Severe central obesity or diabetes can replace weight loss in the detection of frailty in obese younger elderly

A preliminary study

eSupplements

Table S1: The models chosen for frailty assessment in our study

Fried phenotype model – criteria used in our study		*Morley 5 frail scale model – criteria used in our study*	
Criterion	Definition	Criterion	Definition
Physical inactivity	Men: < 383 Kcals of physical activity per week Women: < 270 Kcals of physical activity per week	Aerobic	Cannot walk 1 block
Weakness	Grip strength in the lowest 20% at baseline, adjusted for gender and body mass index; cut-offs were used according to the original paper: For women: BMI 23.1–26: ≤17.3 kg BMI 26.1–29: ≤18 kg BMI > 29: ≤21 kg For men: BMI 24.1–26: ≤30 kg BMI 26.1–28: ≤30 kg BMI > 28: ≤32 kg	Resistance	Question: "Cannot walk up 1 flight of stairs?"
Slowness	<u>4 meters walk test < 4 sec</u>[1]	Illnesses	> 5 diagnosed illnesses[2]
Poor endurance; Exhaustion	As indicated by self-report of exhaustion. Self-reported exhaustion, identified by two questions from the CES–D Depression Scale	Fatigue	Question: "Are you fatigued?"
Weight loss	> 10 pounds (≈4.5 kg) of the original weight in the past 1 year	Loss of weight	<u>> 10 pounds (≈4.5 kg) of the original weight in the past 1 year</u>
Defining robust	No positive scores	Defining robust	No positive scores
Defining pre-frail	1-2 positive scores	Defining pre-frail	1-2 positive scores
Defining frail	3 or greater positive scores	Defining frail	3 or greater positive scores

1- The 4 meters walk test was dichotomized (i.e., < 4 sec considered as frail) according to the widely used 5-item FRAIL scale

2- We defined comorbidities as: > 5 diagnosed morbidities of the following: chronic renal failure, cardiac insufficiency, heart attack, stroke, Parkinson, asthma, hypertension, diabetes, osteoporosis and vision damage [cataract and/or glaucoma]

<u>Underlined criteria refer to criteria that were adjusted (similar but not identical to original model)</u>

eMethod 1: Physical and functional fitness testing of obese older elderly protocol and score sheet

About the test

The 8 tests performed are used as a predictive tool in assessing an individual possible disability and physical function by measuring the physical parameters of strength and endurance, motor ability, balance, aerobic endurance and body composition.

Setting

Hall of the department of endocrinology Sourascky hospital

Isometric knee extension test

Equipment: Hand held push/pull digital dynamometer, standard chair with arm rest (Measurement will be recorded on a data sheet for later transfer to a computer).

Procedure:

- Perform 3 trials / leg, performed in alternate fashion – record best score
- Rest between trials – 15 seconds
- Rest before next test – 30 second

Hand grip test

Equipment: hand dynamometer (Jammer), A standard chair with a straight back without arm rests.

Procedure: The participant sits in a chair with his/her feet flat on the floor and his/her knees at 90-degree angle. The arm being tested should be at a 90-degree angle, next to but not touching his body. The tester demonstrates the test and then the participant does a practice trial on the dominant and then the non-dominant hand. (The tester supports the dynamometer). After the practice trial, the examiner will put the dynamometer in the participants dominant hand and on "Go" the subject will squeeze his hand as hard as possible for 3-4 seconds till examiner says 'stop'. The maximum reading will be recorded. The participant will then perform the test once more on the non-dominant hand. (The tester will support the dynamometer during both tests. (Measurement will be recorded on a data sheet for later transfer to a computer).

- Perform 2 trials / hand, performed in alternate fashion – record best score
- Rest between trials – 15 seconds
- Rest before next test – 30 second

Hand grip test – cont.

Cutoff for grip strength (Kg) criterion for frailty

Men	Women
BMI <24 ≤29	BMI < 23 ≤17
BMI 24.1–26≤30	BMI 23.1–26 ≤17.3
BMI 26.1–28≤30	BMI 26.1–29 ≤18
BMI > 28≤32	BMI > 29 ≤21

Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, Seeman T, Tracy R, Kop WJ, Burke G, McBurnie MA. Frailty in older adults: evidence for a phenotype. J Gerontol A Biol Sci Med Sci. 2001 Mar;56(3):M146-56

4-Meter walk gait speed test

Equipment: 2 small plastic cones, a 5 meter walking space free of obstacles, a stop watch.
Procedure: a five meter walking course will be prepared free of obstacles. Three lines will be drawn on the floor, a starting line, a four meter line and a five meter line. The subject will stand with both feet in front of a line on the floor. On the command go he will start to walk in a comfortable pace past the third line. Timing will commence as the subjects foot drop beyond the starting line and will stop as his entire foot passes the four meter line. There will be one practice trial and two timed trials. The times will be recorded on a data sheet for later transfer to a computer.

Equipment: A standard arm chair. A three line meter. A stop watch.
Procedure: The participant will sit in the chair, on "go" he will stand up from the chair, Walk to the line on the floor at a normal pace, turn, walk back to the chair at a normal pace and Sit down again.
Instructions: Sit down in the chair with your legs flat on the floor. On the command "go", Stand up from the chair, Walk to the Cone at your normal pace, turn around the cone and walk back to the chair at your normal pace and Sit down again.
Do you understand? I will now demonstrate. Now you try, ready, set, go! Very nice.
Now let's do the test. Ready, set, go! Very good, let's try again.

- Perform one trail
- Rest before next test – 30 second

Age	Time (seconds)	95% CI
60 – 69	8.1	(7.1 -9.0)
70 – 79	9.2	(8.2-10.2)

Bohannon RW. Reference values for the timed up and go test: a descriptive meta-analysis. J Geriatr Phys Ther. 2006;29(2):64-8
The Timed Up and Go (TUG) Test. Centers for Disease Control and Prevention National Center for Injury Prevention and Control

4-Meter walk gait speed test – cont.

Instruction: I want you to stand with both feet together. On the command "go" start walking in your usual comfortable pace till you pass beyond the five meters line

- Perform two trails – best time of the two trials
- Rest between trials – 15 seconds
- Rest before next test – 30 second

Frail <0.8m/sec Frail prone >0.8m/s and ≤1m/sec

Castell M-V, Sánchez M, Julián R, Queipo R, Martín S, Otero Á. Frailty prevalence and slow walking speed in persons age 65 and older: implications for primary care. BMC Fam Pract. 2013 Jun 19;14:86.

Timed Up and Go (TUG) Test

Equipment: A standard arm chair. A three line meter. A stop watch.
Procedure: The participant will sit in the chair, on "go" he will stand up from the chair, Walk to the line on the floor at a normal pace, turn, walk back to the chair at a normal pace and Sit down again.
Instructions: Sit down in the chair with your legs flat on the floor. On the command "go", Stand up from the chair, Walk to the Cone at your normal pace, turn around the cone and walk back to the chair at your normal pace and Sit down again.
Do you understand? I will now demonstrate. Now you try, ready, set, go! Very nice.
Now let's do the test. Ready, set, go! Very good, let's try again.

- Perform one trail
- Rest before next test – 30 second

Age	Time (seconds)	95% CI
60 – 69	8.1	(7.1 -9.0)
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The Timed Up and Go (TUG) Test. Centers for Disease Control and Prevention National Center for Injury Prevention and Control

30 – s chair stand

Equipment: A chair with a straight back without arm rests (43 c"m), a stop watch
Procedure: the participant will sit in the middle of the chair, Place his hands on the opposite shoulder crossed at the wrists. The participant will keep his feet flat on the floor, back straight and arms against his chest. Timing will commence at initiation of standing and will stop at the end of 30 seconds. If the participant stopped at the middle of standing it will be counted as an additional repetition. (Measurement will be recorded on a data sheet for later transfer to a computer).

30 – s chair stand – cont.

Instructions: Sit in the middle of the chair, Place your hands on the opposite shoulder crossed at the wrists, Keep your feet flat on the floor, your back straight and keep your arms against your chest. On "Go," rise to a full standing position and then sit back all the way down again. Repeat this for 30 seconds. (Measurement will be recorded on a data sheet for later transfer to a computer).

- Perform one trail
- Rest before next test – 90 seconds

Women			Men		
Age	percentile	#	Age	percentile	#
60-64	10th	9	60-64	10th	11
	25th	12		25th	14
65-69	10th	9	65-69	10th	9
	25th	11		25th	12
70-74	10th	8	70-74	10th	9
	25th	10		25th	12
75-79	10th	7	75-79	10th	8
	25th	10		25th	11

Jones CJ, Rikli RE, Beam WC. A 30-s chair-stand test as a measure of lower body strength in community-residing older adults. Research Quarterly Exercise Sport. 1999 Jun;70(2):113-9.

2 – Minute walk test

Equipment: 2 Two small cones 15.24 meters (50 feet) apart. Four marks on floor 3.05 meter apart. A Stop watch

Procedure: a 15.24 meter walking course will be prepared free of obstacles. Six lines will be drawn on the floor, a starting line, 4 marks on floor 3.05 meter apart and a finish line. The subject will stand with both feet in front of the starting line. On the command go the participant will start to walk back and forth around the cones without slowing down as fast as he can without running for two minutes. On the command "stop" the participant will stop where he is at. There will be one practice trial walking around the two cones without slowing down. The participant will be informed after one minute has passed and again after a minute and forty five seconds has passed. Time will be recorded on a data sheet for later transfer to a computer. The tester will demonstrate one full lap. Instruction: stand with both feet together in front of the cone. On the command "go" start walking as fast as you can without running back and forth around the cones without slowing down. When I tell you to stop, stop where you are on the path until I come to you.

Women

Age	Distance, m (mean [95% CI])	Distance, m/BMI (mean [95% CI])
65-69	155.2 (140.6-169.8)	5.480±0.45 (4.55-6.41)
70-74	145.9 (136.9-154.9)	5.01±0.31 (4.38-5.65)
75-79	140.9 (121.8-159.9)	5.580±0.54 (4.41-6.76)

Men

Age	Distance, m (mean [95% CI])	Distance, m/BMI (mean [95% CI])
65-69	184.2 (170.7-197.8)	7.08±0.35 (6.36-7.80)
70-74	172.4 (163.8-180.9)	6.50±0.26 (6.00-6.56)
75-79	157.6 (140.3-174.9)	5.78±0.44 (4.85-6.70)

Bohannon RW, Wang Y-C, Gershon RC. Two-Minute Walk Test Performance by Adults 18 to 85 Years: Normative Values, Reliability, and Responsiveness. Archives of Physical Medicine and Rehabilitation 2015;96:472-7.

Table S2: Reclassification of frailty states by each model and the diagnostic values (%) in the study

Preliminary study (n=50)							
		Not frail (%)	***Pre- frail (%)***	***Frail (%)***	***Total AUC (95% CI)***	***Values (%) for cutoff of pre-frail and frail (≥1)***	***Values (%) for cutoff of frail (≥3)***
Fried's model	All (n=50; FL, n=8)	32	54	14	0.836 *(0.676-0.996)*	Sensitivity: 100 Specificity: 38 Number classified with FL: 8	Sensitivity: 62.5 Specificity: 95.2 Number classified with FL: 5
	Males (n=20; FL, n=3)	30	65	5	0.725 (0.43-1)	Sensitivity: 100 Specificity: 35.3 Number classified with FL: 3	Sensitivity: 33.3 Specificity: 100 Number classified with FL: 1
	Females (n=30; FL, n=5)	33.3	46.7	20	0.912 *(0.746-1)*	Sensitivity: 100 Specificity: 40 Number classified with FL: 5	Sensitivity: 80 Specificity: 92 Number classified with FL: 4
The 5-item FRAIL scale	All (n=50; FL, n=8)	50	34	16	0.866 *(0.757-0.975)*	Sensitivity: 100 Specificity: 76.5 Number classified with FL: 8	Sensitivity: 50 Specificity: 90.5 Number classified with FL: 4
	Males (n=20; FL, n=3)	65	25	10	0.853 *(0.679-1)*	Sensitivity: 100 Specificity: 59.5 Number classified with FL: 3	Sensitivity: 33.3 Specificity: 94.1 Number classified with FL: 1
	Females (n=30; FL, n=5)	40	40	20	0.904 *(0.793-1)*	Sensitivity: 100 Specificity: 48 Number classified with FL: 5	Sensitivity: 76 Specificity: 100 Number classified with FL: 3
Fried's model – weight loss replaced by high WC	All (n=50; FL, n=8)	30	50	20	0.866 *(0.74-0.992)*	Sensitivity: 100 Specificity: 35.7 Number classified with FL: 8	Sensitivity: 62.5 Specificity: 88.1 Number classified with FL: 5
	Males (n=20; FL, n=3)	30	60	10	0.873 *(0.708-1)*	Sensitivity: 100 Specificity: 35.3 Number classified with FL: 3	Sensitivity: 33.3 Specificity: 94.1 Number classified with FL: 1
	Females (n=30; FL, n=5)	30	43.3	26.7	0.876 *(0.698-1)*	Sensitivity: 100 Specificity: 36 Number classified with FL: 5	Sensitivity: 80 Specificity: 84 Number classified with FL: 4
Fried's model - – weight loss replaced by high BMI	All (n=50; FL, n=8)	28	48	24	0.801 *(0.63-0.972)*	Sensitivity: 100 Specificity: 33.3 Number classified with FL: 8	Sensitivity: 62.5 Specificity: 83.3 Number classified with FL: 5
	Males (n=20; FL, n=3)	30	60	10	0.716 (0.43-1)	Sensitivity: 100 Specificity: 35.3 Number classified with FL: 3	Sensitivity: 33.3 Specificity: 94.1 Number classified with FL: 1
	Females (n=30; FL, n=5)	26.7	40	33.3	0.872 *(0.679-1)*	Sensitivity: 100 Specificity: 32 Number classified with FL: 5	Sensitivity: 80 Specificity: 76 Number classified with FL: 4
Fried's model -	All (n=50; FL, n=8)	30	50	20	0.815 (0.651-0.98)	Sensitivity: 100 Specificity: 35.7	Sensitivity: 62.5 Specificity: 88.1

– weight loss replaced by high WC*BMI						Number classified with FL: 8	Number classified with FL: 5
	Males (n=20; FL, n=3)	30	60	10	0.716 (0.43-1)	Sensitivity: 100 Specificity: 35.3 Number classified with FL: 3	Sensitivity: 100 Specificity: 35.3 Number classified with FL: 1
	Females (n=30; FL, n=5)	30	43.3	26.7	0.888 *(0.709-1)*	Sensitivity: 80 Specificity: 36 Number classified with FL: 5	Sensitivity: 80 Specificity: 84 Number classified with FL: 4
Fried's model – weight loss replaced by high % fat	All (n=50; FL, n=8)	26	56	18	0.833 *(0.672-0.995)*	Sensitivity: 100 Specificity: 31 Number classified with FL: 8	Sensitivity: 62.5 Specificity: 90.5 Number classified with FL: 5
	Males (n=20; FL, n=3)	20	75	5	0.775 (0.475-1)	Sensitivity: 100 Specificity: 23.5 Number classified with FL: 3	Sensitivity: 33.3 Specificity: 100 Number classified with FL: 1
	Females (n=30; FL, n=5)	30	43.3	26.7	0.884 *(0.7-0.995)*	Sensitivity: 100 Specificity: 36 Number classified with FL: 5	Sensitivity: 80 Specificity: 84 Number classified with FL: 4
Fried's model – weight loss replaced by diabetes presence	All (n=50; FL, n=8)	18	64	18	0.877 *(0.779-0.995)*	Sensitivity: 100 Specificity: 21.4 Number classified with FL: 8	Sensitivity: 62.5 Specificity: 90.5 Number classified with FL: 5
	Males (n=20; FL, n=3)	10	85	5	0.824 *(0.588-1)*	Sensitivity: 100 Specificity: 11.8 Number classified with FL: 3	Sensitivity: 33.3 Specificity: 100 Number classified with FL: 1
	Females (n=30; FL, n=5)	23.3	50	26.7	0.916 *(0.802-1)*	Sensitivity: 100 Specificity: 28 Number classified with FL: 5	Sensitivity: 80 Specificity: 84 Number classified with FL: 4

Abbreviations: FL, functional limitations.

Table S3: The correlations between each question of the questionnaire, frailty, anthropometric and metabolic components, frailty scores by the Fried criteria and the adjusted models

	Question / Variable	To dress	Raising from bed	Walking at home	Walking outside	Using stairs	Performing house activities	In shopping	Using transportation	Performing intense PA	Total functional score (9-36)
Fried's phenotype model	4m walk (sec)	.298* (M: .450*)	*.509*** *(M: .450*, F: .579**)*	.382** (F: .541**)	.538** (F: .659**)	.485** (F: .651**)	.454** (F: .538**)	.502** (F: .650**)	.352* (F: .410*)	.588** (M: .580**, F: .571**)	.638** (M: .515*, F: .726**)
	Hand grip (average of both hands; kg)	-0.208	-0.22	-0.241	-.308* (F: -.430*)	-.322*	-0.192	-.322* (F: -.378*)	-.350* (F: -.521**)	-.448** (M: -.451*, F: -.473**)	-.439** (F: -.442*)
	Physical activity energy expenditure (Kcals per week)	-0.226	-0.198	-0.196	-.456** (M: -.562**, F: -.385*)	-.316*	-.365** (M: -.447*	-.360* (F: -.393*)	-0.231	-.289*	-.392** (F: -.375*)
	Frailty total scores by Fried (0-5)	.321* (F: .365*)	.450** (F: .542**)	.331* (F: .429*)	.569** (F: .673**)	.427** (F: .548**)	.460** (F: .584**)	.492** (F: .661**)	.450** (F: .466**)	.415** (F: .467**)	.548** (F: .665**)
FM + WC	WC (cm)	0.212	.280*	0.071	.297*	.342*	0.171	0.25	0.192	.305*	.296*

	Frailty total scores by Fried + severe WC (0-5)	.415** (M: .481*, F: .392*)	.478** (M: .481*, F: .494**)	.295*	.586** (M: .484*, F: .657**)	.462** (F:.579**)	.460** (F: .503**)	.494** (F:.607**)	.437** (F:.479**)	.502** (M:.459*, F: .532**)	.587** (M: .487*, F:.672**)
	Question / Variable	**To dress**	**Raising from bed**	**Walking at home**	**Walking outside**	**Using stairs**	**Performing house activities**	**In shopping**	**Using transportation**	**Performing intense PA**	**Total functional score (9-36)**
FM + diabetes	**HbA1C (%)**	0.1	0.269	0.134	0.189	0.227	0.192	.393*	0.221	0.202	0.231
	Frailty total scores by Fried + diabetes (0-5)	.336* (M: .446*)	.513** (M: .446*, F: .550**)	0.257	.522** (F: .589**)	.420** (F: .569**)	.409** (F:.466**)	.453** (F: .565**)	.461** (F: .489**)	.392** (F: .438*)	.494** (F: .581**)
FM + BMI	BMI	0.101	0.151	0.021	0.201	.397**	0.104	0.16	0.111	0.269	0.263
	Frailty total scores by Fried + severe BMI (0-5)	.335* (F:.395*)	.402** (F:.486**)	0.27	.560** (F:.667**)	.526** (F:.650**)	.393** (F:.501**)	.434** (F:.573**)	.442** (F:.485**)	.463** (F:.522**)	.573** (F:.681**)
FM + % fat	% body fat	0.047	0.111	0.168	0.169	.413**	0.054	0.203	0.116	0.232	0.251
	Frailty total scores by Fried + severe body fat (0-5)	.374** (F:.404*)	.438** (F:.502**)	.293*	.498** (F:.625**)	.391** (F:.573**)	.377** (F:.493**)	.449** (F:.612**)	.452** (F:.491**)	.372** (F:.483**)	.475** (F:.638**)

Correlations between frailty, anthropometric and metabolic characteristics (and their total score) and each of the functional questions (and their total score) using Spearman's rho.

Each question is scored from 1 to 4 (higher scores indicate higher functional impairment).

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Correlations for gender added only when significant

Abbreviations: BMI, body mass index; FM, Fried model; F, Females; M, males; PA, physical activity