SICOM & AOCO 2024
SOMS International Conference on Obesity & Metabolism
in conjunction with Asia-Oceania Conference on Obesity

Cohort of Sarcopenic Obesity

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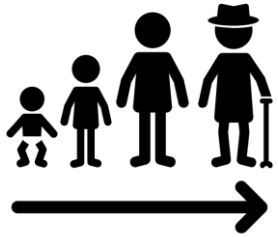
Hosted by SOMS Society for Korean Obesity and Metabolism Studies
Co-Hosted by aoaso Asia Oceania Association for the Study of Obesity

Outline

- The general concept of sarcopenic obesity
- The consensus of sarcopenic obesity
  - EASO & ESPEN
  - Taichung Declaration for sarcopenic obesity in Asia and Oceania Region
- Previous study of sarcopenic obesity
- The cohort of sarcopenic obesity in community in Taichung, Taiwan

The General Concept of Sarcopenic Obesity

Body Composition Changes with Age and The Interplay between Sarcopenia and Obesity



Aging

The change of **body composition**

Sarcopenia

Decline in muscle mass, strength and performance

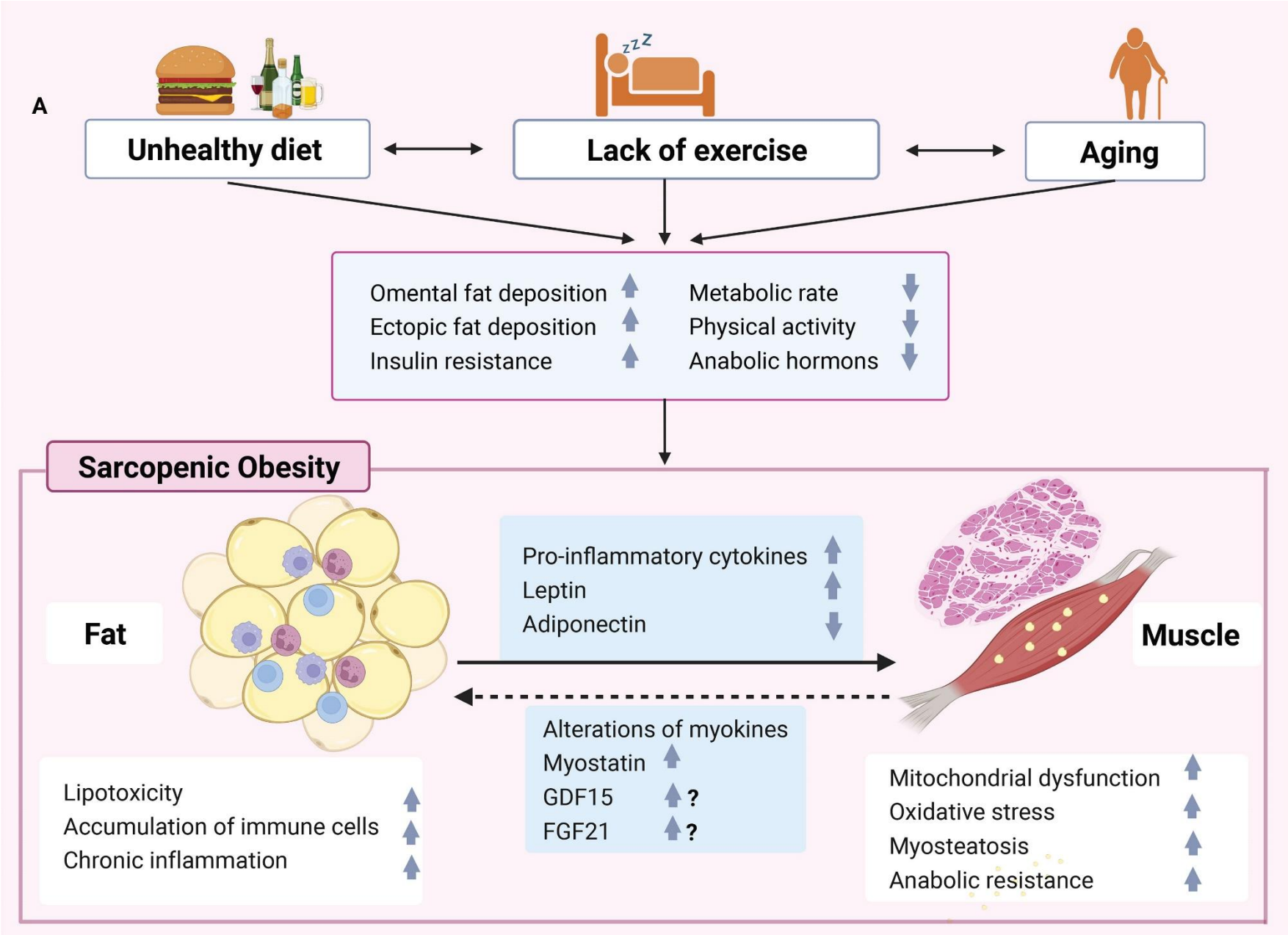
- Decline in physical activity
- Low energy expenditure
- Insulin resistance
- Inflammation

Obesity

Increase in abdominal/ visceral fat

Sarcopenic Obesity

• Atkins, J., & Wannamathee, S. (2020). Sarcopenic obesity in ageing: Cardiovascular outcomes and mortality. *British Journal of Nutrition, 124*(10), 1102-1113. doi:10.1017/S0007114520002172

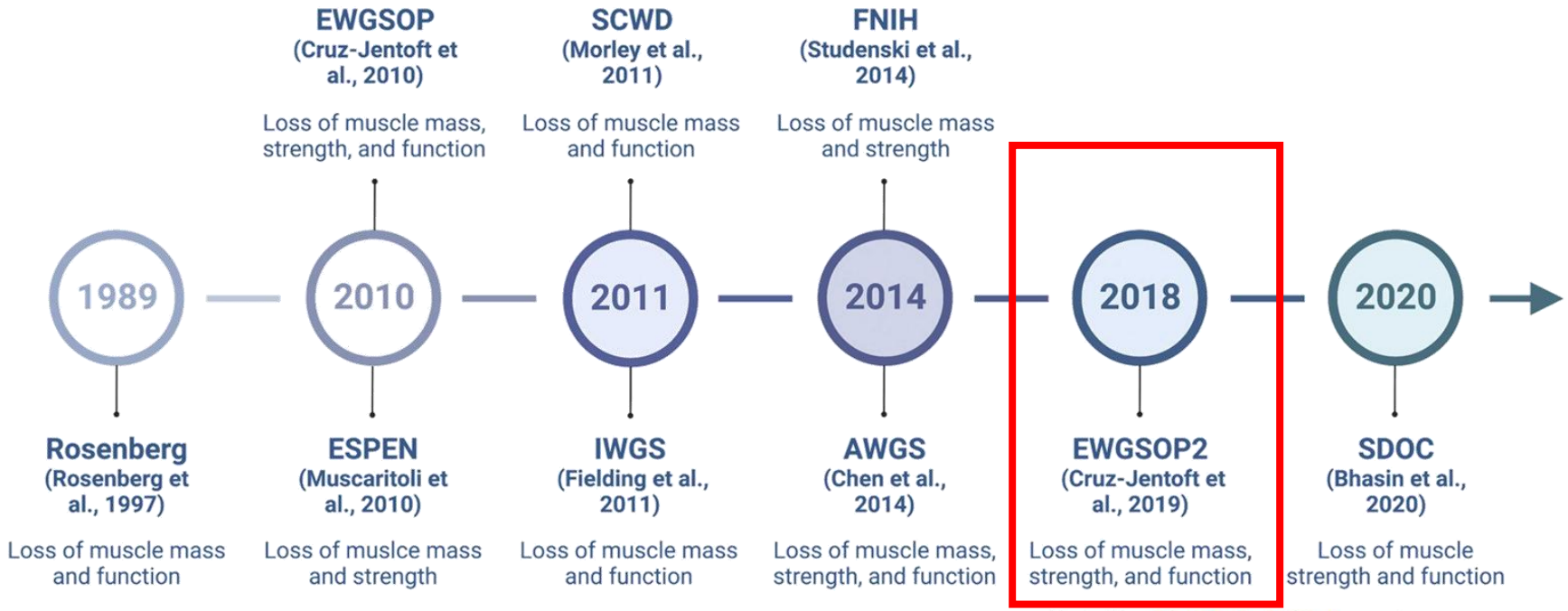


Wei S, Nguyen TT, Zhang Y et al. Sarcopenic obesity: epidemiology, pathophysiology, cardiovascular disease, mortality, and management. Frontiers in Endocrinology, 14 ,2023; DOI=10.3389/fendo.2023.1185221

The Definition of Sarcopenia

Sarcopenia is a progressive and generalized skeletal muscle disorder that is associated with increased likelihood of adverse outcomes including falls, fractures, physical disability and mortality.

Loss of muscle **mass** Loss of muscle **strength** Loss of muscle **function**



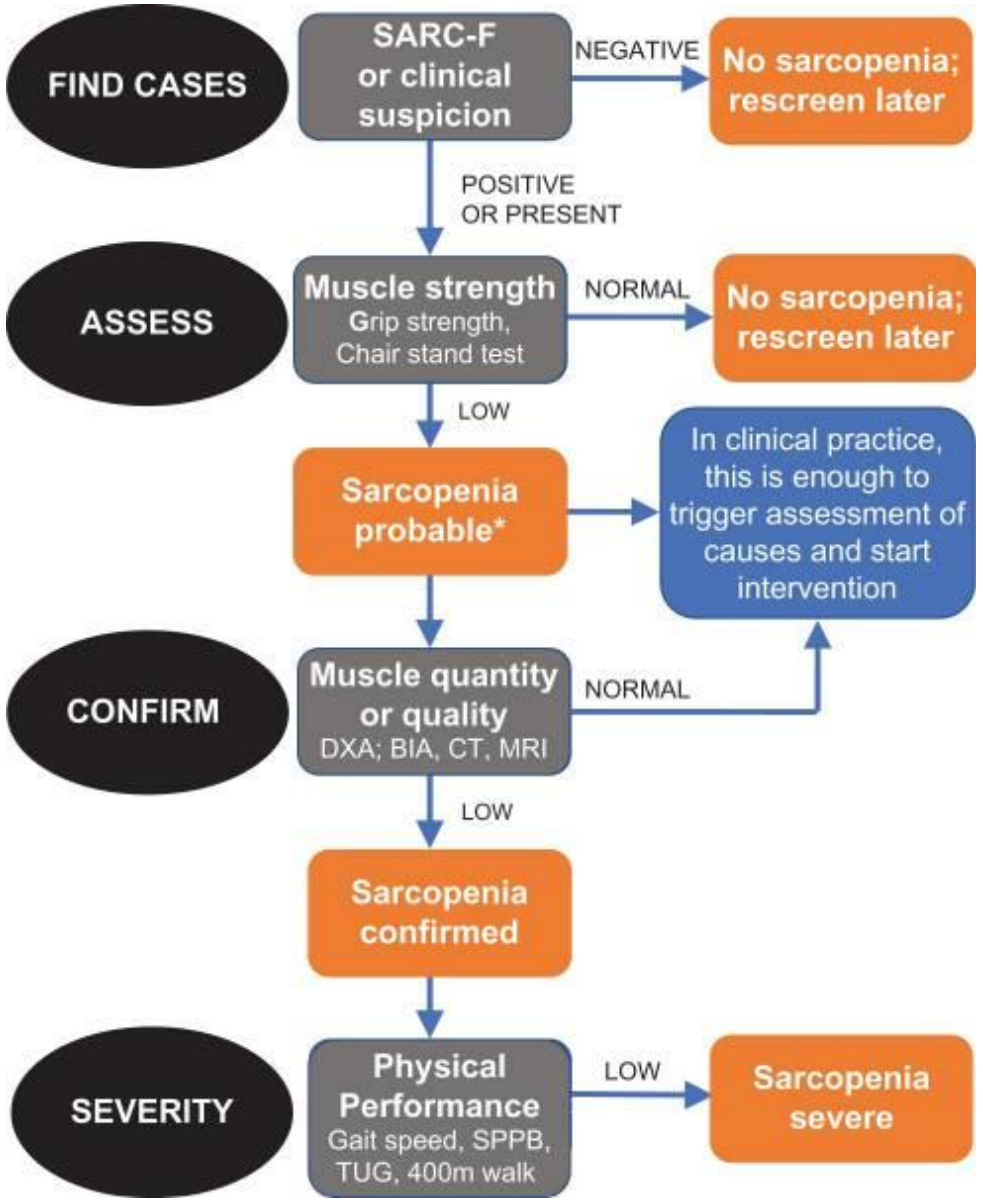
Alfonso J Cruz-Jentoft and others, Sarcopenia: revised European consensus on definition and diagnosis, *Age and Ageing*, Volume 48, Issue 1, January 2019, Pages 16–31, https://doi.org/10.1093/ageing/afy169

Sarcopenia:
EWGSOP2 algorithm for case-finding, making a diagnosis and quantifying severity in practice.

Probable sarcopenia — **Muscle strength**

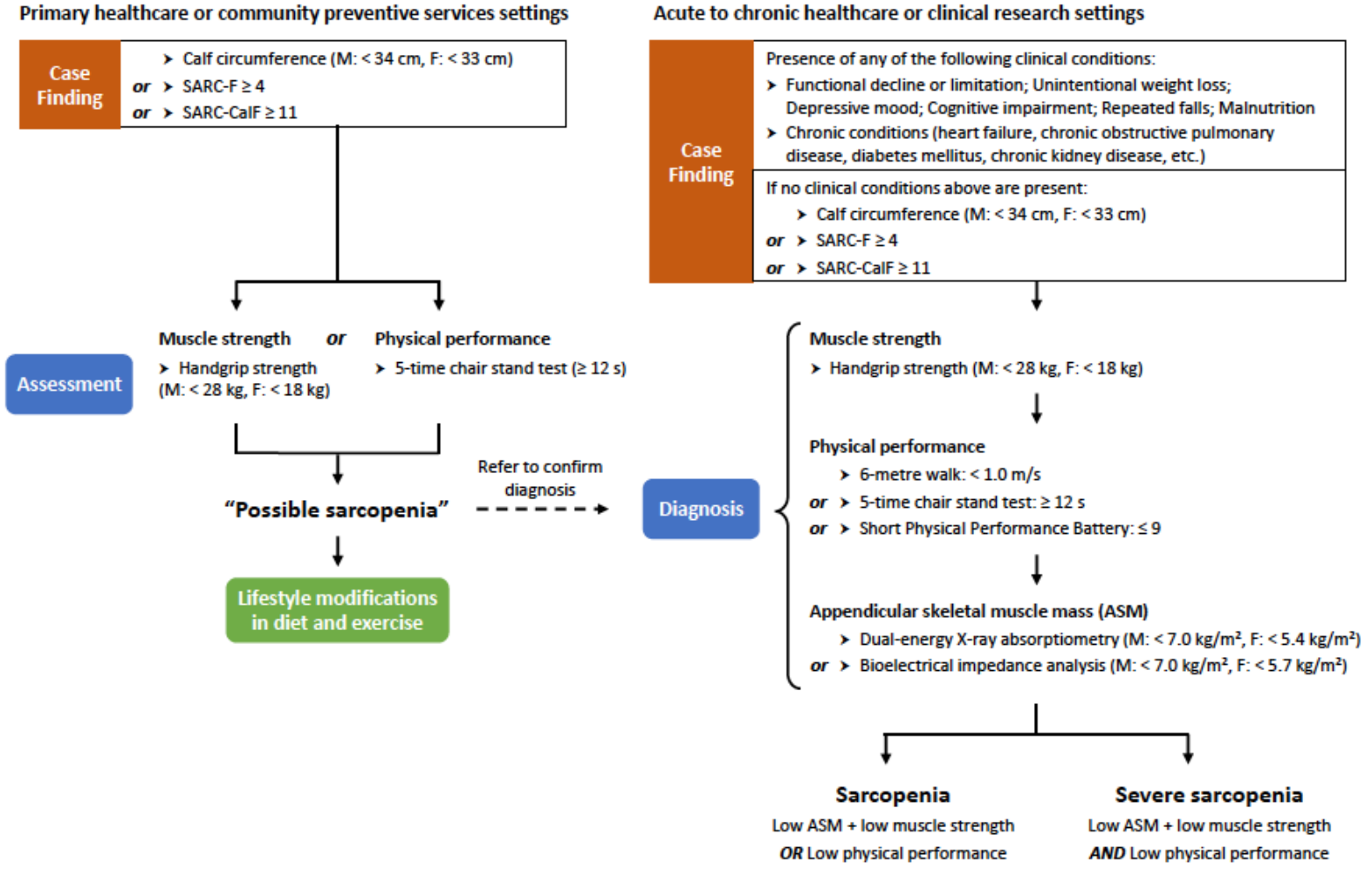
Sarcopenia — **Muscle strength**
Muscle quantity/quality

Severe sarcopenia — **Muscle strength**
Muscle quantity/quality
Physical performance



Alfonso J Cruz-Jentoft and others, Sarcopenia: revised European consensus on definition and diagnosis, *Age and Ageing*, Volume 48, Issue 1, January 2019, Pages 16–31, https://doi.org/10.1093/ageing/afy169

Diagnostic algorithm of Sarcopenia, Asian Working Group for Sarcopenia (AWGS) Criteria 2019



J Am Med Dir Assoc. 2020 Mar;21(3):300-307.e2.doi: 10.1016/j.jamda.2019.12.012.

Diagnostic algorithm of Sarcopenia, Asian Working Group for Sarcopenia (AWGS) Criteria 2019

Primary healthcare or community preventive services settings

Case Finding

- Calf circumference (M: < 34 cm, F: < 33 cm)
- *or* SARC-F ≥ 4
- *or* SARC-CalF ≥ 11

Assessment

Muscle strength	*or*	Physical performance
Handgrip strength (M: < 28 kg, F: < 18 kg)		5-time chair stand test (≥ 12 s)

"Possible sarcopenia" → Refer to confirm diagnosis → **Diagnosis**

Lifestyle modifications in diet and exercise

Calf circumference

https://better5.com/30-second-sit-to-stand-test/

J Am Med Dir Assoc. 2020 Mar;21(3):300-307.e2.doi: 10.1016/j.jamda.2019.12.012.

Diagnostic algorithm of Sarcopenia, Asian Working Group for Sarcopenia (AWGS) Criteria 2019

Acute to chronic healthcare or clinical research settings

Case Finding

Presence of any of the following clinical conditions:

- Functional decline or limitation; Unintentional weight loss; Depressive mood; Cognitive impairment; Repeated falls; Malnutrition
- Chronic conditions (heart failure, chronic obstructive pulmonary disease, diabetes mellitus, chronic kidney disease, etc.)

If no clinical conditions above are present:

- Calf circumference (M: < 34 cm, F: < 33 cm)

or

- SARC-F ≥ 4

or

- SARC-CalF ≥ 11

↓

Diagnosis

J Am Med Dir Assoc. 2020 Mar;21(3):300-307.e2.doi: 10.1016/j.jamda.2019.12.012.

SARC-F

Component	Question	Scoring
Strength	How much difficulty do you have in lifting and carrying 10 pounds?	None = 0 Some = 1 A lot or unable = 2
Assistance in walking	How much difficulty do you have walking across a room?	None = 0 Some = 1 A lot, use aids, or unable = 2
Rise from a chair	How much difficulty do you have transferring from a chair or bed?	None = 0 Some = 1 A lot or unable without help = 2
Climb stairs	How much difficulty do you have climbing a flight of 10 stairs?	None = 0 Some = 1 A lot or unable = 2
Falls	How many times have you fallen in the past year?	None = 0 1–3 falls = 1 4 or more falls = 2

SARC-CalF

Criteria	Questions	Score
Strength	How much is the difficulty to lift/carry 10 pounds (4.5 kilograms) weight?	0=no difficulty 1=some difficulty 2=a lot of difficulty
Assistance	How much is the difficulty to walk across a room and whether the use of aid or help is needed?	0=no difficulty 1=some difficulty 2=a lot of difficulty, use aids, or unable to do without personal help
Rise	How much is the difficulty to transfer from a chair or bed and whether the use of aid or help is needed?	0=no difficulty 1=some difficulty 2=a lot of difficulty, use aids, or unable to do without personal help
Climb	How much is the difficulty to climb a flight of 10 steps?	0 = no difficulty 1=some difficulty 2=a lot of difficulty
Falls	How many falls are experienced for the past one year?	0=no fall 1=1–3 times falls 2=>3 times falls
Calf Circumference	What is the measurement of the right calf circumference while the legs are relaxed and feet are 20 cm apart	Male <34 cm=10 points Male ≥34 cm=0 point Female <33 cm=10 points Female ≥34 cm=0 point

Diagnostic algorithm of Sarcopenia, Asian Working Group for Sarcopenia (AWGS) Criteria 2019

Diagnosis

Muscle strength

- Handgrip strength (M: < 28 kg, F: < 18 kg)

↓

Physical performance

- 6-metre walk: < 1.0 m/s

or

- 5-time chair stand test: ≥ 12 s

or

- Short Physical Performance Battery: ≤ 9

https://better5.com/30-second-sit-to-stand-test/

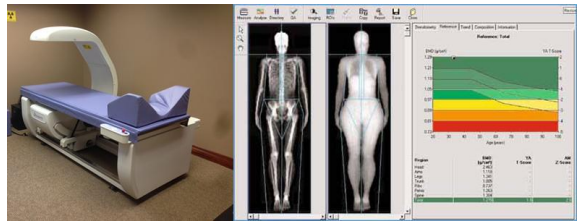
↓

Appendicular skeletal muscle mass (ASM)

- Dual-energy X-ray absorptiometry (M: < 7.0 kg/m², F: < 5.4 kg/m²)

or

- Bioelectrical impedance analysis (M: < 7.0 kg/m², F: < 5.7 kg/m²)



https://www.renuehealth.com/dexa-scan/

J Am Med Dir Assoc. 2020 Mar;21(3):300-307.e2.doi: 10.1016/j.jamda.2019.12.012.

Diagnostic algorithm of Sarcopenia, Asian Working Group for Sarcopenia (AWGS) Criteria 2019

Muscle strength

- Handgrip strength (M: < 28 kg, F: < 18 kg)

Or ↓ **And**

Physical performance

- 6-metre walk: < 1.0 m/s
- *or* 5-time chair stand test: ≥ 12 s
- *or* Short Physical Performance Battery: ≤ 9

Sarcopenia
Low ASM + low muscle strength
OR Low physical performance

Severe sarcopenia
Low ASM + low muscle strength
AND Low physical performance

+ ↓ **+**

Appendicular skeletal muscle mass (ASM)

- Dual-energy X-ray absorptiometry (M: < 7.0 kg/m², F: < 5.4 kg/m²)
- *or* Bioelectrical impedance analysis (M: < 7.0 kg/m², F: < 5.7 kg/m²)

J Am Med Dir Assoc. 2020 Mar;21(3):300-307.e2.doi: 10.1016/j.jamda.2019.12.012.

The consensus of sarcopenic obesity

EASO & ESPEN
Taichung Declaration for sarcopenic obesity in Asia and Oceania Region

The consensus of sarcopenic obesity

EASO & ESPEN

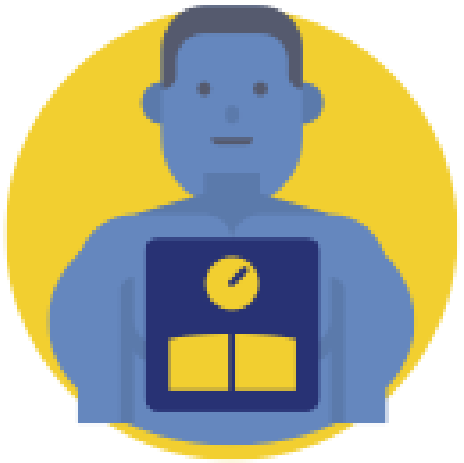
ESPEN FACT-SHEET

SARCOPENIC OBESITY

ESPEN and EASO consensus statement on definition and diagnostic criteria

OBESITY + SARCOPENIA = SARCOPENIC OBESITY

OBESITY + SARCOPENIA = SARCOPENIC OBESITY



Abnormal and excessive fat accumulation

+

Loss of skeletal muscle mass and function

strong negative clinical impact,
may lead to disabilities,
complications,
it negatively affects health
and survival.

3

- **STAGE I:** NO complications
- **STAGE II:** at least one complication attributable to SO

(e.g. metabolic diseases, functional disabilities, cardiovascular and respiratory diseases)

The European Society for Clinical Nutrition and Metabolism (ESPEN) www.espen.org
The European Association for the Study of Obesity (EASO) www.easo.org
Donini LM, et al . Clin Nutr. 2022 Apr;41(4):990-1000. doi: 10.1016/j.clnu.2021.11.014.
Donini LM, et al. Obes Facts. 2022 Feb 23:1-15. doi: 10.1159/000521241.

ESPEN

SARCOPENIC OBESITY

ESPEN and EASO consensus statement on definition and diagnostic criteria

3 STEPS IDENTIFICATION

1.Screening

1

a. HIGH BMI or WC (based on ethnic cut-points)
b. SURROGATE PARAMETERS FOR SARCOPENIA (clinical symptoms, clinical suspicion or questionnaires (e.g. SARC-F in older subjects)

Both conditions (a+b) must be present to proceed with diagnosis

2.Diagnosis

2

c. ALTERED SKELETAL MUSCLE FUNCTIONAL PARAMETERS (Hand grip strenght, chair stand test). **If yes, go to d.**
d. ALTERED BODY COMPOSITION: ↑%fat mass (FM) and ↓muscle mass (MM: ALM/W by DXA or SMM/W by BIA)

Both conditions (c+d) must be present to assess the presence of sarcopenic obesity (SO).

3.Staging

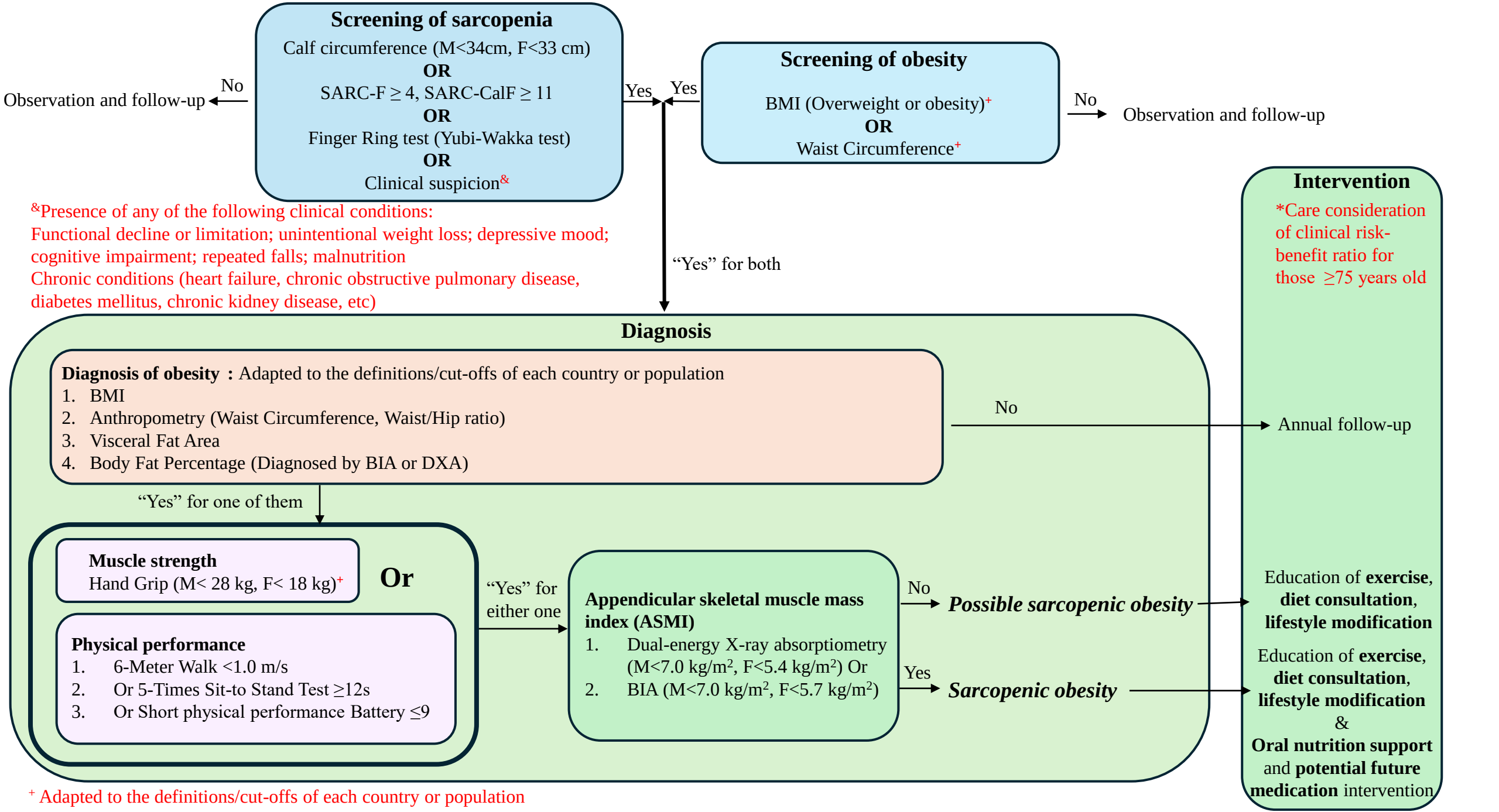
3

A two-level STAGING based on complications from ↑ FM and ↓MM
– **STAGE I:** NO complications
– **STAGE II:** at least one complication attributable to SO (e.g. metabolic diseases, functional disabilities, cardiovascular and respiratory diseases)

The European Society for Clinical Nutrition and Metabolism (ESPEN) www.espen.org
The European Association for the Study of Obesity (EASO) www.easo.org
Donini LM, et al . Clin Nutr. 2022 Apr;41(4):990-1000. doi: 10.1016/j.clnu.2021.11.014.
Donini LM, et al. Obes Facts. 2022 Feb 23:1-15. doi: 10.1159/000521241.

The consensus of sarcopenic obesity

Taichung Declaration for sarcopenic obesity in Asia and Oceania Region


Screening of sarcopenia
Calf circumference (M<34cm, F<33 cm)
OR
SARC-F ≥ 4, SARC-CalF ≥ 11
OR
Finger Ring test (Yubi-Wakka test)
OR
Clinical suspicion&
No
Observation and follow-up
Yes
Yes
Screening of obesity
BMI (Overweight or obesity)+
OR
Waist Circumference+
No
Observation and follow-up
&Presence of any of the following clinical conditions:
Functional decline or limitation; unintentional weight loss; depressive mood; cognitive impairment; repeated falls; malnutrition
Chronic conditions (heart failure, chronic obstructive pulmonary disease, diabetes mellitus, chronic kidney disease, etc)
"Yes" for both
Intervention
*Care consideration of clinical risk-benefit ratio for those ≥75 years old
Diagnosis
Diagnosis of obesity : Adapted to the definitions/cut-offs of each country or population
1. BMI
2. Anthropometry (Waist Circumference, Waist/Hip ratio)
3. Visceral Fat Area
4. Body Fat Percentage (Diagnosed by BIA or DXA)
No
Annual follow-up
"Yes" for one of them
Muscle strength
Hand Grip (M< 28 kg, F< 18 kg)+
Or
Physical performance
1. 6-Meter Walk <1.0 m/s
2. Or 5-Times Sit-to Stand Test ≥12s
3. Or Short physical performance Battery ≤9
"Yes" for either one
Appendicular skeletal muscle mass index (ASMI)
1. Dual-energy X-ray absorptiometry (M<7.0 kg/m², F<5.4 kg/m²) Or
2. BIA (M<7.0 kg/m², F<5.7 kg/m²)
No
Possible sarcopenic obesity
Yes
Sarcopenic obesity
Education of exercise, diet consultation, lifestyle modification
Education of exercise, diet consultation, lifestyle modification & Oral nutrition support and potential future medication intervention
+ Adapted to the definitions/cut-offs of each country or population

Previous study of sarcopenic obesity

The Health Outcomes of Sarcopenic Obesity in Taiwan

Sarcopenia: EWGSOP 2010
Obesity:
(1) Health Promotion Administration in Taiwan: BMI ≥ 27 kg/m^2
(2) Waist circumference of ≥ 90 cm for men and ≥ 80 cm for women
(3) Body fat percentage of > 25 % for men and > 30 % for women

Table 2. Associations of the fall risk between participants with sarcopenia and obesity defined by different obesity parameters

		Sarcopenia			Obesity			Sarcopenic obesity		
	Robust	OR	95 % CI	*P*	OR	95 % CI	*P*	OR	95 % CI	*P*
BMI										
Model 1*	1	0·99	0·39–1·49	0·989	0·67	0·35–1·28	0·227	3·08	1·09–8·71	0·034
Model 2	1	0·93	0·33–2·62	0·889	0·67	0·32–1·39	0·281	4·66	1·42–15·29	0·011
Waist										
Model 1	1	2·10	0·87–5·07	0·098	1·94	1·02–3·70	0·044	4·69	1·53–14·38	0·007
Model 2	1	1·93	0·72–5·22	0·194	2·44	1·17–5·09	0·017	10·16	2·71–38·13	0·001
Body-fat										
Model 1	1	2·67	0·72–9·83	0·141	1·57	0·69–3·55	0·280	2·73	0·96–7·74	0·059
Model 2	1	3·36	0·79–14·37	0·102	1·82	0·75–4·41	0·183	3·33	1·07–10·36	0·038

Logistic regression analyses to examine the fall risk among the robust, obesity, sarcopenia and sarcopenic obesity groups. The robust group is the reference group for the other groups; $P < 0·05$ was considered statistically significant.
* Adjusted covariates: Model 1 = age, sex; Model 2 = Model 1 + health behaviours (smoking and alcohol consumption), the metabolic syndrome, physical activity, osteoporosis, arthritis, and the use of antipsychotic agents and sedative agents.

Peng TC, Chen WL, Chen YY, Chao YP, Wu LW, Kao TW. Br J Nutr. 2021 Dec 14;126(11):1749-1757

The Health Outcomes of Sarcopenic Obesity in Taiwan

Sarcopenia: EWGSOP 2010
Obesity:
(1) Health Promotion Administration in Taiwan: BMI ≥ 27 kg/m^2
(2) Waist circumference of ≥ 90 cm for men and ≥ 80 cm for women
(3) Body fat percentage of > 25 % for men and > 30 % for women

Table 3. Associations of the metabolic syndrome risk between participants with sarcopenia and obesity defined by different obesity parameters

		Sarcopenia			Obesity			Sarcopenic obesity		
	Robust	OR	95 % CI	*P*	OR	95 % CI	*P*	OR	95 % CI	*P*
BMI										
Model 1*	1	1·19	0·68–2·08	0·543	6·01	3·98–9·08	< 0·001	4·64	0·63–33·95	0·131
Model 2	1	1·15	0·65–2·03	0·628	5·42	3·55–8·27	< 0·001	3·65	0·49–27·25	0·207
Waist										
Model 1	1	1·95	0·98–3·88	0·057	10·64	6·92–16·37	< 0·001	5·72	2·27–14·40	< 0·001
Model 2	1	1·93	0·96–3·88	0·064	10·28	6·63–15·93	< 0·001	5·27	2·06–13·45	0·001
Body fat										
Model 1	1	0·54	0·12–2·50	0·433	3·65	2·18–6·13	< 0·001	2·78	1·36–5·68	0·005
Model 2	1	0·49	0·11–2·32	0·37	3·54	2·08–6·00	< 0·001	2·66	1·28–5·50	0·009

Logistic regression analyses to examine the metabolic syndrome risk among robust, obesity, sarcopenia and sarcopenic obesity groups. The robust group is the reference group for other groups; $P < 0·05$ was considered statistically significant.
* Adjusted covariates: Model 1 = age, sex; Model 2 = Model 1 + health behaviours (smoking and alcohol consumption), physical activity, uric acid, stroke and coronary artery disease.

Peng TC, Chen WL, Chen YY, Chao YP, Wu LW, Kao TW. Br J Nutr. 2021 Dec 14;126(11):1749-1757

Sarcopenic and dynapenic obesity on mortality

Sarcopenia: AWGS 2019

Obesity:

(1) WHO Asia Pacific guidelines : BMI ≥ 25 kg/m^2

(2) Waist circumference of ≥ 90 cm for men and ≥ 80 cm for women

(3) Body fat percentage

  (1) Men: < 65 years old: > 27.5 %; ≧65 years old > 27 %

  (2) Women: < 65 years old: > 38.6%; ≧65 years old > 38.8 %

Dynapenic: weakness and/or slowness

	Waist circumference		Body mass index		Fat percentage	
	SO	DO	SO	DO	SO	DO
Model 1	3.3(<.001)*	1.9(<.001)*	3.3(0.002)*	1.3(0.116)	1.9(0.035)*	1.5(0.015)*
Model 2	2.2(0.004)*	1.2(<.001)*	2.1(0.051)	1.1(0.758)	1.6(0.122)	1.2(0.003)*
Model 3	1.9(0.021)*	1.4(0.022)*	1.9(0.094)	1.1(0.728)	1.5(0.184)	1.2(0.338)
Subgroup: middle age	3.7(0.005)*	1.4(0.266)	3.1(0.056)	0.8(0.516)	2.1(0.121)	1.1(0.805)
Subgroup: old age	1.7(0.111)	1.4(0.044)*	1.7(0.314)	1.1(0.644)	1.3(0.479)	1.2(0.412)

Hazzard ratios (p value) 4 1 0

Fig. 2. A heatmap overview highlighting the influence of various adiposity measures on 11-year mortality.

Tseng LY, Liang CK, Peng LN, Lin MH, Loh CH, Lee WJ, Hsiao FY, Chen LK. Clin Nutr. 2024 Aug;43(8):1892-1899. Epub 2024 Jul 4.

Prevalence of sarcopenic obesity in South Korea

Table 4. Prevalence rates of sarcopenic obesity* according to age, sex, and regions in Korean elderly population

Groups	Category	Sarcopenic obesity	
		Men	Women
Age†	60-69	4.3% (4.3-4.4)	5.4% (5.4-5.5)
	70-79	8.1% (8.1-8.2)	9.5% (9.5-9.6)
	≥ 80	11.9% (11.7-12.0)	7.5% (7.4-7.6)
Region‡	Urban	6.2% (6.2-6.2)	8.1% (8.0-8.1)
	Rural	6.1% (6.0-6.1)	6.1% (6.1-6.2)
Total	≥ 60 yr of age	6.1% (6.1-6.2)	7.3% (7.3-7.3)

*Sarcopenia in Koreans is defined as appendicular skeletal muscle mass divided by body weight (%) more than 2 SD below sex-specific young normal mean. Obesity in Koreans is defined as waist circumference greater than the Korean abdominal obesity criteria (waist circumference ≥ 90 cm in men and ≥ 85 cm in women) from the Fourth Korea National Health and Nutrition Examination Survey. Definition of sarcopenic obesity combines those of sarcopenia and obesity; †Values are presented as prevalence rate (95% confidential interval) in same age-groups after adjusting weight; ‡Values are presented as prevalence rate (95% confidential interval) in same living regions after adjusting weight.

J Korean Med Sci 2012; 27: 748-755

Relationship between sarcopenic obesity and metabolic syndrome among Japanese elderly who underwent a comprehensive health checkup

Table 1 Characteristics of participants

	Total (n=235)	Men (n=95)	Women (n=140)	*P* value [a]	
Age (years)	73.2 ± 6.0	73.5 ± 6.7	72.9 ± 5.5	0.455	
BMI (kg/m^2)	22.2 ± 3.5	23.2 ± 2.9	21.5 ± 3.8	<0.001	*
VFA (cm^2)	91.4 ± 51.1	108.7 ± 53.7	79.6 ± 45.7	<0.001	*
AC (cm)	80.7 ± 10.1	82.2 ± 8.8	79.6 ± 10.8	0.049	*
Mets at-risk (n (%)) [b]	74 (31.5)	40 (42.1)	34 (24.3)	0.004	*
Systolic blood pressure (mmHg)	124.9 ± 18.0	126.1 ± 14.5	124.1 ± 20.0	0.401	
Diastolic blood pressure (mmHg)	74.8 ± 10.2	75.2 ± 9.5	74.6 ± 10.7	0.637	
FPG (mg/dL)	107.7 ± 19.6	113.8 ± 22.1	103.6 ± 16.4	<0.001	*
HbA1c (%)	5.9 ± 0.7	6.0 ± 0.9	5.8 ± 0.4	0.006	*
HOMA-R	1.5 ± 1.2	1.7 ± 1.2	1.4 ± 1.2	0.060	
TC (mg/dL)	207.4 ± 34.6	196.3 ± 32.4	214.9 ± 34.2	<0.001	*
TG (mg/dL)	93.7 ± 47.8	105.6 ± 56.1	85.6 ± 39.4	0.002	*
HDL-C (mg/dL)	61.2 ± 14.4	54.2 ± 13.0	65.9 ± 13.4	<0.001	*
LDL-C (mg/dL)	113.4 ± 29.1	110.3 ± 28.8	85.6 ± 39.4	0.188	
hsCRP (mg/dL)	0.12 ± 0.35	0.11 ± 0.31	0.12 ± 0.37	0.821	
ASM (kg)	16.0 ± 3.8	19.8 ± 2.4	13.4 ± 1.7	<0.001	*
SMI (kg/m^2)	6.29 ± 0.94	7.14 ± 0.61	5.72 ± 0.63	<0.001	*
Percentage of FM (%)	27.9 ± 8.1	24.1 ± 6.7	30.5 ± 8	<0.001	*
FM (kg)	15.9 ± 6.6	15.9 ± 6.2	15.9 ± 6.9	0.977	
Body composition phenotypes (n (%)) [b]				0.280	
Standard	73 (31.1)	31 (32.6)	42 (30.0)		
Sarcopenia	46 (19.6)	22 (23.2)	24 (17.1)		
Obesity	73 (31.1)	23 (24.2)	50 (35.7)		
Sarcopenic obesity	43 (18.3)	19 (20.0)	24 (17.1)		

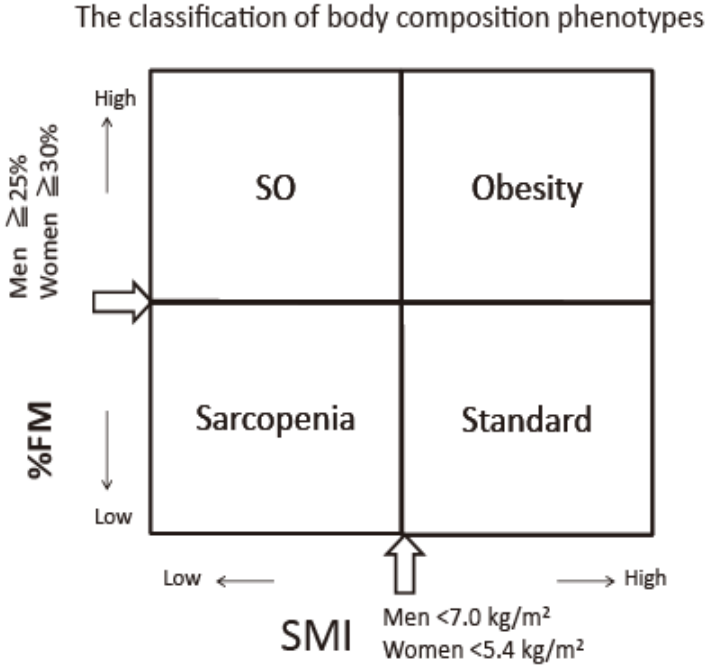


Table 3 Relationship between body composition phenotypes and metabolic syndrome, multivariate logistic regression analyses

	Total (n=235)				
	Model 1			Model 2	
	OR	95%CI		OR	95%CI	
Standard	1.00	ref		1.00	ref	
Sarcopenia	0.43	0.13–1.47		2.11	0.51–8.74	
Obesity	9.69	4.13–22.75	*	1.88	0.61–5.84	
Sarcopenic obesity	3.12	1.23–7.94	*	3.02	0.99–9.22	#

*: P <0.05, #: P=0.05

Multivariate logistic regression analyses were performed to assess the relationship between body composition phenotypes and the risk of metabolic syndrome.
The risk of metabolic syndrome was analyzed as an independent variable, and all four phenotypes of body composition were included as dependent variables.
Model 1: adjusted for age and sex.
Model 2: adjusted for all variables including Model 1 + body mass index, smoking, drinking, and regular exercise habits.

•Takayama M, Azuma K, Hayashi K et al.Relationship between sarcopenic obesity and metabolic syndrome among Japanese elderly who underwent a comprehensive health checkup.*HEP*. 2017; 44: 587-593

Diagnosis of sarcopenic obesity in Japan: Consensus statement of the Japanese Working Group on Sarcopenic Obesity

This algorithm applies to those aged 40 to 75

Screening

Screening of Sarcopenia (a)

【Recommended but omittable】

Calf circumference (M: <34 cm; F: <33 cm)
or SARC-F ≥ 4, SARC-CalF ≥ 11
or "Finger ring test" (Yubi-Wakka test)
or Clinical symptoms or suspicion

Screening of Obesity (b)

【Required】

WC: (M: ≥ 85 cm; F: ≥ 90 cm)
or
BMI: ≥ 25 kg/m^2
(based on ethnic cutoffs)

Probability of sarcopenic obesity

Diagnosis

Evaluation of Sarcopenia (c)

Hand grip (M: < 28 kg; F: < 18kg)
or
Five times sit-to-stand test
and
Limb skeletal muscle mass corrected for BMI
(M: < 0.789 kg/BMI; F: < 0.512 kg/BMI)

Muscle strength/physical function
Muscle mass

Evaluation of Obesity (d)

Visceral fat area ≥ 100 cm^2
or
Body fat percentage:
(M: ≥20%; F: ≥30%)

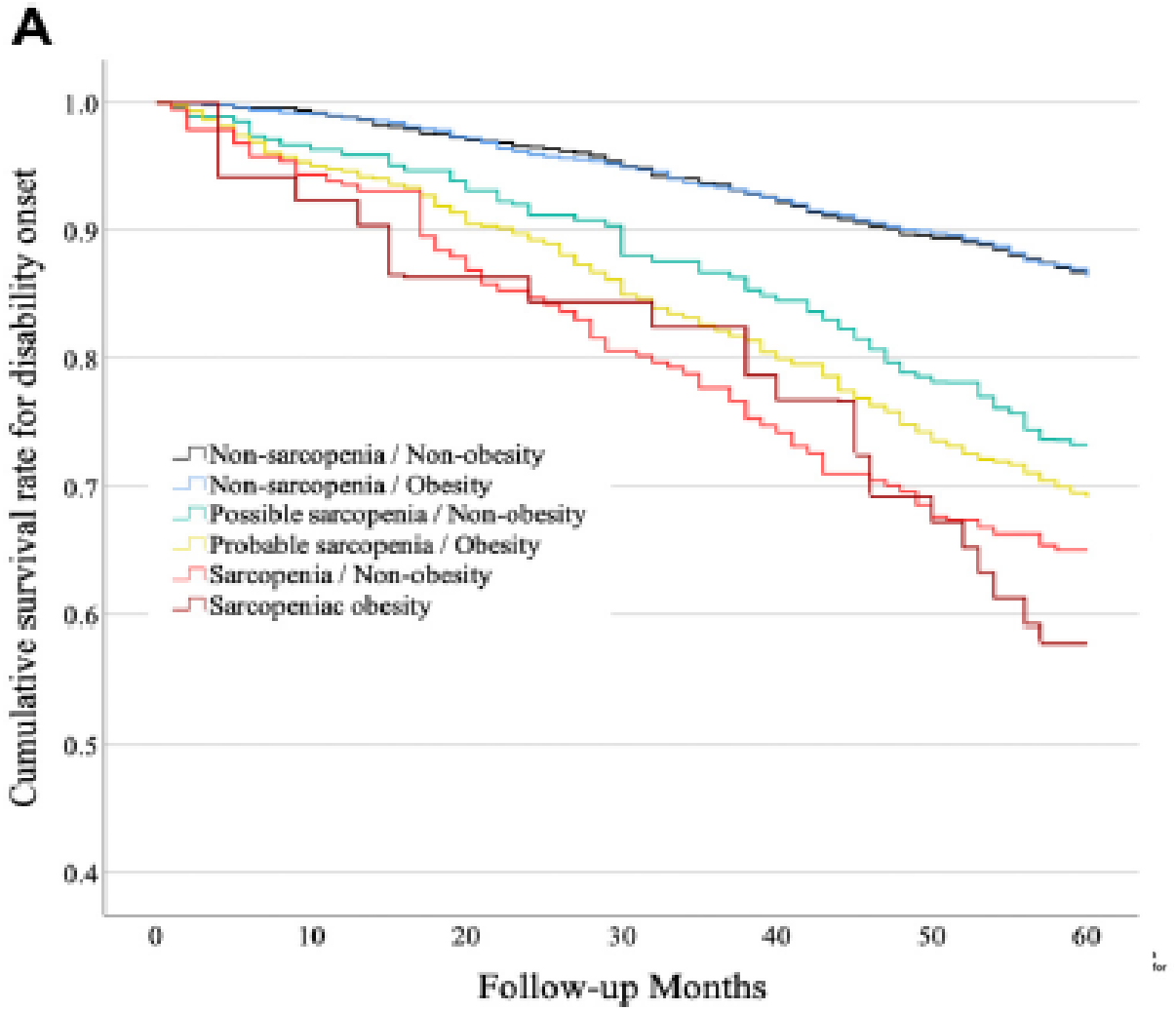
Stage I Sarcopenic Obesity: Low muscle strength/physical function + low muscle mass + obesity
Stage II Sarcopenic Obesity: Low muscle strength/physical function + low muscle mass + obesity + comorbidities (metabolic diseases, disabilities resulting from high fat mass and/or low muscle mass, as well as cardiovascular and respiratory diseases)

Ishii K, Ogawa W, Kimura Y, Kusakabe T, Miyazaki R, Sanada K, Satoh-Asahara N, Someya Y, Tamura Y, Ueki K, Wakabayashi H, Watanabe Y, Yamada M, Arai H. Geriatr Gerontol Int. 2024 Oct;24(10):997-1000.

Sarcopenic Obesity and Risk of Disability in Community-Dwelling Japanese Older Adults: A 5-Year Longitudinal Study (prevalence of SO:2.07%)

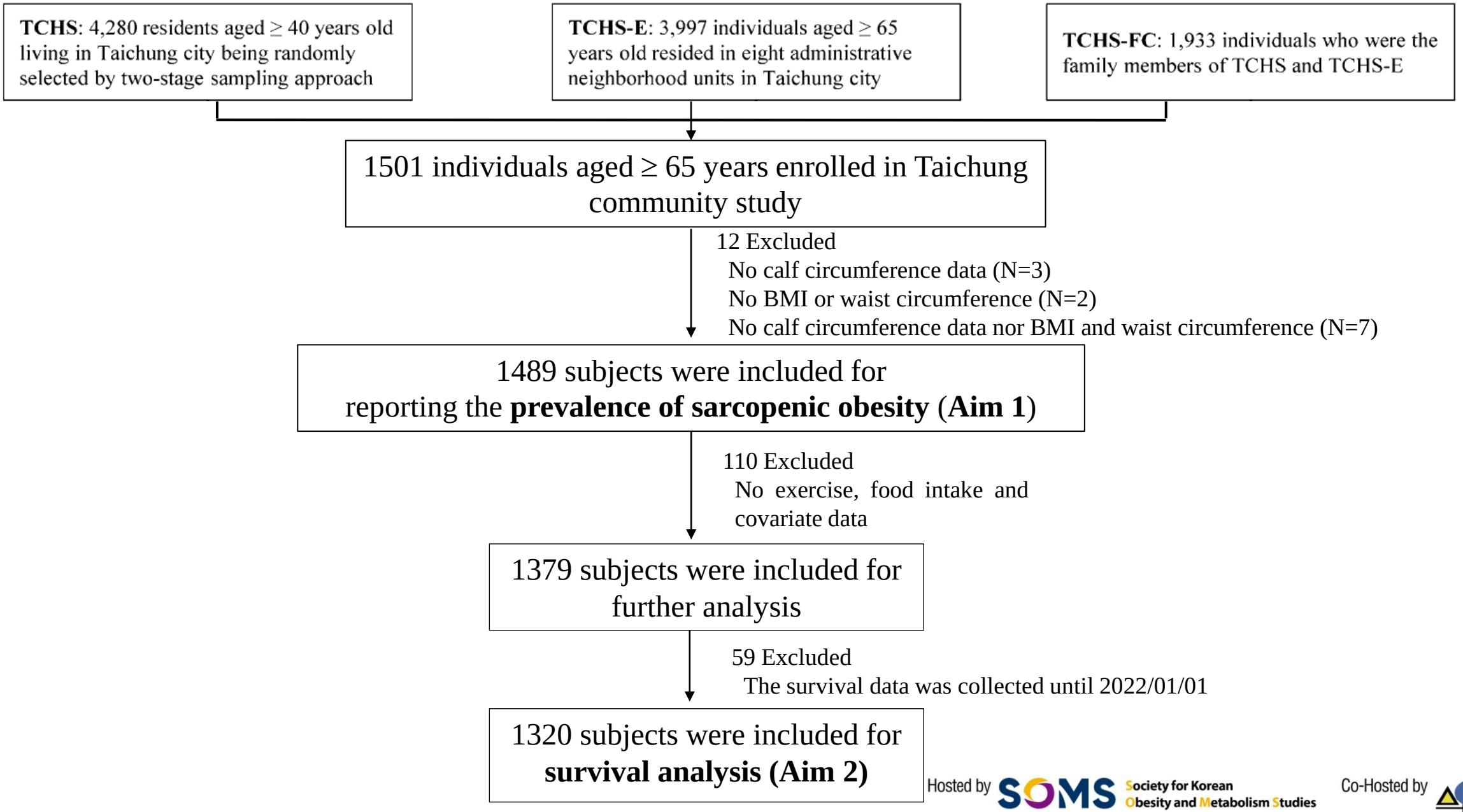
Table 2
HRs of the Group According of Sarcopenia and Obesity for Disability Onset During 5 years Adjusted by Covariates

Variables	HR (95% CI)	*P*
Group		
Nonsarcopenia/nonobesity (ref)	–	–
Nonsarcopenia/obesity	0.87 (0.67, 1.13)	.305
Possible sarcopenia/nonobesity	1.30 (0.87, 1.95)	.197
Possible sarcopenia/obesity	1.60 (1.22, 2.09)	.001
Sarcopenia/nonobesity	2.05 (1.42, 2.95)	<.001
Sarcopenic obesity	2.36 (1.53, 3.63)	<.001
Sex, male	0.71 (0.57, 0.87)	.001
Age	1.13 (1.11, 1.15)	<.001
Medication	1.05 (1.02, 1.08)	<.001
Heart diseases	1.01 (0.98, 1.05)	.444
Osteoporosis	1.28 (1.05, 1.57)	.015
Respiratory diseases	1.01 (0.82, 1.24)	.910
Osteoarthritis	1.30 (1.07, 1.58)	.008
Education, y	1.05 (1.02, 1.08)	.001
Living alone	0.95 (0.91, 1.00)	.029
Geriatric depression score	0.87 (0.72, 1.06)	.163
Mini-Mental State Examination	0.78 (0.53, 1.14)	.199
Exercise habit	1.02 (0.86, 1.22)	.788
Current smoking	1.17 (0.98, 1.40)	.089
Current drinking	1.20 (0.99, 1.45)	.065



M Morikawa, S Lee, K Makino, et al. Sarcopenic Obesity and Risk of Disability in Community-Dwelling Japanese Older Adults: A 5-Year Longitudinal Study. Journal of the American Medical Directors Association,24(8),2023,P1179-1184.https://doi.org/10.1016/j.jamda.2023.03.008.

Cohort of sarcopenic obesity in community in Taichung, Taiwan (2009-2023)


TCHS: 4,280 residents aged ≥ 40 years old living in Taichung city being randomly selected by two-stage sampling approach
TCHS-E: 3,997 individuals aged ≥ 65 years old resided in eight administrative neighborhood units in Taichung city
TCHS-FC: 1,933 individuals who were the family members of TCHS and TCHS-E
1501 individuals aged ≥ 65 years enrolled in Taichung community study
12 Excluded
No calf circumference data (N=3)
No BMI or waist circumference (N=2)
No calf circumference data nor BMI and waist circumference (N=7)
1489 subjects were included for reporting the prevalence of sarcopenic obesity (Aim 1)
110 Excluded
No exercise, food intake and covariate data
1379 subjects were included for further analysis
59 Excluded
The survival data was collected until 2022/01/01
1320 subjects were included for survival analysis (Aim 2)

The diagnosis of sarcopenia obesity According to Taichung Declaration for sarcopenic obesity in Asia and Oceania Region

Diagnosis of obesity

BMI: ≥27 kg/m^2
Waist Circumference: M ≥90cm, F ≥80cm
Body Fat Percentage (Diagnosed by BIA or DXA): (M≥25%, F≥30%)

No → ***No sarcopenic obesity***

Diagnosis of sarcopenia

Muscle Strength
Hand Grip (M< 28 kg, F< 18 kg)
Physical performance
1. 6-Meter Walk <1.0 m/s
2. Or 5-Times Sit-to Stand Test ≥12s
3. Or Short physical performance Battery ≤9

"Yes" for either one →

Appendicular skeletal muscle mass index (ASMI)
1. Dual-energy X-ray absorptiometry (M<7.0 kg/m2, F<5.4 kg/m2) Or
2. BIA (M<7.0 kg/m2, F<5.7 kg/m2)

No → ***Possible sarcopenic obesity***

Yes → ***Sarcopenic obesity***

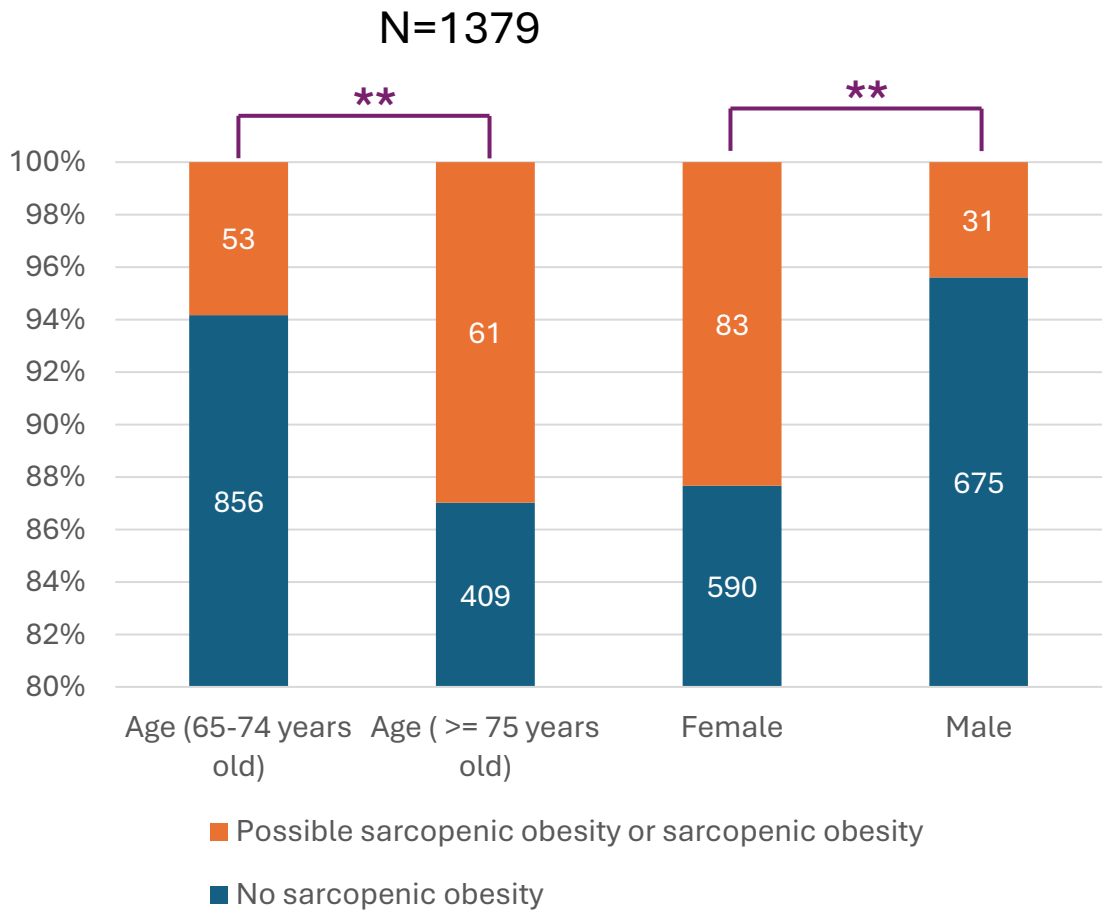
The prevalence of sarcopenia obesity among older adults in the community (n=1489)

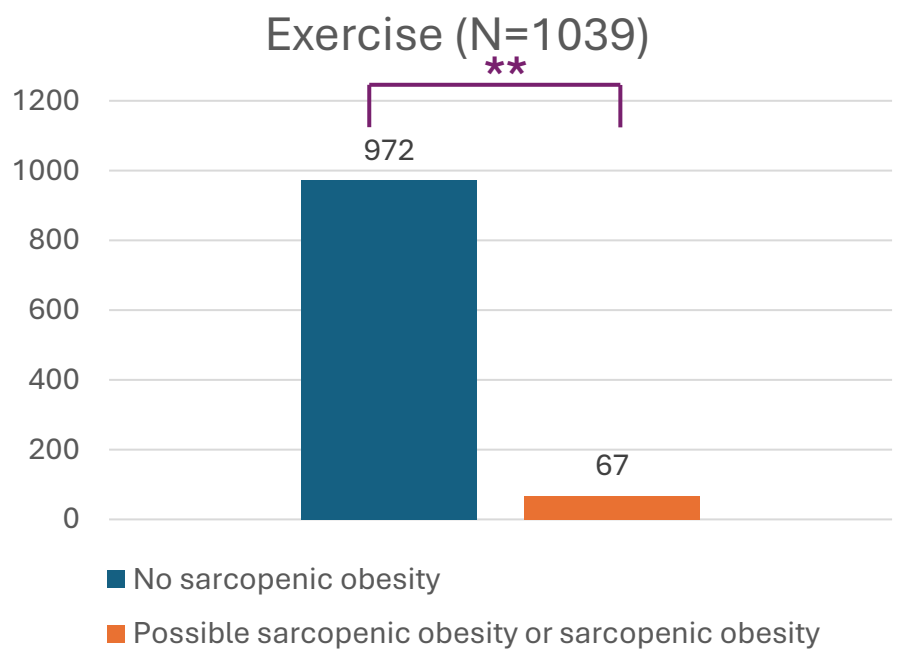
	65-74 years			≥ 75 years		
	All	Female	Male	All	Female	Male
Number of subjects	970	508	462	515	215	304
Outcome						
Healthy (screening stage)	92.68%	90.16%	95.45%	85.36%	76.28%	91.78%
Diagnosis stage						
No (Annual follow-up)	0.93%	0.98%	0.87%	1.73%	2.33%	1.32%
Possible sarcopenic obesity	4.64%	6.89%	2.16%	9.06%	15.35%	4.61%
Sarcopenic obesity	1.75%	1.97%	1.52%	3.85%	6.05%	2.30%

Components of sarcopenic obesity (n=1489)

	All N (%)	No sarcopenic obesity N (%)	Possible sarcopenic obesity or Sarcopenic obesity N (%)	
Components of sarcopenic obesity	N=1489	N=1358	N=131	p-value
Obesity markers				
BMI				**<0.01**
<24 kg/m^2	755 (50.71)	706 (51.99)	49 (37.4)	
24-26 kg/m^2	461 (30.96)	397 (29.19)	64 (49.61)	
≥27 kg/m^2	273 (18.33)	255 (18.75)	18 (13.95)	
Low calf circumference (M <34cm, F <33cm)	474 (31.83)	343 (25.26)	131 (100)	**<0.01**
High waist circumference (M ≥90cm, F ≥80cm)	696 (46.74)	582 (42.86)	114 (87.02)	**<0.01**
High body fat % (M≥25%, F≥30%) [a]	1036 (70.38)	906 (67.51)	130 (100)	**<0.01**
Muscle markers				
Low appendicular skeletal muscle mass index [b]	317 (24)	280 (23.29)	37 (31.09)	0.07
Low grip strength [C] (M<28kg, F<18kg)	266 (18.1)	221 (16.44)	45 (35.71)	**<0.01**
Physical performance				
Low walking speed [d]	555 (38.12)	529 (39.66)	26 (21.31)	**<0.01**
Poor performance of 5-times sit-to stand test [e]	69 (17.69)	62 (16.8)	7 (33.33)	0.07
Poor performance of SPPB [f]	78 (17.61)	70 (16.83)	8 (29.63)	0.11

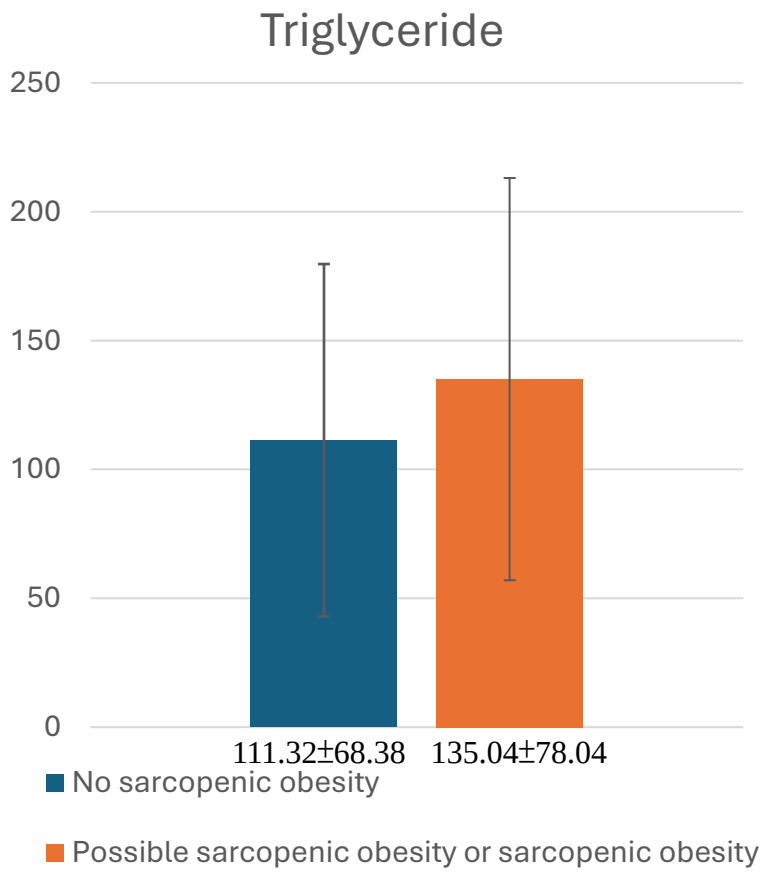
Exercise habit is significantly different between "No sarcopenic obesity" and "possible sarcopenic obesity or sarcopenic obesity" group

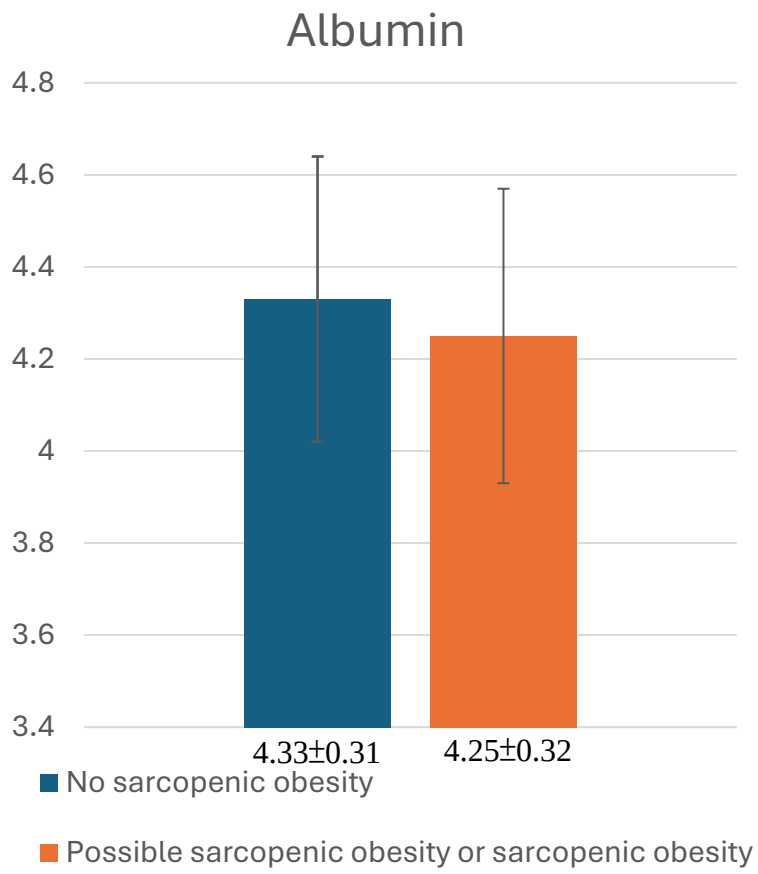


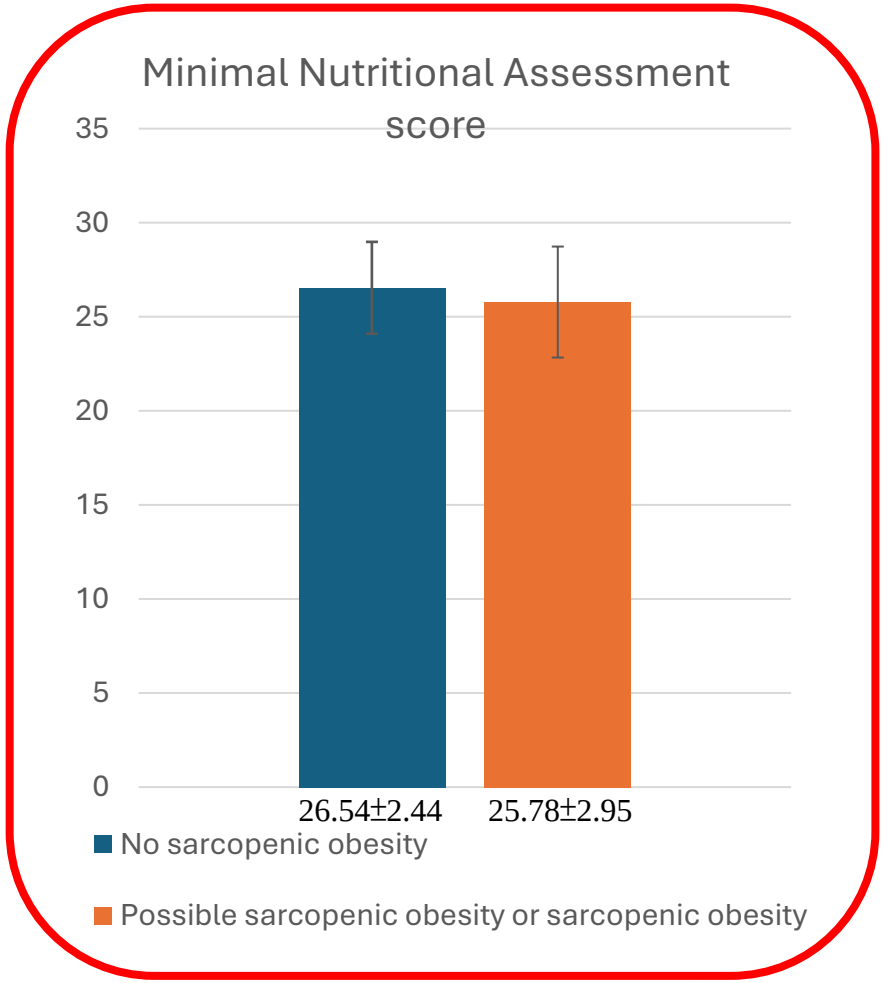


**P<0.01

Significant difference of Nutrition related variables between "No sarcopenic obesity(N=1265)" and "possible sarcopenic obesity or sarcopenic obesity(N=114)" group**







**P<0.01

Minimal Nutritional Assessment score (MNA score)

Long MNA®
Mini Nutritional Assessment

Nestlé Nutrition Institute

Last name: First name:

Sex: Age: Weight, kg: Height, cm: Date:

Complete the screen by filling in the boxes with the appropriate numbers.
Add the numbers for the screen. If score is 11 or less, continue with the assessment to gain a Malnutrition Indicator Score.

Screening

A Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?
0 = severe decrease in food intake
1 = moderate decrease in food intake
2 = no decrease in food intake ☐

B Weight loss during the last 3 months
0 = weight loss greater than 3kg (6.6lbs)
1 = does not know
2 = weight loss between 1 and 3kg (2.2 and 6.6 lbs)
3 = no weight loss ☐

C Mobility
0 = bed or chair bound
1 = able to get out of bed / chair but does not go out
2 = goes out ☐

D Has suffered psychological stress or acute disease in the past 3 months?
0 = yes 2 = no ☐

E Neuropsychological problems
0 = severe dementia or depression
1 = mild dementia
2 = no psychological problems ☐

F Body Mass Index (BMI) = weight in kg / (height in m)²
0 = BMI less than 19
1 = BMI 19 to less than 21
2 = BMI 21 to less than 23
3 = BMI 23 or greater ☐

Screening score (subtotal max. 14 points) ☐☐
12-14 points: Normal nutritional status
8-11 points: At risk of malnutrition
0-7 points: Malnourished

For a more in-depth assessment, continue with questions G-R

Assessment

G Lives independently (not in nursing home or hospital)
1 = yes 0 = no ☐

H Takes more than 3 prescription drugs per day
0 = yes 1 = no ☐

I Pressure sores or skin ulcers
0 = yes 1 = no ☐

J How many full meals does the patient eat daily?
0 = 1 meal
1 = 2 meals
2 = 3 meals ☐

K Selected consumption markers for protein intake
- At least one serving of dairy products (milk, cheese, yoghurt) per day — yes ☐ no ☐
- Two or more servings of legumes or eggs per week — yes ☐ no ☐
- Meat, fish or poultry every day — yes ☐ no ☐

0.0 = if 0 or 1 yes
0.5 = if 2 yes
1.0 = if 3 yes ☐.☐

L Consumes two or more servings of fruit or vegetables per day?
0 = no 1 = yes ☐

M How much fluid (water, juice, coffee, tea, milk...) is consumed per day?
0.0 = less than 3 cups
0.5 = 3 to 5 cups
1.0 = more than 5 cups ☐.☐

N Mode of feeding
0 = unable to eat without assistance
1 = self-fed with some difficulty
2 = self-fed without any problem ☐

O Self view of nutritional status
0 = views self as being malnourished
1 = is uncertain of nutritional state
2 = views self as having no nutritional problem ☐

P In comparison with other people of the same age, how does the patient consider his / her health status?
0.0 = not as good
0.5 = does not know
1.0 = as good
2.0 = better ☐.☐

Q Mid-arm circumference (MAC) in cm
0.0 = MAC less than 21
0.5 = MAC 21 to 22
1.0 = MAC greater than 22 ☐.☐

R Calf circumference (CC) in cm
0 = CC less than 31
1 = CC 31 or greater ☐

Assessment (max. 16 points) ☐☐.☐
Screening score ☐☐.☐
Total Assessment (max. 30 points) ☐☐.☐

Malnutrition Indicator Score

24 to 30 points	☐	Normal nutritional status
17 to 23.5 points	☐	At risk of malnutrition
Less than 17 points	☐	Malnourished

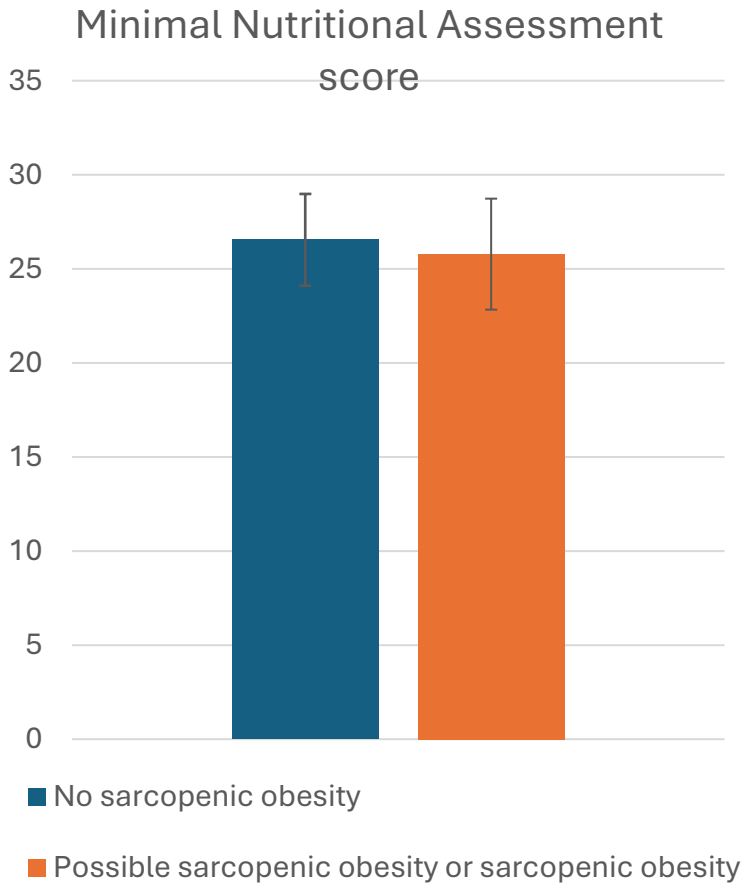
Hosted by SOMS Society for Korean Obesity and Metabolism Studies

Co-Hosted by Asia Oceania Association for the Study of Obesity

Minimal Nutritional Assessment score (MNA score)

Malnutrition Indicator Score

24 to 30 points	☐	Normal nutritional status
17 to 23.5 points	☐	At risk of malnutrition
Less than 17 points	☐	Malnourished



	No sarcopenic obesity	Possible sarcopenic obesity or Sarcopenic obesity	
Minimal Nutritional Assessment score[c]	**26.54±2.44**	**25.78±2.95**	**<0.01**
0≤MNA<24	153 (12.09)	22 (19.30)	0.04
24≤MNA≤30	1112 (87.91)	92 (80.70)	

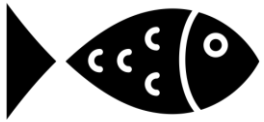
Protein intake between 2 groups

K Selected consumption markers for protein intake

- At least one serving of dairy products (milk, cheese, yoghurt) per day — yes ☐ no ☐
- Two or more servings of legumes or eggs per week — yes ☐ no ☐
- Meat, fish or poultry every day — yes ☐ no ☐

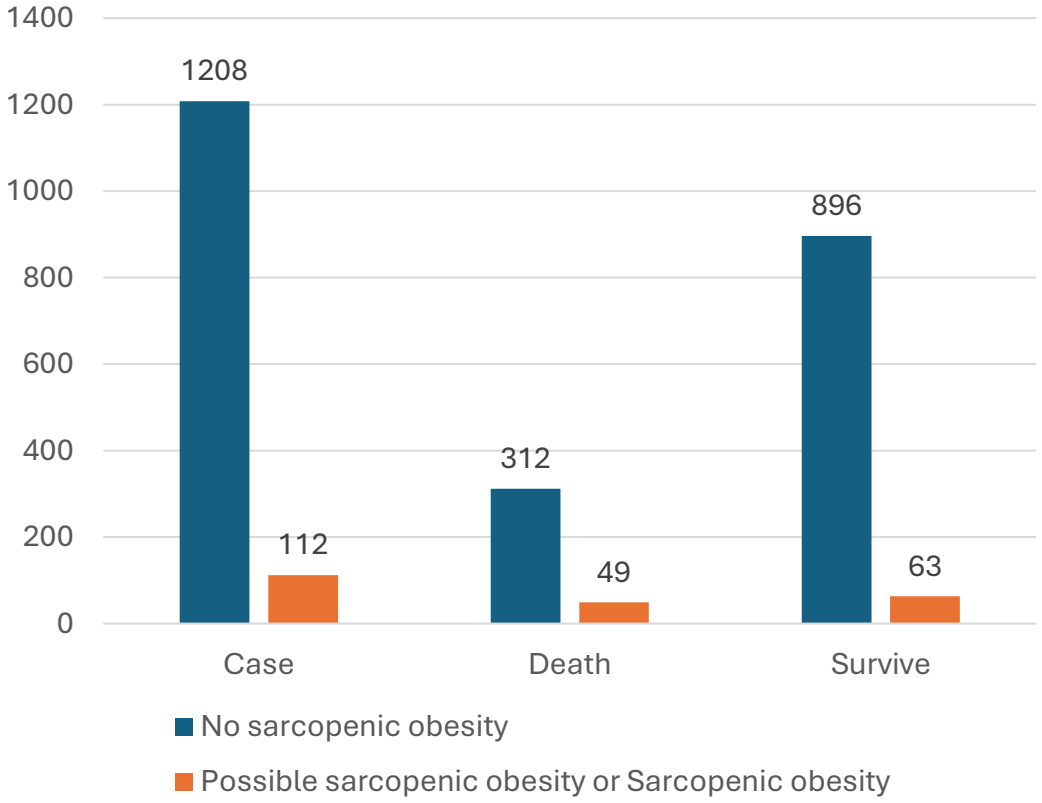
0.0 = if 0 or 1 yes
0.5 = if 2 yes
1.0 = if 3 yes

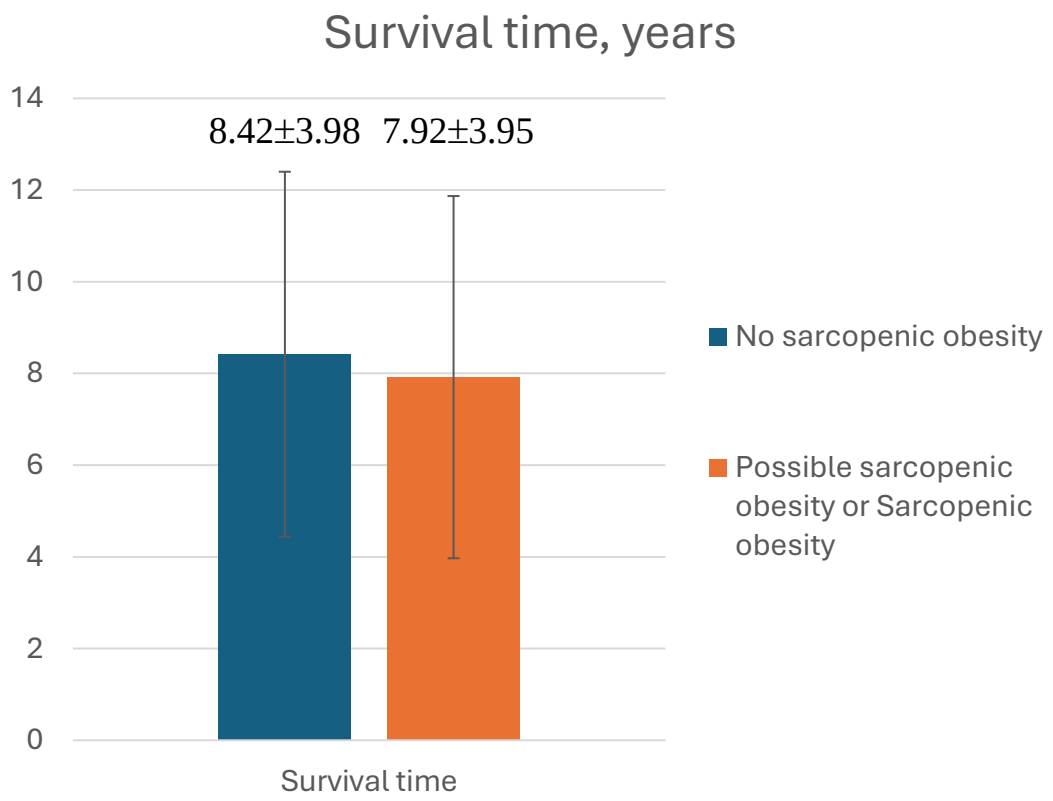
☐.☐



	No sarcopenic obesity	Possible sarcopenic obesity or Sarcopenic obesity	
Variable	N=1265	N=114	p-value
Protein intake			
At least one serving of dairy products (milk, cheese, yoghurt) per day[d]	563 (44.54)	49 (43.36)	0.84
Two or more servings of legumes or eggs per week	1131 (89.41)	92 (80.71)	**<0.01**
Meat, fish or poultry every day[e]	1042 (82.44)	89 (78.76)	0.37
Combination with above items			**0.04**
0-1 item	203 (16.05)	29 (25.44)	
2 items	623 (49.25)	51 (44.74)	
3 items	439 (34.71)	34 (29.82)	

Mortality (2009-2021)





Hazard ratio for Mortality (Crude)

Predictor	HR (95% CI)	p-value
Age (years)		
65-74	1	
≥ 75	3.59 (2.89, 4.44)	**<0.01**
Gender		
Female	1	
Male	1.71 (1.38, 2.12)	**<0.01**
Exercise		
Yes	1	
No	1.73 (1.40, 2.14)	**<0.01**
GDS	1.09 (1.04, 1.13)	**<0.01**
Diabetes		
No	1	
Yes	1.92 (1.50, 2.45)	**<0.01**
DBP, mmHg	0.98 (0.97, 0.99)	**<0.01**
TG, mg/dL	1.00 (1.00, 1.00)	0.91
HDL, mg/dL	1. 00 (0.99, 1.00)	0.34
FPG, mg/dL	1.01 (1.00, 1.01)	**<0.01**
Albumin, g/dL	0.41 (0.30, 0.55)	**<0.01**

Predictor	HR (95% CI)	p-value
Minimal Nutritional Assessment		
24≤MNA≤30	1	
0≤MNA<24	2.77 (2.19, 3.51)	**<0.01**
Two or more servings of legumes or eggs per week		
Yes	1	
No	1.28 (0.97, 1.68)	0.08
Sarcopenic obesity		
No	1	
Possible sarcopenic obesity/ Sarcopenic obesity	**1.84 (1.36, 2.49)**	**<0.01**

Hazard ratio for Mortality (adjust with MNA)

Predictor	HR (95% CI)	p-value
Age (years)		
65-74	1	
≥ 75	2.7 (2.15, 3.4)	**<0.01**
Gender		
Female	1	
Male	1.91 (1.51, 2.43)	**<0.01**
Exercise		
Yes	1	
No	1.46 (1.16, 1.83)	**<0.01**
GDS	1.05 (1.00, 1.10)	**<0.01**
Diabetes		
No	1	
Yes	1.54 (1.14, 2.07)	**<0.01**
DBP, mmHg	0.99 (0.98, 1.00)	**<0.01**
TG, mg/dL	1.00 (1.00, 1.00)	0.83
HDL, mg/dL	1.00 (1.00, 1.01)	0.49
FPG, mg/dL	1.00 (1.00, 1.01)	0.04
Albumin, g/dL	0.59 (0.43, 0.82)	**<0.01**

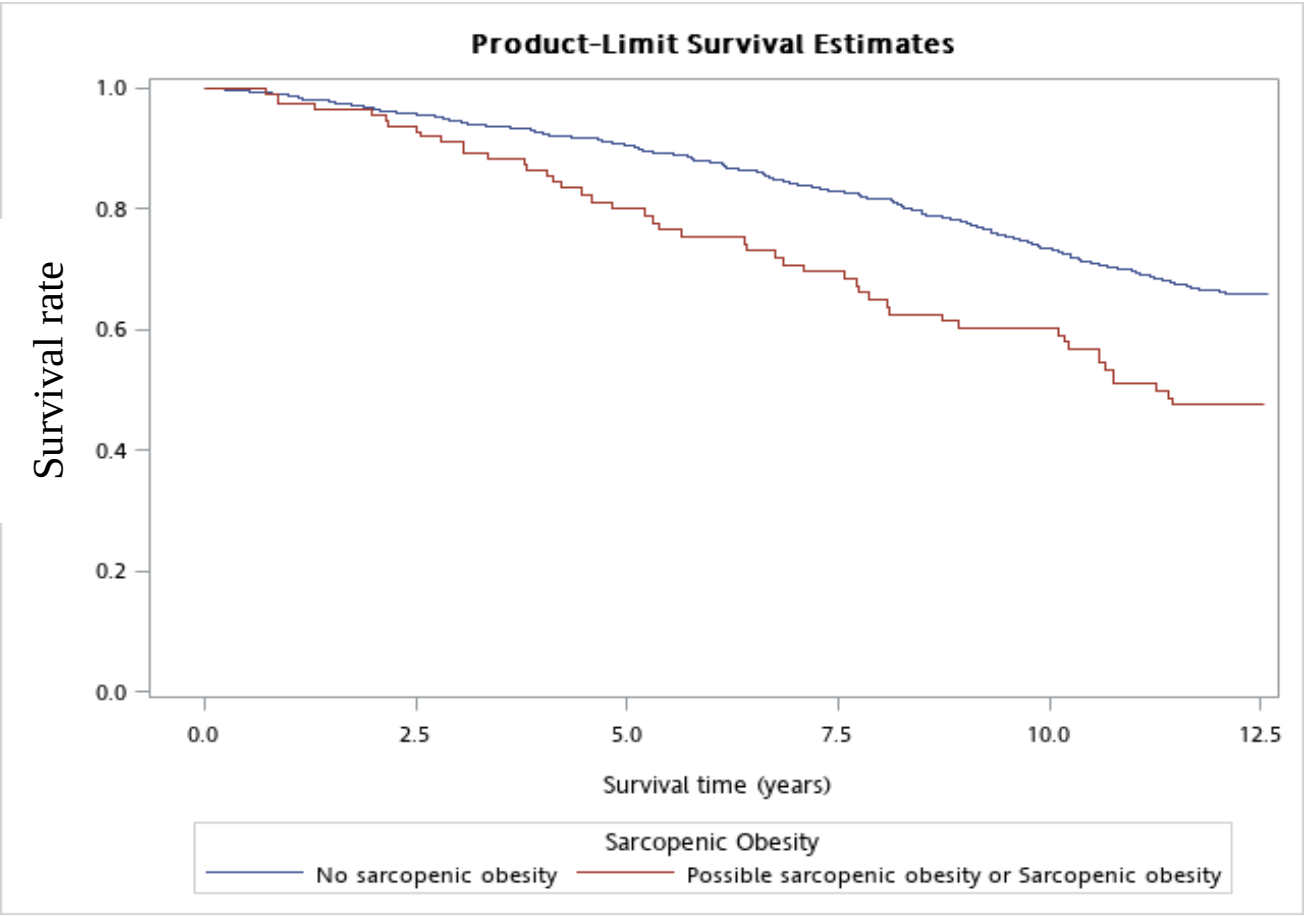
Predictor	HR (95% CI)	p-value
Minimal Nutritional Assessment		
24≤MNA≤30	1	
0≤MNA<24	1.94 (1.47, 2.55)	**<0.01**
Sarcopenic obesity		
No	1	
Possible sarcopenic obesity/ Sarcopenic obesity	**1.67 (1.21, 2.31)**	**<0.01**

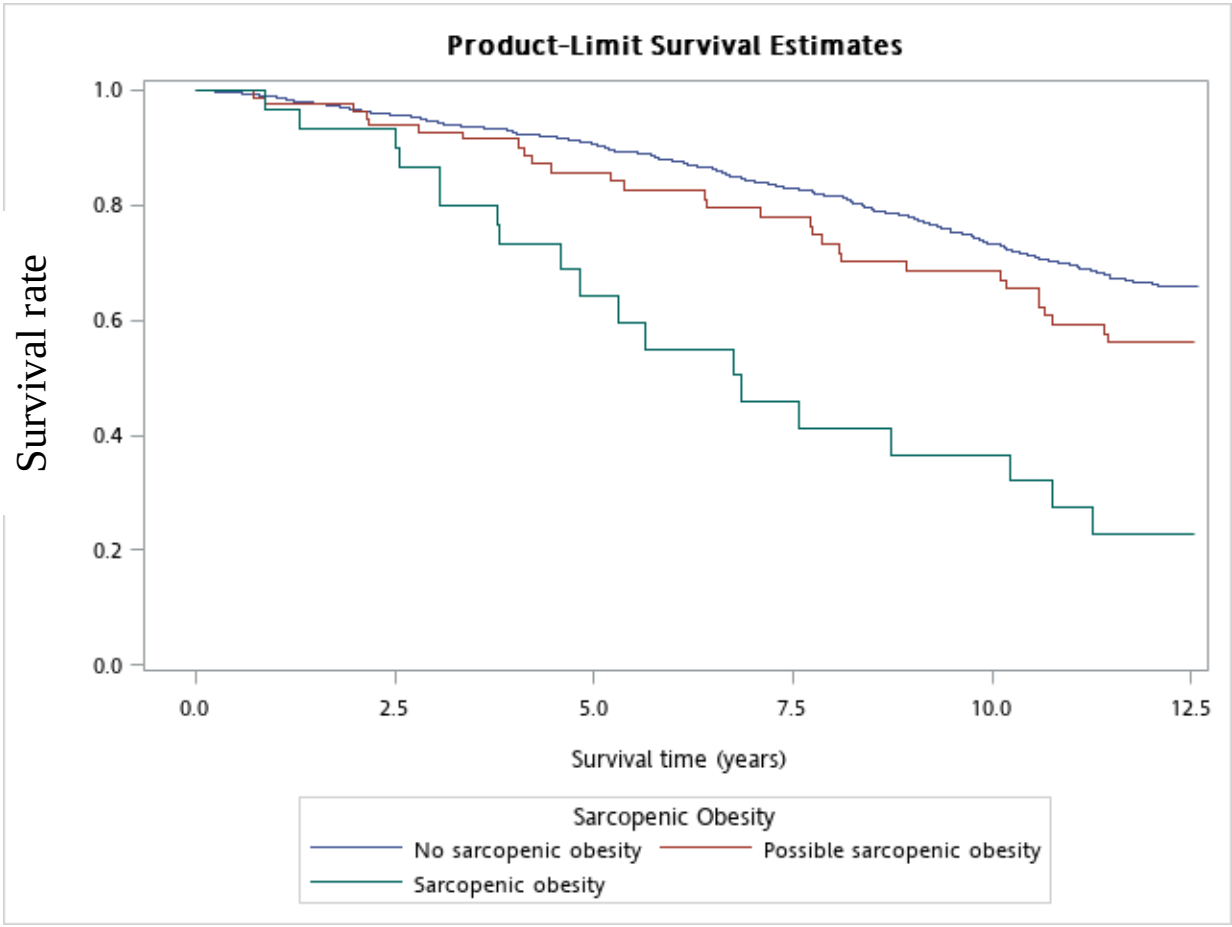
Hazard ratio for Mortality (adjust with protein intake)

Predictor	HR (95% CI)	p-value
Age (years)		
65-74	1	
≥ 75	2.78 (2.21, 3.49)	**<0.01**
Gender		
Female	1	
Male	1.93 (1.52, 2.45)	**<0.01**
Exercise		
Yes	1	
No	1.55 (1.24, 1.93)	**<0.01**
GDS	1.08 (1.04, 1.13)	**<0.01**
Diabetes		
No	1	
Yes	1.55 (1.15, 2.09)	**<0.01**
DBP, mmHg	0.99 (0.98, 1.00)	0.17
TG, mg/dL	1.00 (1.00, 1.00)	0.95
HDL, mg/dL	1.01 (1.00, 1.01)	0.16
FPG, mg/dL	1.00 (1.00, 1.01)	0.06
Albumin, g/dL	0.53 (0.39, 0.73)	**<0.01**

Predictor	HR (95% CI)	p-value
Two or more servings of legumes or eggs per week		
Yes	1	
No	1.09 (0.82, 1.43)	0.56
Sarcopenic obesity		
No	1	
Possible sarcopenic obesity/ Sarcopenic obesity	**1.63 (1.18, 2.25)**	**<0.01**

Survival analysis





Conclusion

- The prevalence of sarcopenic obesity in Taichung community study are 1.75% and 3.85% in 65-74 years old and ≥ 75 years old respectively
- The prevalence of Sarcopenic obesity is significantly increased in older people and female group
- Exercise and higher score of minimal nutritional assessment may be the protective factors for sarcopenic obesity
- Sarcopenic obesity is related to highest mortality in this study

Acknowledgement

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Thanks for your attention!