

Sarcopenic Obesity: Anthropometric Diagnosis

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Abstract

A recent increase in the prevalence of obesity has been noticed in individuals of all age groups. With an increase in life expectancy, more elderly people are affected with obesity. This is often associated with low muscle mass. This entity called as sarcopenic obesity is known to be associated with a significant higher morbidity and mortality. However, due to complex definitions and techniques used to define sarcopenic obesity, it is often under diagnosed in clinical practice. In this manuscript we propose simple, cost effective and easy to use anthropometric indices based on standard south Asian cutoffs that could help in screening and diagnosis of Sarcopenic obesity.

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Introduction

Obesity has reached pandemic proportions globally and is known to affect individuals of all age groups including the elderly population.^{1,2} It is often screened, diagnosed and stratified using body mass index. However, evolution in the understanding of the concept of adiposity, central adiposity and normal weight obesity have led to exploration of newer modalities of diagnosis.³ These include anthropometric measurements such as waist circumference, waist hip ratio and neck circumference, as well as imaging tools like dual energy Xray absorptiometry (DEXA) and bioimpedance analysis (BIA).⁴

Ideally, obesity should be viewed through a wider prism that we term barophenotypic characterization.⁵ Sarcopenic obesity is a unique form of obesity coupled with low muscle mass and is often associated with significant clinical and public health impact.⁶ In addition to skeletal fragility, diabetes, hypertension, dyslipidaemia, cardiovascular disease and even depression has been directly linked to sarcopenic obesity.⁷ Timely identification of sarcopenic obesity will allow institution of preventive and therapeutic measures focused on muscle building and adipose tissue reduction.

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Proposed anthropometric indicators to diagnose Sarcopenic obesity

Currently, the diagnosis of sarcopenia is confirmed by a reduction in muscle mass, measured by DXA or BIA. There is an increased interest in anthropometric tools to identify sarcopenia, with mid-calf circumference (MCC), emerging as a cost effective, simple and an accurate screening tool.⁸

While anthropometric thresholds are in vogue for diagnosis of obesity, and of sarcopenia, there is no composite index to label sarcopenic obesity. Researchers and scientists use two separate investigations to identify sarcopenic obesity: usually a lower muscle mass, and a high body fat. While this approach is valid, its use in clinical practice is limited by the lack of access to DXA in most centers. A simple composite index, based upon easily performed measurements, will allow easy identification of sarcopenic obesity, obviate the need for expensive imaging technology, and allow a "unified" thought process. We propose 3 anthropometric indices to help screen for sarcopenic obesity

1. Waist circumference = WCR = $\frac{\text{Waist calf ratio}}{\text{Calf circumference}}$
2. Calf circumference = CCI = $\frac{\text{Calf central index}}{\text{Waist Hip Ratio}}$
3. Body mass index = BCI = $\frac{\text{Body calf index}}{\text{Calf circumference}}$

All the three indices are based on accepted anthropometric measurements.⁹ Validated normative thresholds are available for both men and women, in various ethnic groups.¹⁰ The formulae are chosen such that the name is easy to pronounce and the resultant ratio is simple to calculate. (Table) The concept allows for rational and pragmatic picturization of the severity of both sarcopenia and obesity, juxtaposed with each other.

Derivation of normative indices

The south Asian ethnicity specific normative ranges for the above mentioned indicators were used to determine the proposed definitions in the Table. The cut points used for defining obesity by using waist circumference; waist hip ratio and body mass index were 80 cm (women) & 90 cm (men); 0.8 (women) & 0.9 (men); 23 kg/m² (in both men and women), respectively.^{4,11} Sarcopenia was defined as calf circumference less than 34 & 33 cm in men and women,

Table: Anthropometric indices for sarcopenic obesity.

Waist circumference/Calf circumference	Normal	<2.5
Waist Calf Ratio	Suspected sarcopenic obesity	2.5 to 3.5
	Confirmed sarcopenic obesity	> 3.5
Calf circumference/waist hip ratio	Normal	> 40
Calf Central Index	Suspected sarcopenic obesity	30-40
	Confirmed sarcopenic obesity	>40
Body mass index/ Calf circumference	Normal	<0.6
Body Calf Index	Suspected sarcopenic obesity	0.6-1.0
	Confirmed sarcopenic obesity	>1.0

respectively. These cut points were used to provide simple easy to use ratios to suspect and define sarcopenic obesity.

We understand that varying ethnic groups, genders and ages may have different cut-offs for suspicion and confirmation of diagnosis of sarcopenic obesity. Through these need to be validated, their use will add value to clinical medicine. We hope that this concept will be studied in future prospective studies, assessed through secondary data analysis of existing data sets and validated in different ethnic populations.

Conclusion

Sarcopenic obesity is being increasingly recognized as an emerging public health problem in elderly people. It is often associated with several comorbidities and has been shown to be an independent risk factor for predicting cardiometabolic disease and its associated mortality. In this manuscript the authors propose simple, cost effective and easy to use indices, based on standard anthropometric measures with previously validated cutoffs that can be used to screen sarcopenic obesity in low resource settings.

References

1. Verma M, Das M, Sharma P, Kapoor N, Kalra S. Epidemiology of overweight and obesity in Indian adults - A secondary data analysis of the National Family Health Surveys. *Diabetes Metab Syndr*. 2021;15:102166.
2. Sridharan K, Cherian KE, Kurian ME, Asha HS, Paul TV, Kapoor N. Utility of anthropometric indicators in predicting osteoporosis in ambulant community dwelling rural postmenopausal women from southern India. *Trop Doct*. 2020;50:228-32.
3. Kapoor N, Lotfaliany M, Sathish T, Thankappan KR, Thomas N, Furler J, et al. Prevalence of normal weight obesity and its associated cardio-metabolic risk factors - Results from the baseline data of the Kerala Diabetes Prevention Program (KDPP). *PLoS One*. 2020;15:e0237974.
4. Kapoor N, Lotfaliany M, Sathish T, Thankappan KR, Thomas N, Furler J, et al. Obesity indicators that best predict type 2 diabetes in an Indian population: insights from the Kerala Diabetes Prevention Program. *J Nutr Sci*. 2020;9:e15.
5. Kalra S, Das S, Kota S, Anne B, Kumar A, Punyani H, et al. Barophenotypic Characterization – The key to Person Centric Management of Obesity. *Indian J Endocrinol Metab*. 2021;25:295-8.
6. Atkins JL, Wannamathée SG. Sarcopenic obesity in ageing: cardiovascular outcomes and mortality. *Br J Nutr*. 2020;124:1102-13.
7. Jose A, Cherian KE, Nandyal MB, Jiwanmall SA, Kattula D, Paul TV, et al. Trabecular Bone Score and Bone Mineral Density in Postmenopausal Women with Morbid Obesity-A Clinical Paradox. *Med Sci (Basel)*. 2021;9.
8. Ito A, Ishizaka M, Kobayashi K, Sawaya Y, Hara T, Nagasaka Y, et al. Changes in the screening efficacy of lower calf circumference, SARC-F score, and SARC-CalF score following update from AWGS 2014 to 2019 sarcopenia diagnostic criteria in community-dwelling older adults. *J Phys Ther Sci*. 2021;33:241-5.
9. Kalra S, Kapoor N, Bhattacharya S, Aydin H, Coetzee A. Barocrinology: The Endocrinology of Obesity from Bench to Bedside. *Med Sci (Basel)*. 2020;8.
10. Kapoor N, Sahay R, Kalra S, Bajaj S, Dasgupta A, Shrestha D, et al. Consensus on Medical Nutrition Therapy for Diabetes (CoMeND) in Adults: A South Asian Perspective. *Diabetes Metab Syndr Obes*. 2021;14:1703-28.
11. Kapoor N, Furler J, Paul TV, Thomas N, Oldenburg B. Ethnicity-specific cut-offs that predict co-morbidities: the way forward for optimal utility of obesity indicators. *J Biosoc Sci*. 2019;51:624-6.