Malaysian Society of Body Composition
4th AGM, 9 June 2023

Scientific Update

Muscle, Fat & Bone in Older People: Relation to Healthy Ageing

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Healthy Ageing

Decade of Healthy Ageing, 2020 - 2030
World Health Organisation

Globally,

- In 2020, 2/3 older people live in middle-income countries
- By 2030, 1 in 6 people are ≥ 60y
- By 2040, 1 in 5 people are ≥ 60y

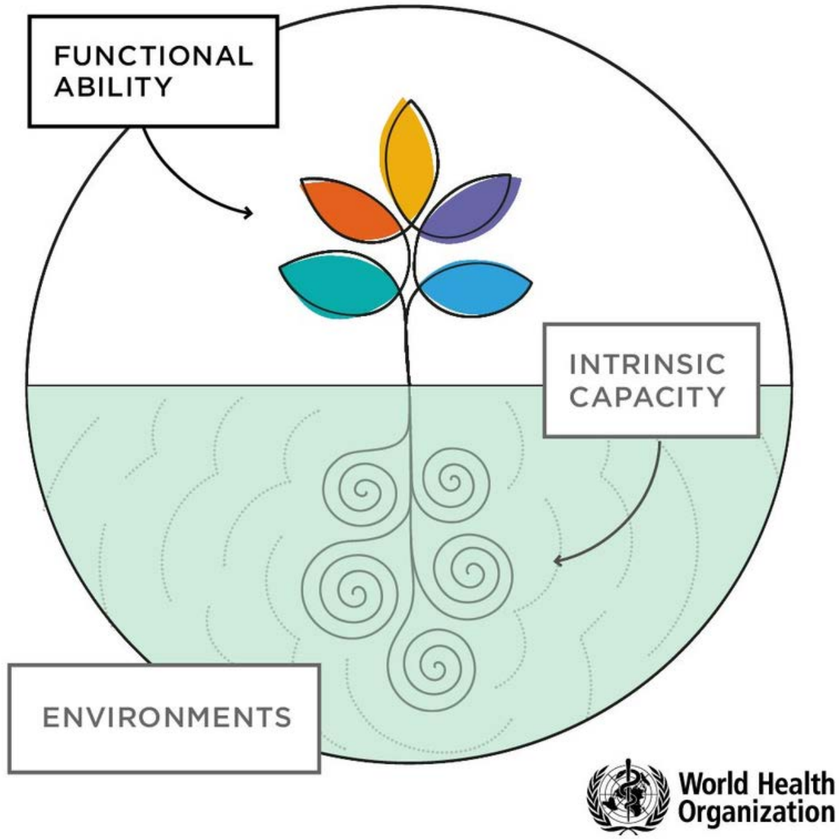
Healthy Ageing

Healthy ageing is the process of developing and maintaining the functional ability that enables well-being in older age. Functional ability reflects a person's physical and mental capacities, the environments he or she inhabits and the ways in which people interact with their environment.

Healthy Ageing (WHO)

Functional Ability

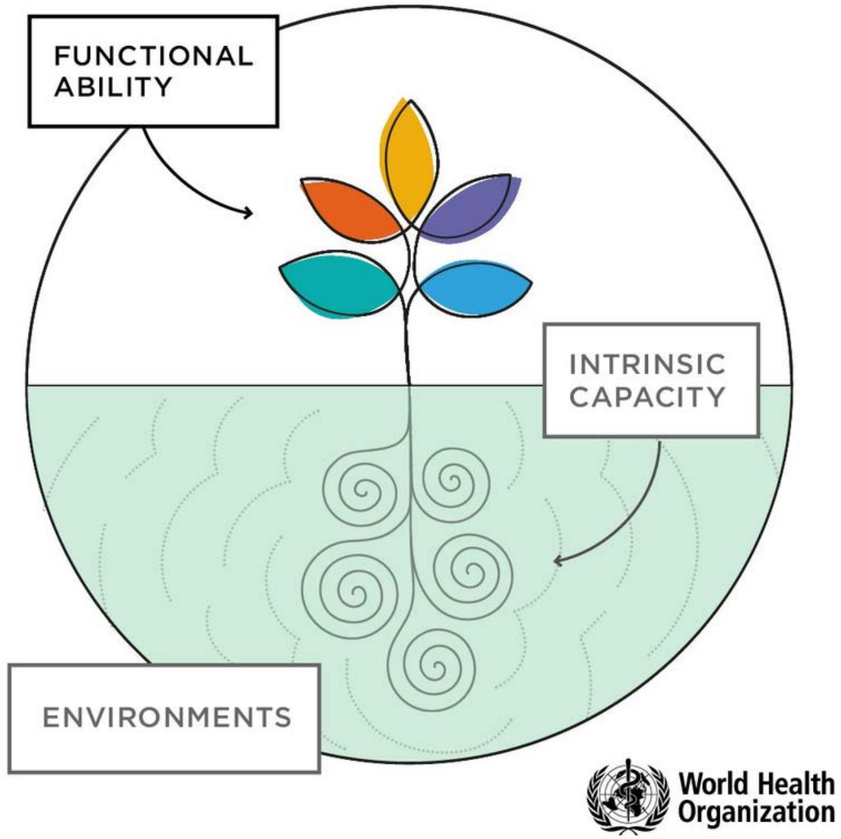
- Ability to meet basic needs, standard of living
- Ability to learn, grow and make decisions
- Ability to be mobile
- Ability to build and maintain relationships
- Ability to contribute to society



Healthy Ageing - WHO

Functional Ability - From intrinsic capacity: Physical and mental

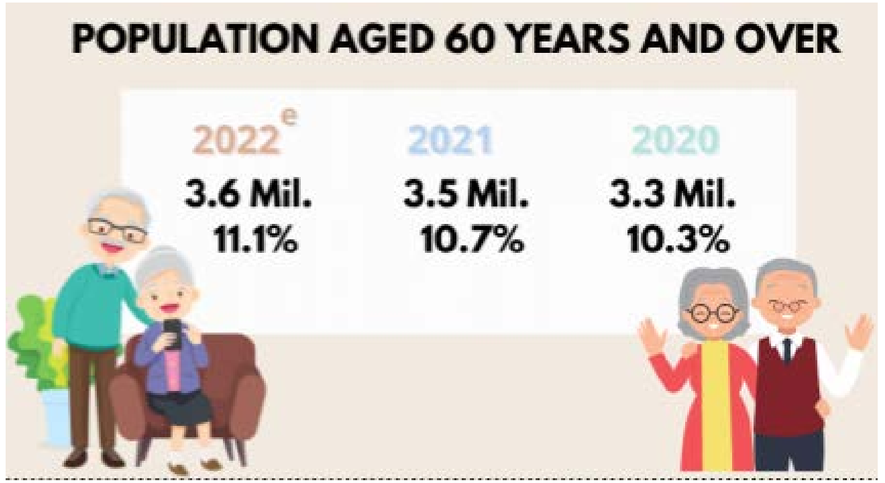
- Locomotor capacity
- Sensory capacity
- Vitality
- Cognition
- Psychological capacity



Challenges towards Healthy Ageing

Are we ready?

Malaysia's Older Adult population



Dept of Statistics Malaysia, accessed 13 May 2023, https://www.dosm.gov.my/portal-main/release-content/current-population-estimates-malaysia-2022

What enables functional ability?

How do we enable functional ability?

Bone Muscle & Fat

What enables functional ability?

Bone, muscle & fat

Bone

Structural & mesenchymal reservoir

- 95% adult bone density set in adolescence
- Bone resorption > Bone formation after third decade
- Accelerated decline of bone mineral post-menopausal

Muscle

Energy powerhouse for movement, posture

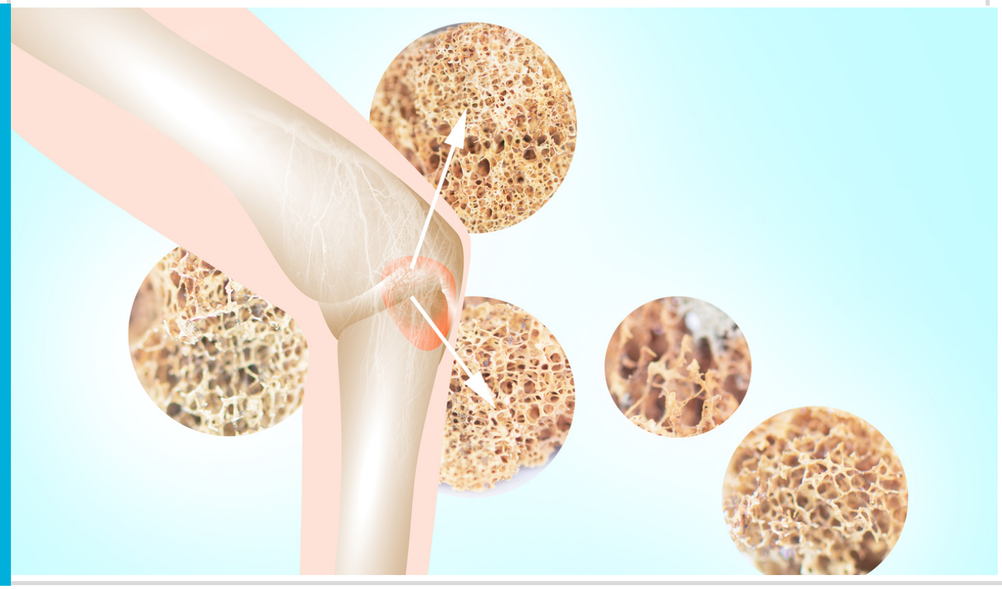
- Active tissue that regulates basal metabolism
- Reserves of ATP for 2-h long running
- Slow-twitch fibres, fast-twitch muscles to generate strength endurance, power

Fat

Energy source, endocrine disruptor

Required as part of health, daily energy resource
Too few and too much results in health issues
Energy reserve - used when sick, longer duration physical activity

Bone in OP



OSTEOPOROSIS

Low bone mineral density (BMD) (≤−2.5 T-score from dual-energy x-ray absorptiometry [DXA]) or presence of fragility fracture(s) or both

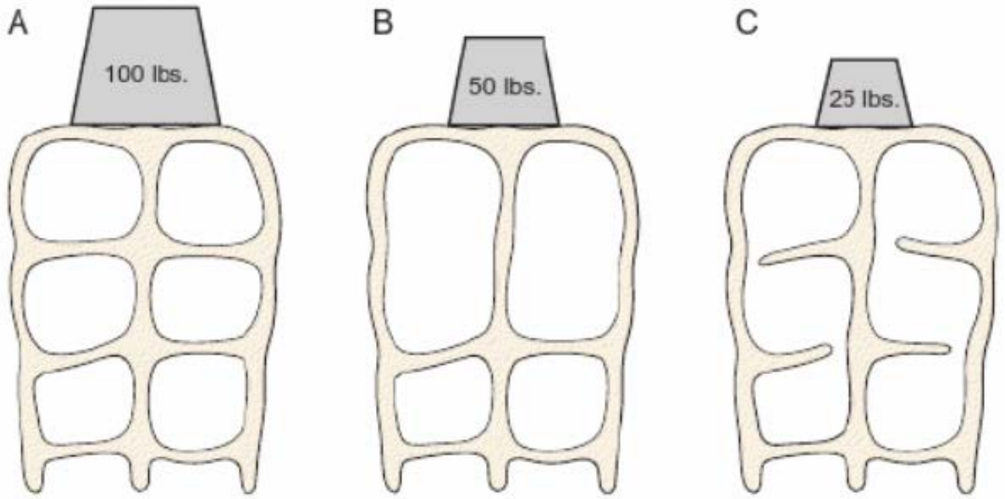
(Beck, 2022, Exerc Sports Sc Rev)

Main concern of osteoporosis = Fractures

Fractures depends on bone strength
Bone strength = Density + Structure + Quality

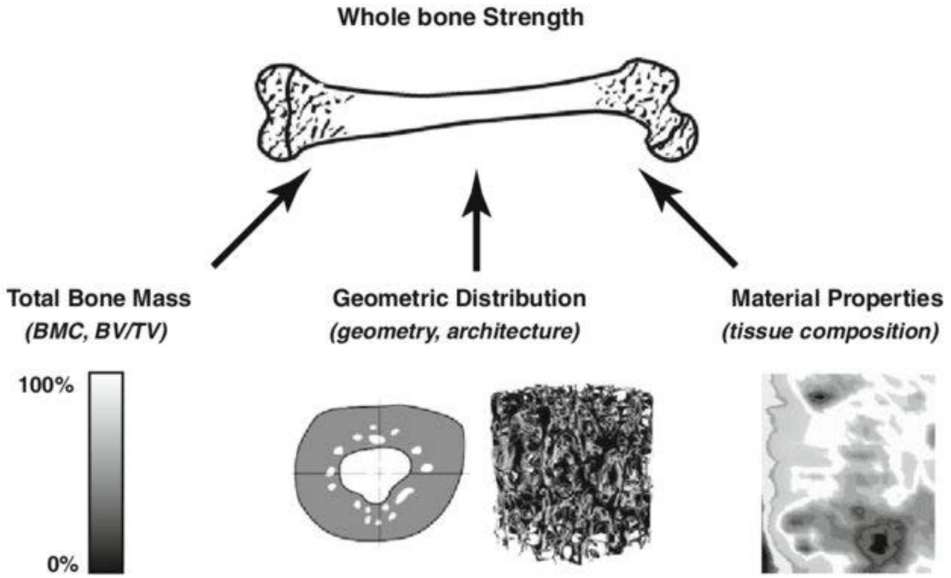
(Burr & Akks, 2014, Chpt 1, Basic Appl Bone Biol)

BONE STRENGTH



Model A & C - Similar mass
Model B - Lower mass than A & C

(Burr & Akks, 2014, Chpt 1, Basic Appl Bone Biol)



Bone material = Quality
Compromised collagen-links, AGEs

(Cole & van der Mulen, 2011, Clin Ortho Related Res)

Osteoporosis

(Beck, 2022, Exerc Sports Sc Rev)

Assessed

- Bone mineral density - DXA, CT, US
- Bone structure - pQCT, CT, MRI
- Bone quality - bone biopsy

Consequences

- High risk of fragility fractures
- Leads to disability
- All-course mortality

Treatment

- Pharmacotherapy - anti-absorptives, anabolic agents
- Nutrition - calcium, vitamin D
- Exercise - resistance & impact training

Muscle & Fat in OP

MUSCLE DISORDER

Sarcopenia: A progressive age-related muscle mass loss, poor muscle strength and reduced muscle performance

(ICD-10, 2016)

FAT DISORDER

Obesity: Excessive adipose tissue especially around visceral organs that would increase risks of chronic diseases such as type 2 diabetes.

(International Diabetes Federation)

Sarcopenia

(Chen et al.,2020, JAMDA)

Assessed

- Muscle strength: Handgrip, 5-time sit-to-stand
- Muscle mass: DXA, BIA
- Muscle performance: 6-m gait, SPPB

Consequences

- Leads to frailty
- Higher incidences of falls & fractures
- Lower QoL
- All-course mortality

Treatment

- Nutrition - essential amino acids, adequate kcal
- Exercise - resistance training
- Possible pharmaco treatment in the future

Sarcopenia Diagnostic criteria

Table I. Former and ISarcoPRM diagnostic criteria for sarcopenia by different working groups (in chronological order)

	Diagnostic criteria			
Study group, (reference)	Muscle mass	Muscle strength	Performance	Outcome (severe or mobility limited)
ESPEN-SIG Muscaritoli et al. 2010 (4)	ASM/Wt (%)	×	Gait speed < 0.8 m/s	×
EWGSOP Cruz-Jentoft et al. 2010 (5)	ASM/Ht^2 ♂ < 7.26 kg/m^2 ♀ < 5.5 kg/m^2	Grip strength ♂ < 30 kg ♀ < 20 kg	Gait speed ≤ 0.8 m/s SPPB ≤ 8	Low (muscle mass + strength + performance)
IWGS Fielding et al. 2011 (6)	ASM/Ht^2 ♂ ≤ 7.23 kg/m^2 ♀ ≤ 5.67 kg/m^2	×	Gait speed < 1 m/s	×
SSCWD Morley et al. 2011 (7)	ASM/Ht^2 ♂ ≤ 7.26 kg/m^2 ♀ ≤ 5.45 kg/m^2	×	Gait speed ≤ 1 m/s < 400 m during a 6-min walk	×
FNIH Mclean et al. 2014 (8) Studenski et al. 2014 (9)	ASM/BMI ♂ < 0.789 ♀ < 0.512	Grip strength ♂ < 26 kg ♀ < 16 kg	×	Gait speed ≤ 0.8 m/s Inability to rise from a chair w/o support
AWGS Chen et al. 2014 (10)	ASM/Ht^2 ♂ < 7.0 kg/m^2 ♀ < 5.4 kg/m^2	Grip strength ♂ < 28 kg ♀ < 18 kg	Gait speed < 0.8 m/s	
EWGSOP2 Cruz-Jentoft et al. 2019 (11)	ASM/Ht^2 ♂ < 7.0 kg/m^2 ♀ < 5.5 kg/m^2	Grip strength ♂ < 27 kg ♀ < 16 kg CST > 15 s	×	Gait speed ≤ 0.8 m/s SPPB ≤ 8
AWGS 2019 Chen et al. 2020 (12)	ASM/Ht^2 ♂ < 7.0 kg/m^2 ♀ < 5.4 kg/m^2	Grip strength ♂ < 28 kg ♀ < 18 kg	CST ≥ 12 s Gait speed < 1 m/s SPPB ≤ 9	Low (muscle mass + strength + performance)
ISarcoPRM Kara et al. 2020 (13)	STAR ♂ < 1.4 ♀ < 1.0	Grip strength ♂ < 32 kg ♀ < 19 kg CST ≥ 12 s	×	Gait speed ≤ 0.8 m/s Inability to rise from a chair w/o support

(Kara et al.,2020, J Rehab Med)

Sarcopenia

Clinical routine management

- Need for medical doctors to check under usual care for older adults
- Muscle strength test - detect possible/probable sarcopenia
- SARC-F - detect severe sarcopenia, late capture & treatment

Concomitant diagnosis

Commonly accompanying but not sarcopenia

- Frailty - fatigue, psychosocial
- Malnutrition - inadequate intake, absorption issues
- Cachexia - cancer, cardiac

(Dent et al., 2021, Nat Aging)

Obesity

Measured

Body mass index - >30 kg/m^2
Body fat percentage - DXA, BIA; > 30% men, >42% women
Waist circumference - >102 cm men, >88 cm women

(Berens et al., 2020, BMC Geriatrics)

Consequences

Obesity-related co-morbidities - CVD, T2D, OA
Mobility issues - disabilities
All-cause mortality

Treatment

Pharmacotherapy - appetite suppressants, lipase inhibitors AOMs
Diet therapy - low kcal, low fat, high-fibre
Exercise - higher volume, AE & RE

JOURNAL ARTICLE

Cohort Profile Update: The Concord Health and Ageing in Men Project (CHAMP)

Saman Khalatbari-Soltani, Fiona M Blyth, Vasi Naganathan ✉, David G Le Couteur, David J Handelsman, Markus J Seibel, Vasant Hirani, F A Clive Wright, Louise M Waite, Robert G Cumming

International Journal of Epidemiology, Volume 51, Issue 1, February 2022, Pages 31–32h, https://doi.org/10.1093/ije/dyab171

Published: 03 October 2021

Overview

- Started in 2005, n = 1705 men aged 70 y & above
- Follow-up measures at 2007/09, 2012/13, 2015/16 and 2019/20
- Clinical (blood samples), physical, dietary, QoL, cognition, oral health

5-y follow-up - frailty, disability, institutionalisation, mortality

Mean age: 81.4± 4.6 y, n = 950, BMI: 27.6± 3.9

Low lean mass (ALM:BMI <0.789):

- OR 2.12-2.35, p<0.001 frailty (adapted Fried)
- ADL and IADL disability scores: Full adj not sig

Obese (>30%) - No effects except OR 0.51 (0.31,0.84) on institutionalisation

(Hirani et al., 2018 ,Age and Ageing)

Bone
Volume 140, November 2020, 115546

Incidence and predictors of fractures in older adults with and without obesity defined by body mass index versus body fat percentage

Anoohya Gandham [a], Ayse Zengin [a], Maxine P. Bonham [c], Tania Winzenberg [d], Saliu Balogun [d], Feitong Wu [d], Dawn Aitken [d], Flavia Cicuttini [e], Peter R. Ebeling [a], Graeme Jones [d], David Scott [a b d f]

- Age 63 y at baseline, follow-up at 10y
- Obesity by BMI >30 kg/m^2
- Obesity by DXA body fat % >30 men, >40 women
- Self-report incidence fracture at 2.7y, 5y and 10y, n=1099

Result

- Obese by BMI 28%, by body fat 43%
- By BMI - aBMD & ALM higher than non-obese
- Obese-BMI - lower 40-50% likelihood non-vertebral facture
- Obese-BF - lower muscle strength (hand, led, knee) than non-obese
- Falls risk score OR2.15 (O-BMI), OR1.72 (O-BF)

Bone-Muscle-Fat

Additional challenges towards healthy ageing

Osteosarcopenia

- Presence of osteoporosis & sarcopenia
- Inter-related from bone-muscle cross talk

(Papadopoulou et al., 2022, Nutrients)

Sarcopenic obesity

- Presence of sarcopenia & obesity
- Recommend to look into the relation of ALM to fat ratio rather than defined obesity condition

(Donini et al., 2022, Obes Facts)

How to enable functional ability?

Diagnose & Treat

Diagnose early

Assess body composition & function

- Sarcopenia, osteoporosis, obesity measures and monitoring
- Assess as early as age 50 y
- Earlier intervention

Nutrition

Sufficient & suitable consultation

- Components to treat body composition measures
- Educate & empower of food beliefs, availability, source
- Calcium, protein, vitamins, fibre

Exercise

Professional consult & progression

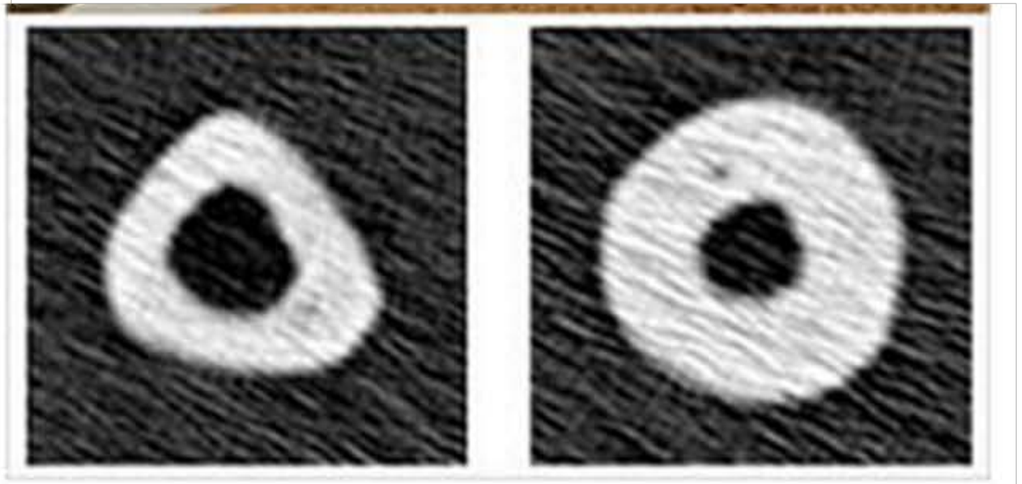
- Assess ability, individual prescription
- Specific with exercise principles and progressions
- Educate & empower on fitness & exercise skills & habits

Physical activity when young provides lifelong benefits to cortical bone size and strength in men

Stuart J. Warden[a,b,1], Sara M. Mantila Roosa[a], Mariana E. Kersh[c], Andrea L. Hurd[a], Glenn S. Fleisig[d], Marcus G. Pandy[c], and Robyn K. Fuchs[a,b]

[a]Center for Translational Musculoskeletal Research and [b]Department of Physical Therapy, School of Health and Rehabilitation Sciences, Indiana University, Indianapolis, IN 46202; [c]Department of Mechanical Engineering, University of Melbourne, Parkville, VIC 3010, Australia; and [d]American Sports Medicine Institute, Birmingham, AL 35205

Edited by Christopher B. Ruff, The Johns Hopkins University School of Medicine, Baltimore, MD, and accepted by the Editorial Board February 21, 2014 (received for review November 22, 2013)



Exercise is Medicine Grant

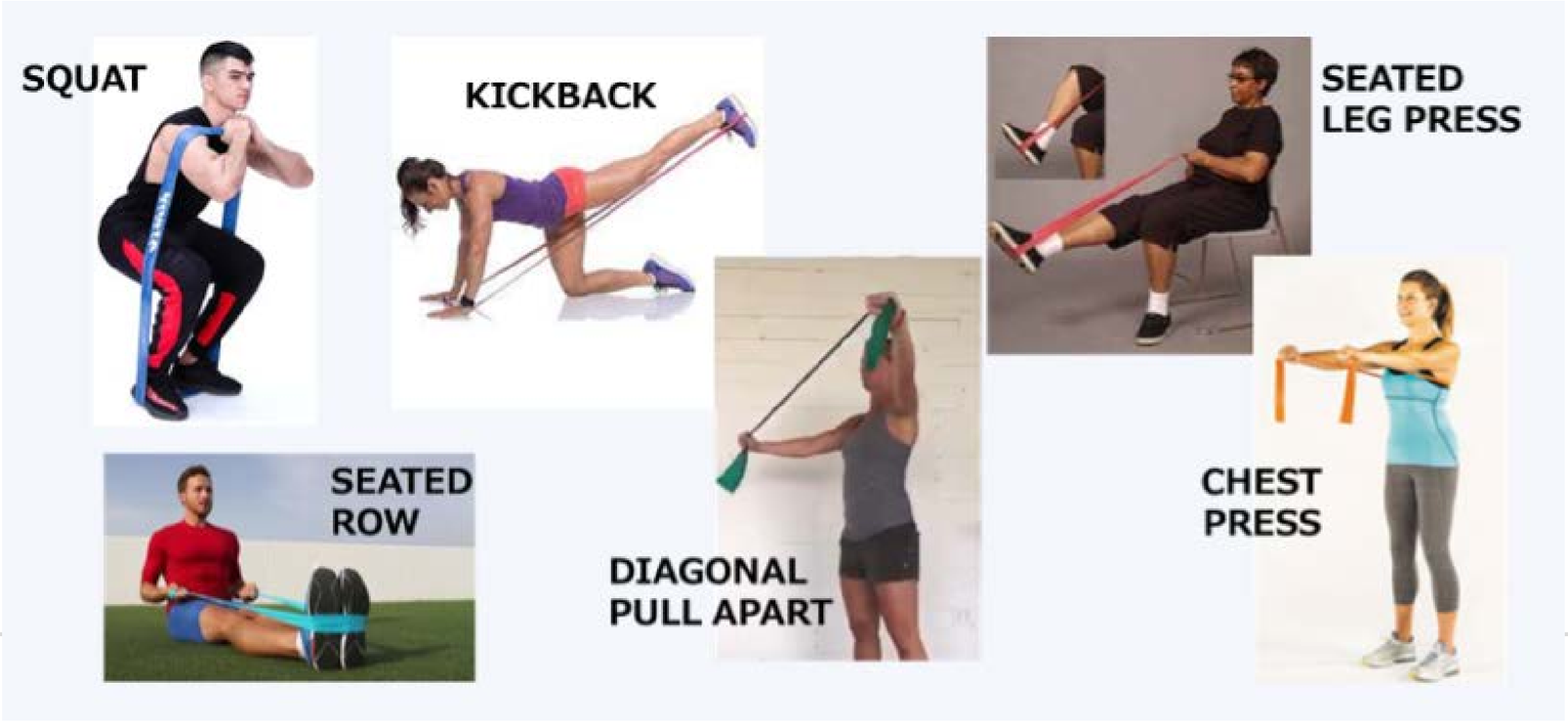
Screened 320 people, got 18 sarcopenic

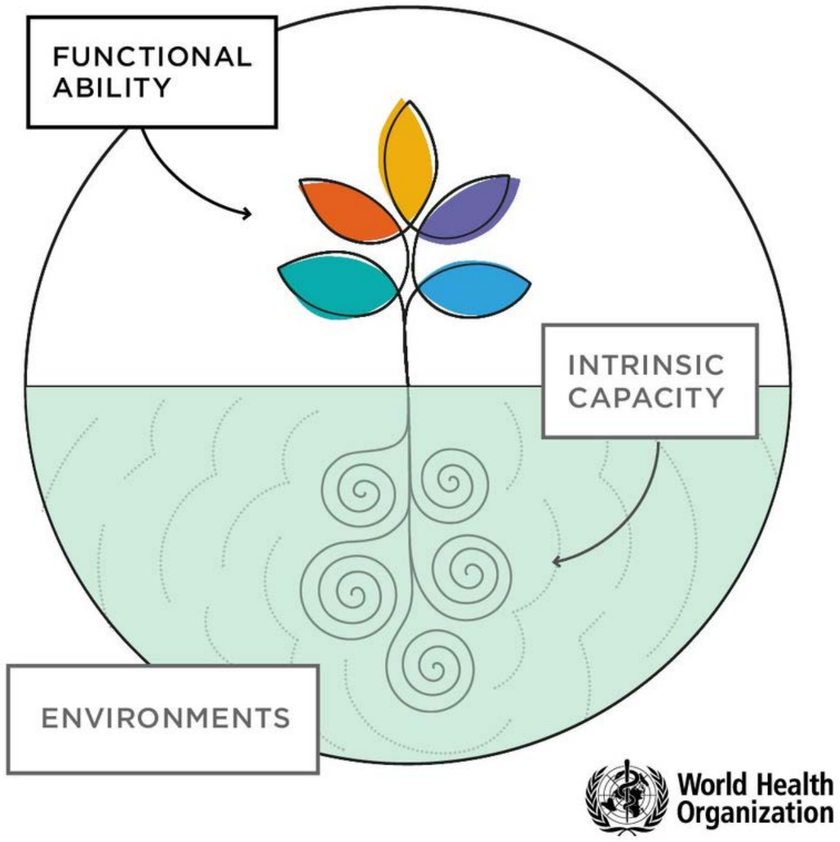
- n=16, 66±3.1y, BMI 25.5±4.4 kg/m^2
- Randomised 1) HIRT and 2) HIRT+Nutrition
- 12-week intervention, 80% 1-RM
- Exercise physiologist graduate trainer

Result

Pre-sarcopenia: 11--->4 (ALM)
Sarcopenia: 2 --->0
Severe sarcopenia: 3 --->1

No difference with HIRT vs HIRT+Nutrition groups





Conclusion

- Rexamine understanding of bone, muscle, fat in older people
- More consequences to healthy ageing than we know
- Applications on how to improve bone, muscle and fat
- Exercise is key but need professional consultation

Thank you

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