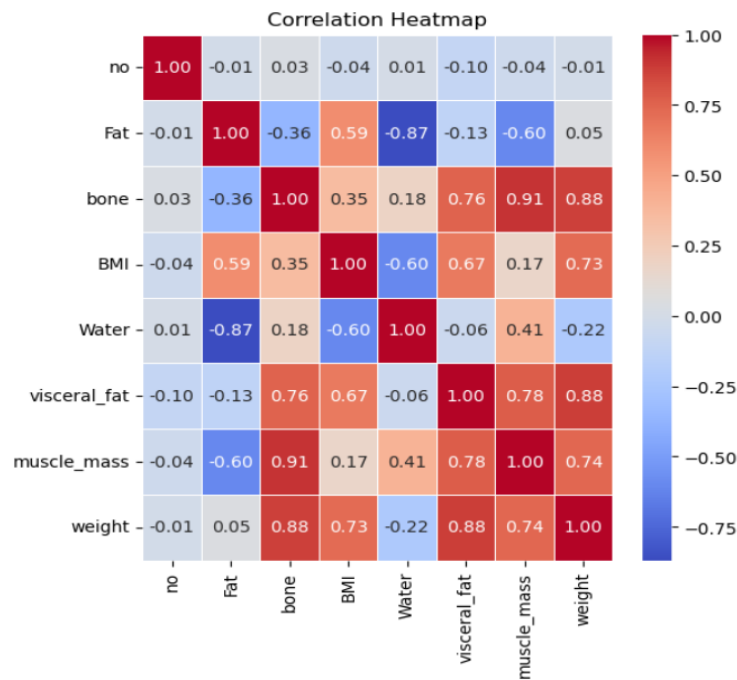**The following insights have been drawn using the Python programming language**

Figure 1: Heat Map of BCA parameters

In the Heat Map, 1.00 refers to a 100% strong positive correlation between the parameters, and -1.00 refers to a 100% strong negative correlation between the parameters.

Following is the description of the correlation coefficients between pairs of variables and the relationship between BCA components and etiological factors:

There is a significant positive correlation between the following parameters. Here, positively correlated means in a pair of variables, if the value of one parameter increases, then the other parameter also increases simultaneously and vice versa. From the above observations, we can see a positive correlation between muscle mass and bone mass (approx.91%), Bone mass and weight (approximately 88%), weight and visceral fat percent (approximately 88%), visceral fat percent and muscle mass (approximately 78%), visceral fat percent and bone mass (approximately 76%), weight and BMI (approximately 73%), BMI and visceral fat (approximately 67%), fat and BMI (approximately 59%), water content and muscle mass (approximately 41%) and lastly between bone mass and BMI (approximately 35%). Here, we can see the highest or strongest positive correlation between muscle mass and bone mass, correlating approximately 91%. That means if muscle mass in our body is high, then bone mass would also be relatively high, whereas the least positively correlated parameters were seen to be between bone mass and BMI, which was approximately 35%. That means if our body's bone mass is high, BMI may not be high or be relatively less correlated than other parameters.

There is a significant negative correlation between the following parameters. Here, negatively correlated means that if one parameter's value increases, another value decreases simultaneously in a pair of variables. From the above observations, we can see a negative correlation between water content and BMI (approximately 60%) and between fat percent and water content (approximately 87%). The highest negatively correlated variable is between fat percent and water content, approximately 87%, which means if the fat percent is more in our body automatically, the water percent will be less.

The study also explores the relation between the BCA parameters and the etiological factors for Sthoulya; from the above observations and results, it is seen that there are positive correlations observed between the consumption of sweets prepared with milk (madhura aahara), milk itself (paya), and chips (snigdha aahara) with a higher body fat percentage (correlation approximately 74%, 63% and 58%) respectively. Similarly, sweets prepared with milk (madhura aahara) and milk (paya) are associated with higher body weight (correlation approximately 68% and 55%), respectively. On the other hand, consuming chicken meat (anupa mamsa), rice boiled with milk (payasa), and milk (paya) is linked to increased muscle mass (correlation approximately 72%, 65% and 58%), respectively. For example, an individual's intake of madhura aahara leads to higher body fat (approximately 74% positive correlation) and hence may be a reason for Sthoulya (obesity).

Furthermore, the study finds that eating salty snacks, baked foods, cheese, cold items (sheeta aahara), and consuming larger quantities of food (atibhojana) is associated with higher levels of visceral fat (correlation approximately 75%, 68% and 64%) respectively, highlighting the impact of dietary choices on the accumulation of fat around the organs. Hence, the findings emphasize strong connections between body composition, nutritional habits, and health outcomes. They suggest that maintaining a balanced diet and healthy body composition can significantly benefit Body composition parameters.

CONCLUSION

The study explores the parallels between ancient Ayurvedic principles and modern scientific methodologies for understanding obesity. By investigating the correlation between the Ayurvedic concept of Sthoulya roga, specifically the imbalance in Kapha dosha and the associated nidanas (causative factors), with contemporary body composition analysis (BCA), significant insights have been garnered into the multifaceted nature of obesity. The research conducted among 100 subjects' findings indicates a profound association between the Ayurvedic causative factors of obesity (Sthoulya) due to mamsavriddhi (muscle tissue growth) and medovriddhi (adipose tissue growth) with modern BCA parameters such as muscle mass, fat percentage, visceral fat, and bone mass. We can see that a few of the etiological factors like madhura aahara sevana, paya, anupa mamsa sevana, snigdha aahara sevana, etc., led to an increase in body parameters such as fat percent, bone mass, muscle mass, visceral fat etc. which suggests from this study we could identify few etiological factors which caused obesity (Sthoulya) in an individual.

The study was conducted among 100 subjects and utilized a comprehensive methodology, questionnaire assessments with BCA. This approach not only reaffirmed the relevance of Ayurvedic wisdom in contemporary health science but also highlighted the significant role of Kapha dosha imbalance in the manifestation of obesity.

In conclusion, this study not only validates the ancient Ayurvedic understanding of obesity but also opens new pathways for integrated therapeutic approaches by bridging the gap between traditional and contemporary methodologies.

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REFERENCES

1. World Health Organization (WHO) "Obesity and overweight." (cited 2002) Available from https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.
2. Bray GA, Kim KK & Wilding JPH. Obesity: A chronic relapsing progressive disease process. A position statement of the World Obesity Federation. Obesity Reviews, 2017;18(7),715–723. Available from https://doi.org/10.1111/obr.12551.
3. Apovian CM. Obesity: Definition, comorbidities, causes, and burden. The American Journal of Managed Care, 2022; 7 Suppl.: s176–s185.
4. Poirier P, Giles TD, Bray GA, Hong Y, Stern JS, Pi-Sunyer FX & Eckel RH. Obesity and cardiovascular disease: Pathophysiology, evaluation, and effect of weight loss: An update of the 1997 American Heart Association Scientific Statement on Obesity and Heart Disease from the Obesity Committee of the Council on Nutrition, Physical Activity, and Metabolism. 2006; 113(6): 898–918. Available from https://doi.org/10.1161/CIRCULATIONAHA.106.171016.
5. Vaidya Ravidatta Tripathi, Charaka Samhita with Vaidymanorama Hindi commentary. Chaukhamba Sanskrit Pratisthan Delhi; Sutrasthana 21/9, 2013: 301.
6. Agnivesha, Charaka, Drudabala, Chakrapanidatta Sutrasthana, Chapter Astounindhitiya Adhyaya, Verse 4.

Charka Samhita with Ayurveda Deepika Commentary. Reprint Edition 2017, Varanasi Chaukhamba Surbharati Prakashan. P 117.

7. Sushruta, Dalhana, Gayadas, Sutra Sthana chapter Doshadhatumalakshayavruddhi vignyana Adhyaya, verse 32. In: Acharya YT(Edi), Sushruta Samhita with Nibandha sangraha and Nyayachandrika commentary. Reprint Edition: 2017. Varanasi: Chaukhamba Surbharati Prakashana: 2017: p. 73

8. Agnivesha, Charaka, Drudabala, Chakrapanidatta. Sutra Sthana, Chapter Astauninditiya Adhyaya, Verse 4. In: Acharya YT(Edi.). Charaka Samhita with Ayurveda Deepika Commentary. Reprint Edition: 2017. Varanasi: Chaukhamba Surbharati Prakashan; 2017. p. 117.

9. Sushruta, Dalhana, Gayadas, sutra Sthana chapter Doshadhatumalakshayavruddhi vignyana Adhyaya, verse 32. In: Acharya YT(Edi), Sushruta Samhita with Nibandha Samgraha and Nyayachandrika commentary. Reprint Edition: 2017. Varanasi: Chaukhamba Surbharati Prakashana: 2017: p. 73.

10. Heymsfield *et al*. Handbook of Anthropometry: Physical Measures of Human Form in Health and Disease. Springer. 2016.

11. Kyle UG *et al*. Bioelectrical impedance analysis - part I: Review of principles and methods. Clinical Nutrition, 2004; 23(5): 1226-1243.

12. Heymsfield SB. Body Composition: An Overview. In Handbook of Anthropometry: Physical Measures of Human Form in Health and Disease. 2016: p. 29-53.

13. Author-Kyle UG *et al*. Bioelectrical impedance analysis - part I: a review of principles and methods. Clinical Nutrition, 2004; 23(5):1226-1243.

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