Clinical Nutrition Open Science 67 (2026) 100680

Contents lists available at ScienceDirect

Clinical Nutrition Open Science

journal homepage:
www.clinicalnutritionopenscience.com

Short Communication

Nutritional intake and physical status in older adults with obesity and probable sarcopenic obesity prior to hip and knee arthroplasty☆

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ARTICLE INFO

Article history:
Received 7 May 2026
Accepted 12 May 2026
Available online 15 May 2026

Key words:
Sarcopenic obesity
Arthroplasty
Nutritional assessment
Body composition
Physical function
Preoperative care

ABSTRACT

Background: Malnutrition and sarcopenia are often overlooked in obese patients, despite their impact on surgical outcomes. In orthopedic care, nutritional risk is typically assessed using BMI or limited biomarkers, which may fail to appraise important deficits in diet, body composition and physical function.
Objective: To assess preoperative nutritional intake, body composition, and physical function in older adults with obesity and probable sarcopenic obesity awaiting hip or knee arthroplasty.
Methods: Obese patients (BMI $\geq$30 kg/m^2) scheduled for total hip or knee arthroplasty (TKA, THA) were included. Nutritional intake was evaluated through three-day food diaries, body composition via DEXA, and physical function using standardized functional tests. Nutrient intake was compared with Dutch Recommended Daily Allowances and national references.
Results: The study population consisted of 21 women and 8 men (mean age 64 $\pm$10, BMI 35 $\pm$3, 69% TKA). Despite obesity, significant variation was observed in muscle mass, strength, physical

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https://doi.org/10.1016/j.nutos.2026.100680

performance, and dietary intake. Energy intake was below recommended levels for both men and women. Several key micronutrients (e.g., calcium, magnesium, vitamin B6) were frequently consumed at suboptimal levels. A case series of four representative patients (two women, two men) with BMI 30–35 kg/m^2 demonstrated substantial individual diversity in body composition and physical function.

Conclusion: Obese older patients awaiting arthroplasty show considerable heterogeneity in nutritional intake, body composition, and physical function. They cannot be considered as one homogeneous group. Comprehensive assessments beyond BMI and standard screening are needed to identify at-risk patients for developing surgical complications and guide targeted prehabilitation strategies.

Introduction

Obesity is increasingly prevalent among patients undergoing total hip and knee arthroplasty (THA, TKA) and is associated with a higher risk of postoperative complications, including infections, delayed wound healing, and revision surgery [1,2]. While excess body mass is often emphasized, malnutrition and sarcopenia may coexist in patients with obesity and remain underrecognized. The phenotype of sarcopenic obesity—characterized by low muscle mass in the presence of excess adiposity—has been associated with impaired physical function and poorer clinical outcomes [3].

Preoperative nutritional assessment in orthopedic care is commonly limited to BMI or isolated laboratory markers like albumin, which do not capture dietary intake, micronutrient adequacy, or functional muscle capacity. Subsequently, interventions may focus solely at reducing intake to lower BMI, without taking these critical factors into account.

Improved understanding of these factors is crucial for developing personalized prehabilitation strategies and optimizing postoperative recovery, particularly during the preoperative "teachable moment," when patients may be more receptive to lifestyle changes [4].

This study describes baseline dietary intake, body composition, and physical function in older adults with obesity and probable sarcopenic obesity scheduled for hip or knee arthroplasty.

Methods

Patients scheduled for THA or TKA were included from the ProActief study, a previously published pilot randomized controlled trial investigating preoperative prehabilitation targeting physical and nutritional status [5]. Eligibility criteria were BMI $\geq$30 kg/m^2 and probable sarcopenic obesity according to EWGSOP2 criteria [6], defined as low muscle strength (handgrip strength <16 kg in women, <27 kg in men, or chair rise time >15 s) in combination with obesity. Participants with complete baseline measurements were included in this analysis.

Dietary intake was assessed using three-day food diaries (two weekdays and one weekend day). Diaries were checked for completeness (by the dietician together with the patient), digitized, and analyzed using Evry software (HCI Evry, Version 2.9.1.0, Alphen aan den Rijn, the Netherlands), linked to the Dutch Food Composition Table. Mean daily intake of energy, macro- and micronutrients was calculated. Intake was compared with Dutch Recommended Daily Allowances (DRDA) and national intake data from the Dutch Food Consumption Survey (DFCS) [7,8]. Dietary intake analyses were limited to nutrients derived from food consumption; intake from dietary supplements was not included.

Details on the body composition measurements and physical tests can be found in the original manuscript of Oosting *et al.*, where the methodology is described in more detail [5].

Data were assessed for normality using the Shapiro-Wilk test and descriptive statistics are analyzed and presented as mean ± standard deviation and stratified by sex (by use of IBM SPSS Statistics 29). To highlight individual differences among patients with comparable BMI, we selected a case series consisting of two female and two male patients with a BMI between 30 and 35, demonstrating variation in physical function and body composition.

Ethics

The protocol was approved by the Gelderse Vallei Hospital (BCWO 1911-074) and the Medical Ethics Review Committee (METC-WU, ABR: NL.72249.081.19). Written informed consent was obtained. The study complied with the Declaration of Helsinki and local regulations.

Results

Preoperative characteristics of the study population (n = 29) are presented in Table 1. BMI ranged from 30 to 43 (mean 35 ±3) and age from 40 to 82 (mean 64 ±10). Twenty patients were planned for a TKP (Mean BMI 35 ±3 and age 62 ±10) en 9 patients for a THP (Mean BMI 34 ±4 and age 69 ±7).

Mean macro- and micronutrient intake for male and female participants is shown in Table 2. Mean energy intake was below recommended levels in both sexes. Intake of dietary fiber, vitamin D, calcium, magnesium, and vitamin B6 was frequently below DRDA, particularly among women.

The four patients (table 3) had comparable BMI values but fat percentage varied from 29.7% to 51.4%, and ASMI ranged from 6.3 to 10.6 kg/m^2. Only one patient had ASMI value below the sex-specific reference cut-off for sarcopenia [6]. Timed Up & Go times ranged from 8.2 to 20.4 seconds, and the 6-minute walk distance ranged from 210 to 375 meters (with one patient unable to perform the test), indicating poor physical performance.

Table 1
Preoperative characteristics of the study population stratified by sex

Characteristic	Female (n = 21)	Male (n = 8)
Demographic characteristics		
Age (years)	62.7 ± 9.9 (40–82)	69.1 ± 7.6 (60–81)
Height (cm)	169.9 ± 5.9 (1.58–1.80)	179.5 ± 5.7 (1.70–1.87)
Weight (kg)	98.1 ± 11.4 80.5–125.0)	117.8 ± 13.4 (93.0–138.0)
BMI (kg/m^2)	33.9 ± 2.7 (29.9–40.4)	36.6 ± 4.2 30.0–42.6)
ASA 1 (%)	5	0
ASA 2 (%)	52	50
ASA 3 (%)	43	50
Total knee (%)	62	88
Body composition (DEXA)		
Appendicular skeletal muscle mass index (ASMI, kg/m^2)	7.4 ± 0.7 (5.9–8.5)	9.29 ± 1.22 6.7–10.6)
Fat percentage (%)	45.6 ± 4.3 (39.0–52.0)	37.9 ± 7.1 29.7–49.7)
Physical function		
Timed Up and Go (s)	12.4 ± 4.8 (6.4–25.9)	10.1 ± 3.7 (6.0–17.4)
Handgrip strength (kg)	24.7 ± 10.4 (5–43)	43.0 ± 13.8 (24–66)
Six-minute walk distance (m)	289 ± 70 (175–420)	341 ± 77 (255–460)
Inflammation markers		
CRP (mg/L)	7.1 ± 6.5	8.0 ± 8.0
IL-6 (pg/mL)	1.5 ± 4.1	0.6 ± 0.5

Data are presented as mean ± standard deviation (range) unless otherwise stated. Abbreviations: BMI, body mass index; ASA, American Society of Anesthesiologists classification; DEXA, dual-energy X-ray absorptiometry; ASMI, appendicular skeletal muscle mass index; TUG, Timed Up and Go test; CRP, C-reactive protein; IL-6, interleukin-6. ASA classification and prosthesis type are presented as percentages.

Table 2
Preoperative macro- and micronutrient intake of the study population compared to recommended daily allowances and national reference values, stratified by sex

	Female			Male		
	Study population mean ± SD	Recommended (DRDA)	Dutch population (DFCS)	Study population mean ± SD	Recommended (DRDA)	Dutch population (DFCS)
Macronutrients						
Energy (kcal/day)	1543 ± 343	1800	1653	1821 ± 337	2300	2011
Protein (g/day)	73 ± 19	81	72	91 ± 28	98	84
Carbohydrates (g/day)	150 ± 34	180–315[a]	191	160 ± 30	230–403[a]	230
Dietary fiber (g/day)	15 ± 5	25	19	19 ± 7	30	22
Total fat (g/day)	63 ± 18	44–89[b]	67	75 ± 27	55–111[b]	84
Saturated fat (g/day)	24 ± 8	<20	27	26 ± 10	<25	32
Trans fat (g/day)	0.5 ± 0.3	<2	1.3	0.5 ± 0.4	<2.5	1.5
Alcohol (g/day)	7 ± 11	0	7	15 ± 18	0	18
Micronutrients						
Calcium (mg/day)	902 ± 303	1100	920	910 ± 454	950	999
Iron (mg/day)	7.9 ± 1.6	9	9.2	14 ± 7	9	11
Sodium (mg/day)	1951 ± 644	1500	2370	2114 ± 636	1500	3055
Potassium (mg/day)	2691 ± 681	3100	3111	4317 ± 2765	3500	3664
Magnesium (mg/day)	268 ± 72	280	290	378 ± 225	350	342
Zinc (mg/day)	8.8 ± 2.6	7	9.3	12 ± 4	9	11
Vitamin B6 (mg/day)	1.2 ± 0.5	1.5	1.7	1.4 ± 0.4	1.8	2.1
Vitamin B12 (μg/day)	4.1 ± 1.5	2.8	4.6	5.1 ± 2.5	2.8	5.6
Vitamin C (mg/day)	80 ± 53	75	103	78 ± 47	75	104
Vitamin D (μg/day)	1.9 ± 0.9	10	3.8	3.9 ± 2.8	10	4.6

Data are presented as mean ± standard deviation. Abbreviations: DRDA, Dutch Recommended Daily Allowances; DFCS, Dutch Food Consumption Survey.
[a] Carbohydrate requirements calculated as 40–70% of the recommended total energy intake.
[b] Total fat requirements calculated as 20–40% of the recommended total energy intake.

Discussion

Despite a similar BMI range, older adults awaiting hip or knee arthroplasty showed pronounced heterogeneity in muscle mass, strength, physical performance, and dietary intake. Variability in fat percentage, appendicular skeletal muscle mass, and functional outcomes demonstrates that BMI alone does not adequately reflect physical reserve. This aligns with evidence that BMI is an incomplete measure of obesity-related risk and that broader assessment of body composition and function is needed to understand surgical outcomes [1,3]. Although obesity is associated with increased risks of postoperative complications and revisions [2], BMI does not differentiate between patients with preserved and impaired muscle function.

The case series illustrates this point vividly. Consider the two female patients with nearly identical BMI values (32.0 vs. 32.3 kg/m^2): the 82-year-old had a fat percentage of 51.4%, an ASMI of 6.3 kg/m^2, and was unable to complete the chair rise test or walk more than 210 metres in six minutes, while the 57-year-old had a fat percentage of 39.0%, an ASMI of 7.4 kg/m^2, and completed 242 metres. In the male pair (BMI 30.0 vs. 34.9 kg/m^2), functional capacity diverged even more sharply: one patient could not perform the six-minute walk test at all, while the other walked 375 metres and completed the chair rise test in 23 seconds. These contrasts underscore that patients with comparable BMI can differ fundamentally in their preoperative risk profile and, consequently, in the type and intensity of prehabilitation they require.

Reported energy intake was generally lower than expected, with inadequate protein and micronutrient intake in several patients. Compared with Dutch dietary reference values and data from the general Dutch population, participants showed particularly low intakes of fiber and vitamin B6, while sodium intake exceeded recommendations. Given the well-documented tendency toward underreporting in self-reported dietary assessments among individuals with obesity [9], it is highly likely that some degree of underreporting occurred in our cohort. Nevertheless, even when accounting for

Table 3
Baseline characteristics, sarcopenia screening, body composition, physical function, nutritional intake, and inflammation markers of four patients with suspected sarcopenia

Category	Variable	Pt 1	Pt 3	Pt 2	Pt 4
Demographic characteristics	Age (years)	82	57	81	74
	Sex	Female	Female	Male	Male
	Type of surgery	Knee	Knee	Hip	Knee
	BMI (kg/m^2)	32.0	32.3	30.0	34.9
Sarcopenia & malnutrition screening	SARC-F (score)	7	5	4	5
	Handgrip strength (kg)	20	15	24	66
	Chair Rise Test (s)	Not able[a]	24.9	Not able[a]	23.0
	SNAQ score	0	0	0	0
Body composition (DEXA)	Fat percentage (%)	51.4	39.0	42.2	29.7
	ASMI (kg/m^2)	6.3	7.4	6.7	10.6
Physical function	Timed Up & Go (s)	20.4	19.4	17.4	8.2
	6-Minute Walk Distance (m)	210	242	Not able	375
Inflammation markers	CRP (mg/L)	7.0	<4	<4	<4
	IL-6 (pg/mL)	3.0	0.04	0.9	0.04
Nutritional intake	Energy (kcal/day)	1368	1666	1977	2272
	Protein (g/day)	75	65	122	104

Abbreviations: BMI, body mass index; SARC-F, Sarcopenia Functional Questionnaire; DEXA, dual-energy X-ray absorptiometry; ASMI, appendicular skeletal muscle mass index; SNAQ, Simple Nutritional Assessment Questionnaire; CRP, C-reactive protein; IL-6, interleukin-6. Reference values for sarcopenia: SARC-F $\geq$4, handgrip strength <16 kg (female)/<27 kg (male), chair rise test >15 s, ASMI <5.5 kg/m^2 (female)/<7.0 kg/m^2 (male); for malnutrition: SNAQ $\geq$2; for reduced physical capacity: six-minute walk distance <400 m.

[a] Patient was unable to perform the chair rise test without using hands.

this probable bias, the observed patterns suggest that undernutrition and poor dietary quality may be more relevant concerns than excessive caloric intake. Importantly, our previous pilot study demonstrated that adapting the habitual diet to increase protein intake without the use of supplements was feasible in this population [5]. The present additional analyses provide further direction for optimizing such interventions, for example by targeting insufficient fiber intake or specific micronutrient inadequacies, thereby moving toward a more comprehensive dietary strategy.

These findings highlight the importance of integrating structured nutritional and functional assessment into preoperative care and of developing practical screening approaches that adequately capture probable sarcopenic obesity–related risk profiles [4–6]. Given the growing emphasis on prehabilitation in orthopedic surgery, routine preoperative body composition assessment combined with comprehensive dietary evaluation seems warranted. Although DEXA was used in this study, more affordable and widely available alternatives such as bioelectrical impedance analysis (BIA) may offer a practical route to implementation in standard orthopedic pathways. Several limitations should be acknowledged. The sample size (n = 29, including only 8 men) limits statistical power; sex-stratified comparisons are therefore exploratory and should be interpreted with caution. Additionally, food-diary data alone cannot confirm true nutrient inadequacy: future studies should complement dietary records with biochemical indices (e.g., serum 25(OH)D, vitamin B6, magnesium) to validate observed deficiencies.

Conclusion

Older patients with obesity undergoing hip or knee arthroplasty differ substantially in functional capacity and nutritional intake. BMI alone is insufficient for risk stratification; assessment of muscle function and nutritional status, combined with targeted multicomponent interventions, may better support optimal surgical outcomes.

Author contributions

All authors had a substantial contribution to the conception to this study, reviewed it critically and gave final approval of the version to be published. They agreed to be accountable for all aspects of the

work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

EO: conception and design, analysis and interpretation of the data, drafting of the article, obtaining of funding, collection of data, MH: conception and design, interpretation of the data, critical revision of the article for important intellectual content, collection of data. JE: analysis and interpretation of the data, critical revision of the article for important intellectual content, statistical expertise. HH: critical revision of the article for important intellectual content. MM: critical revision of the article for important intellectual content. JZ: conception and design, interpretation of the data, critical revision of the article for important intellectual content.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used ChatGPT (OpenAI) to check and improve the grammar and language of the manuscript. After using this tool, the authors carefully reviewed and edited the content as needed and take full responsibility for the content of the published article.

Role of the funding source

This study was partly funded by a grant from the Research Fund of Hospital Gelderse Vallei. This grant sponsor has no involvement in the study design, collection, analysis and interpretation of data; in the writing of the manuscript; and in the decision to submit the manuscript for publication.

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgements

The study was conducted by a research grant of the Gelderse Vallei hospital.

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