GastroGeb
Centres de Gastroentérologie
Réseau Crohn et Colite
Lausanne - Bulle

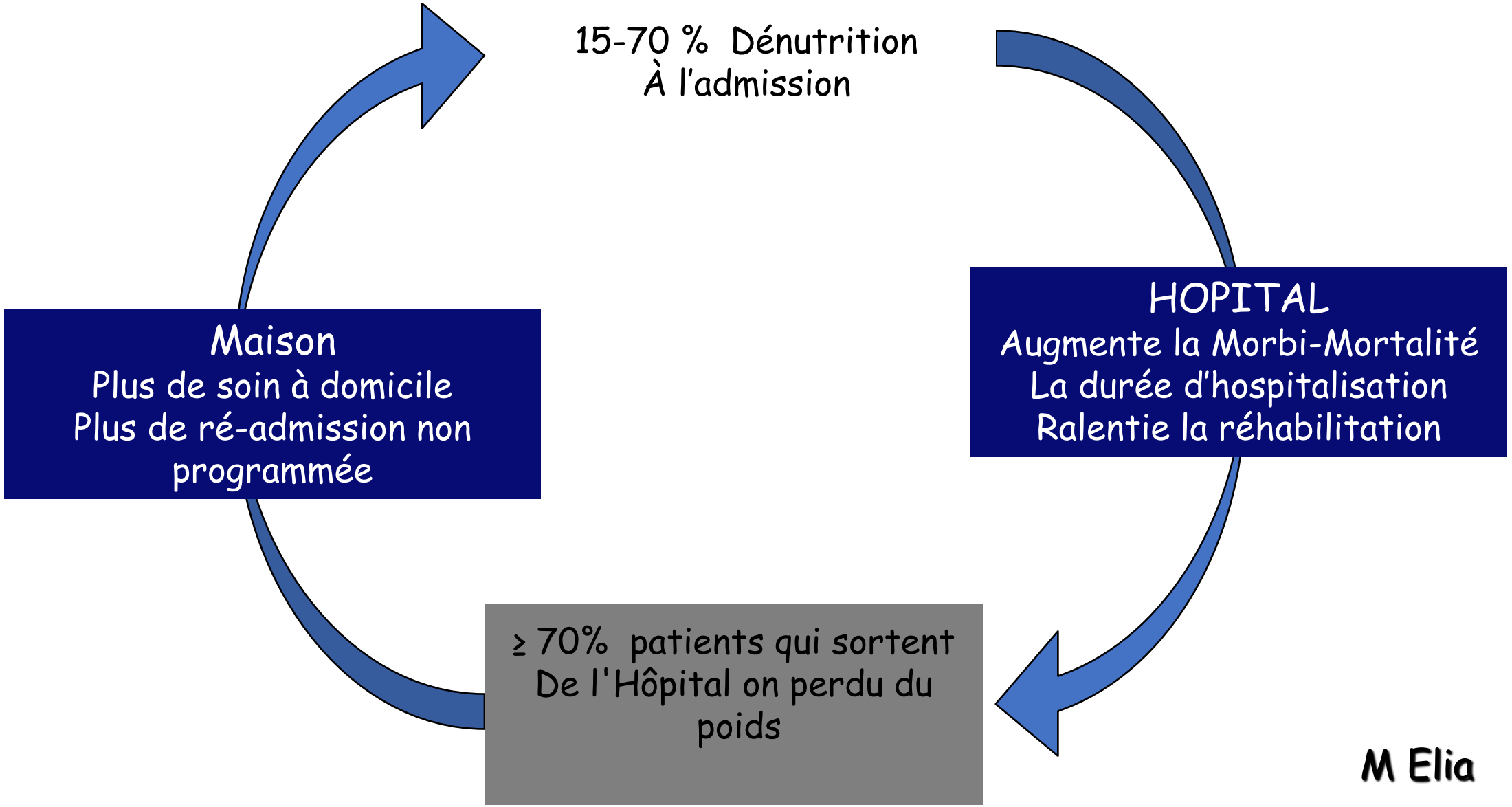
Le Muscle et La Maladie

Dre Jacquelin-Ravel Nathalie
Lausanne (Gastro-Entérologie Beaulieu)
Nyon
njacquelin@svmed.ch

Messages Clefs

- La Dénutrition : Impact majeur
- La Sarcopénie : 1989, Besoin d'une définition standardisée, validée, reproductible et efficiente : BIA DXA CT IRM
- La Cible Calorique : Calorimétrie indirecte
- La Cible Protéique : les études : 1.2g/kg, 1.3 g/kg
- Les Nutriments Spécifiques : exemple de l'HMB (arginine, leucine, Vit D, omega3…)
- Une Nutrition efficiente : Individualisée = Calorimétrie Indirecte + Hand Grip + Bioimpédancemétrie + Préalbumine + ….

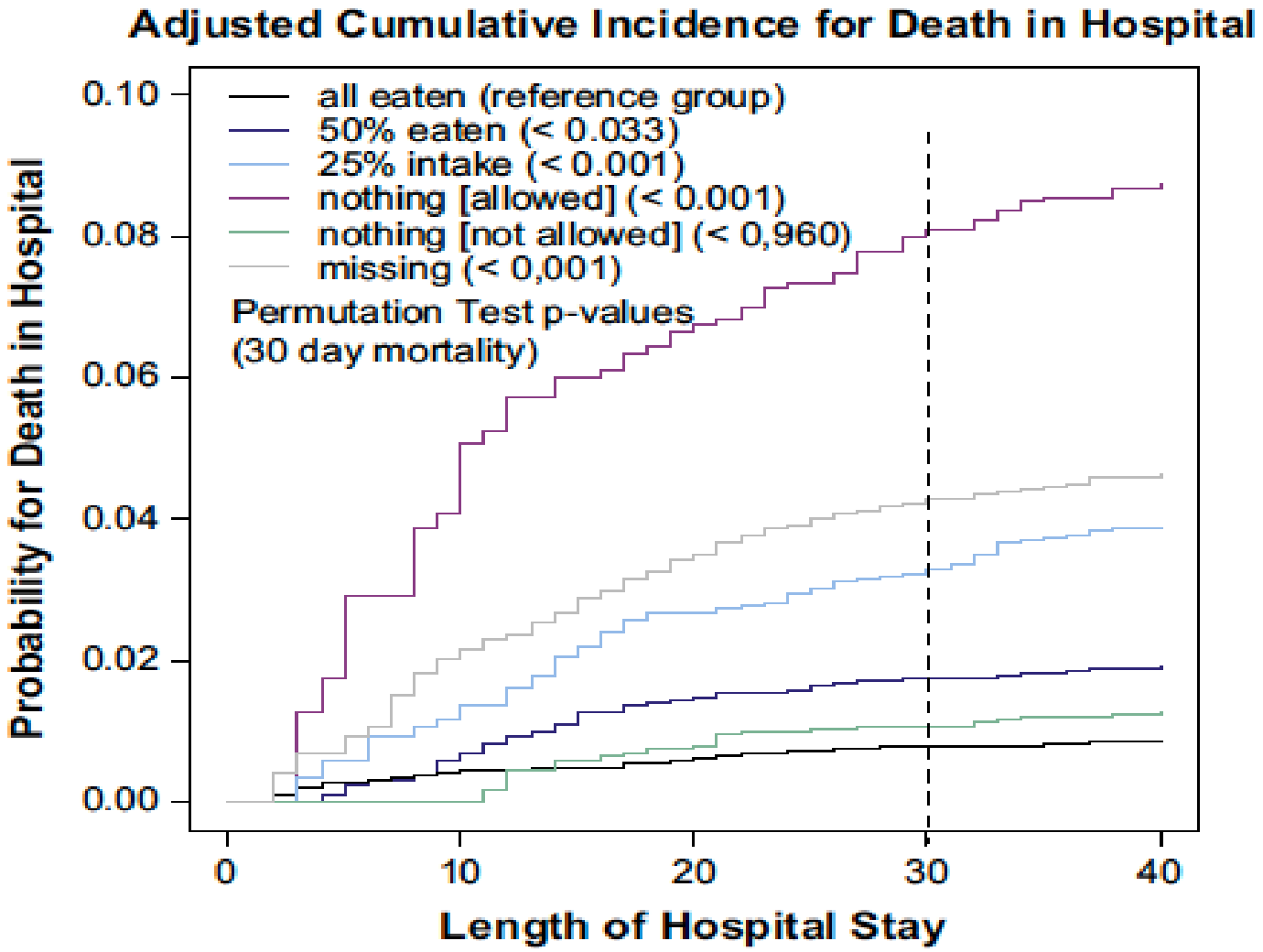
Le Cercle Vicieux de la Dénutrition



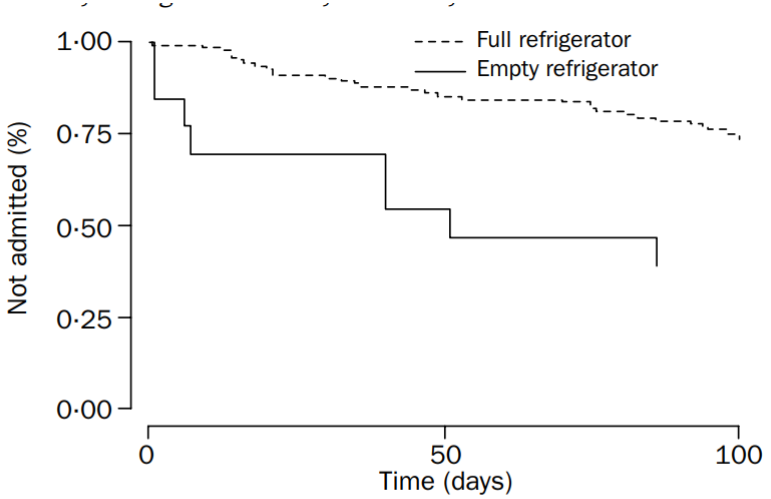
M Elia

Diminution de la prise alimentaire chez 16’290 adults hospitalisés: NutritionDay

Hiesmayr M et al. Clin Nutr 2009; 28: 484-91



Le Contenu du réfrigérateur et admission à l'hôpital des patients âgés>65 ans

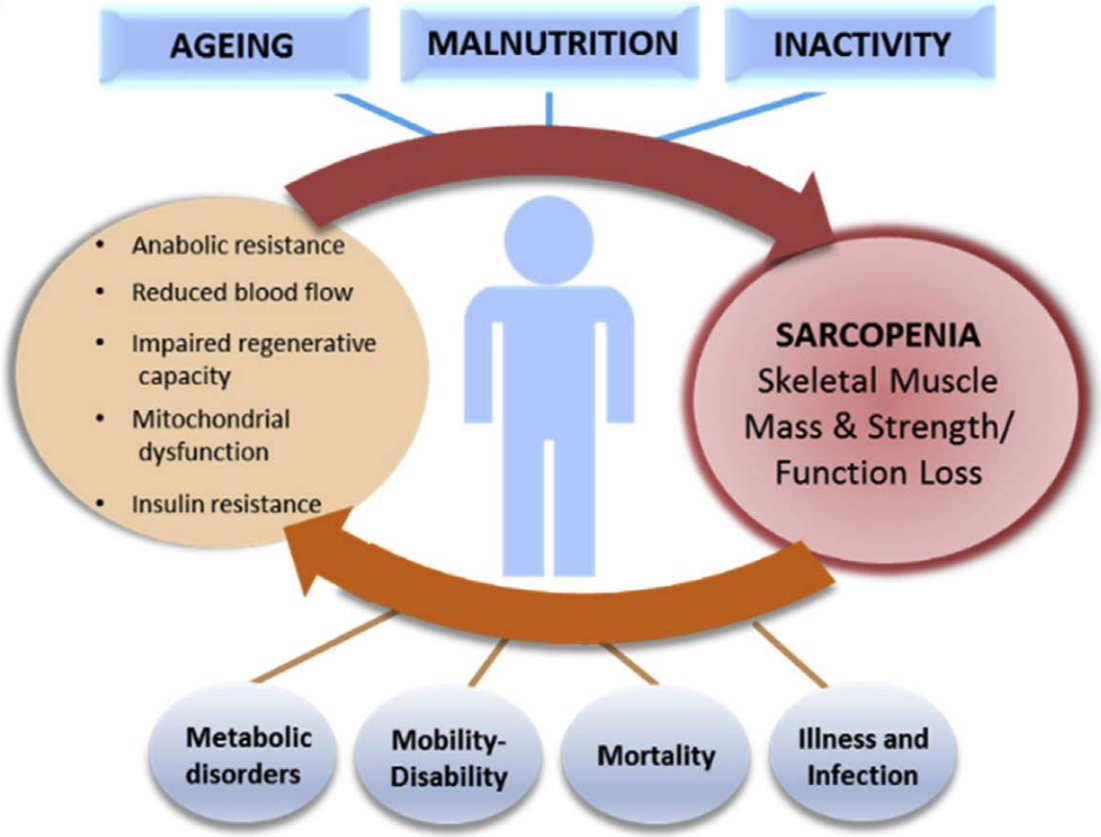


Kaplan-Meyer curves of risk of admission according to refrigerator status

Log-rank test: p=0·006 at 30 days, p=0·812 at 60 days, and p=0·458 at 90 days.

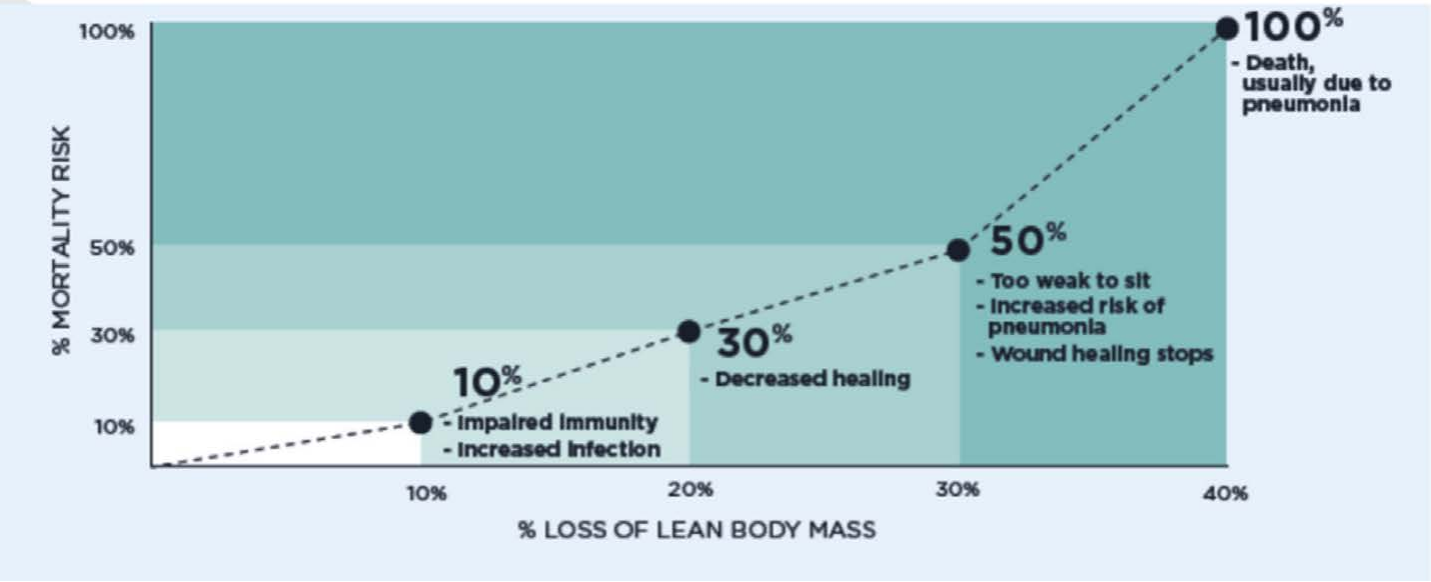
Boumendgel Lancet 2000 ; 356 : 563

Relation dénutrition, perte de masse musculaire et fonction



Landi F et al., Muscle loss: The new malnutrition challenge in clinical practice, Clinical Nutrition, https://doi.org/10.1016/j.clnu.2018.11.02

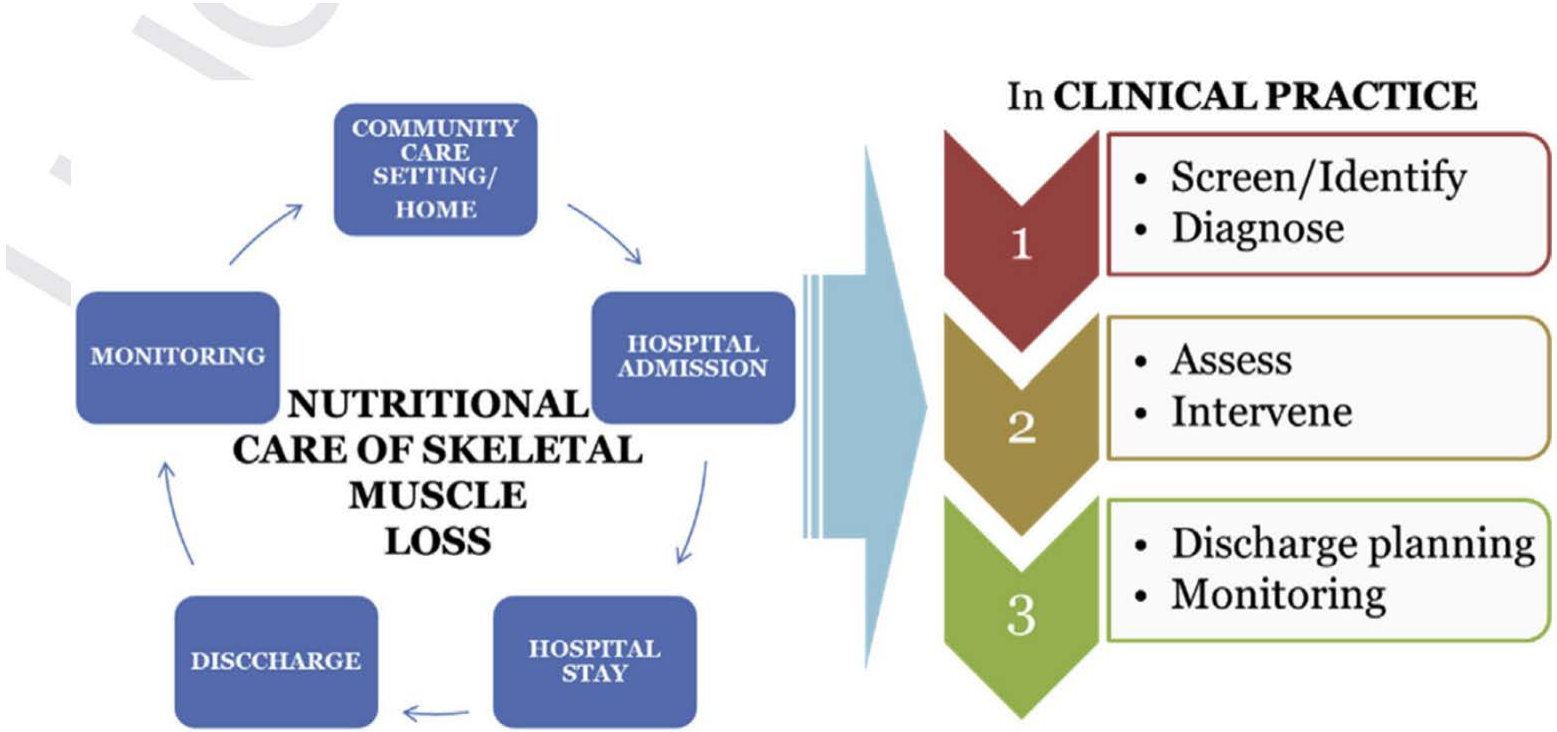
Les complications augmentent avec l'augmentation de la perte de la «Lean Body Mass»



Lean Body Mass = Mass or Graisse – Contenu Mineral Osseux = Muscle + tendon +peau + tissu conjonctif

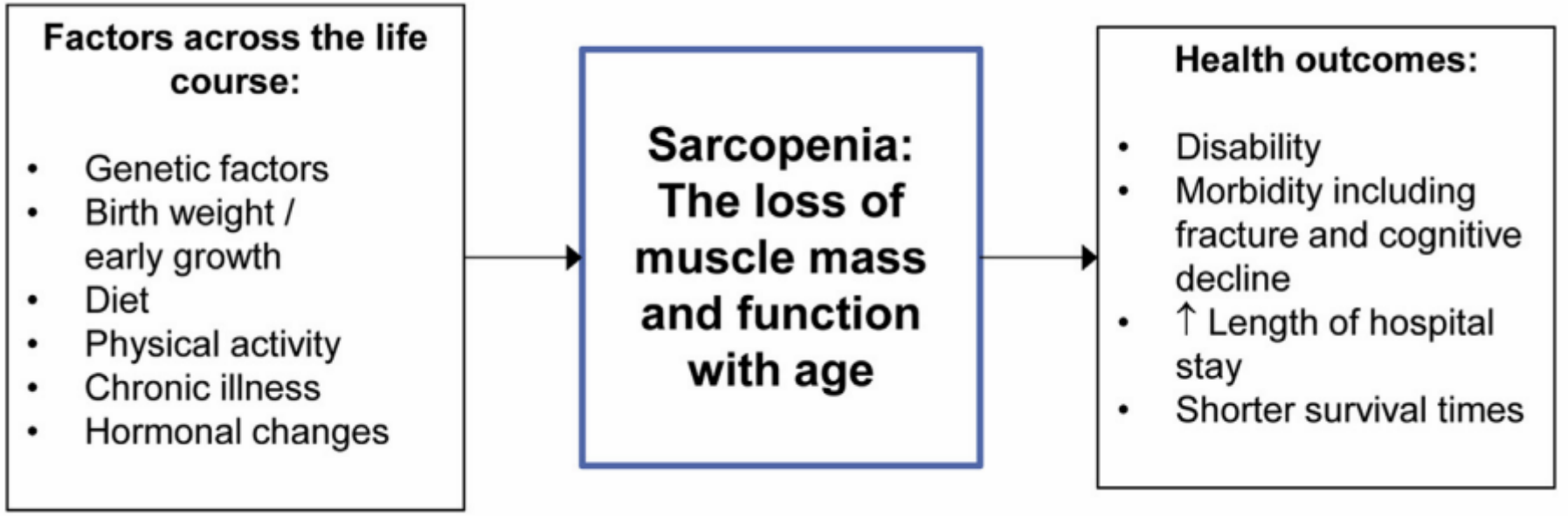
Landi F et al., Muscle loss: The new malnutrition challenge in clinical practice, Clinical Nutrition, https://doi.org/10.1016/j.clnu.2018.11.02

La perte de masse musculaire, une conséquence de la dénutrition, une prise en charge continue



Landi F et al., Muscle loss: The new malnutrition challenge in clinical practice, Clinical Nutrition, https://doi.org/10.1016/j.clnu.2018.11.02

EPIDEMIOLOGIE de la SARCOPENIE



Dodds RM Journal of Clinical Densitometry 2015

Passer du NRS au GLIM : ESPEN Global Initiative Adult Malnutrition

GLIM CRITERIA

Phenotypic criteria:

- **Unintentional weight loss** by time frame
- **Low body mass index (BMI; kg/m^2)** according to age and ethnicity
- **Reduced muscle mass** based on valid body composition assessment methods
  - Examples: physical exam, dual-energy absorptiometry, bioelectrical impedance analysis, ultrasound, computed tomography, magnetic resonance imaging, mid upper arm circumference, or calf circumference

Etiologic criteria:

- **Reduced food intake or assimilation** based on quantitative or qualitative report
  - Examples: 3-day food record, food frequency questionnaire, or patient self-report
  - Considerations:
    - Gastrointestinal symptoms that impact food intake or absorption (e.g., dysphagia, nausea, vomiting, diarrhea, constipation, abdominal pain, etc.)
    - Presence of malabsorptive disorders (e.g., intestinal failure, pancreatic insufficiency, post-operative bariatric surgery, etc.)
    - Other relevant clinical situations affecting food intake (e.g., esophageal strictures, gastroparesis, intestinal pseudo-obstruction, etc.)
- **Inflammation and Disease Burden** from acute or chronic injury or disease
  - Acute: major infection, burns, trauma, or closed head injury
  - Chronic: malignant disease, chronic obstructive pulmonary disease, congestive heart failure, or chronic kidney disease
  - Supportive laboratory tests: C-reactive protein, albumin, or pre-albumin

Intérêt de Dépister La Masse/Fonction musculaire pour identifier la Sarcopénie

- Dépister des patients non identifiés par le simple NRS : patients qui passent à travers les mails du filet avec les critères actuels.
- Thérapie Nutritionnelle individualisée
- Analyse plus différenciée que la simple perte de poids

SARCOPENIE : DéfinitionS

1. Masse Musculaire : Définition initiale
2. Force Musculaire : Définition secondaire
3. Performance Physique : Définition tertiaire
4. Mesures combinées : EWGSOP

Les différentes méthodes d'évaluation : Masse, force, fonction

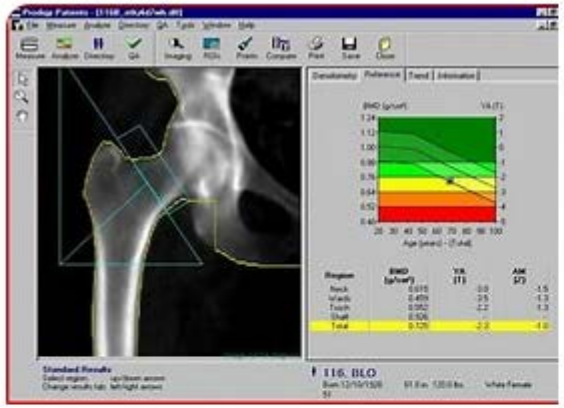
Methods routinely available to assess muscle-related outcomes in research and clinical practice. Adapted from Cruz-Jentoft et al., 2010 [24] and 2018 [53].

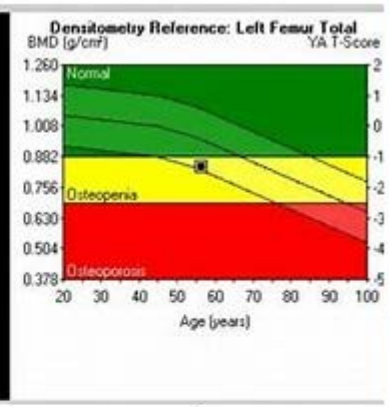
Variable	Research	Clinical practice
Skeletal muscle strength	Grip strength Chair stand test (chair rise test) Knee flexion/extension Peak expiratory flow	Grip strength Chair stand test (chair rise test)
Skeletal muscle mass	Dual energy X-ray absorptiometry (DXA) Computed tomography (CT) Magnetic resonance imaging (MRI) Bioelectrical impedance analysis (BIA) Ultrasound	DXA BIA Lumbar muscle cross-sectional area by CT Anthropometry
Physical performance	Short Physical Performance Battery (SPPB) Gait speed Timed-up-and-go test (TUG) 400-meter walk or long-distance corridor walk Stair climb power test	SPPB Gait speed TUG 400-m walk

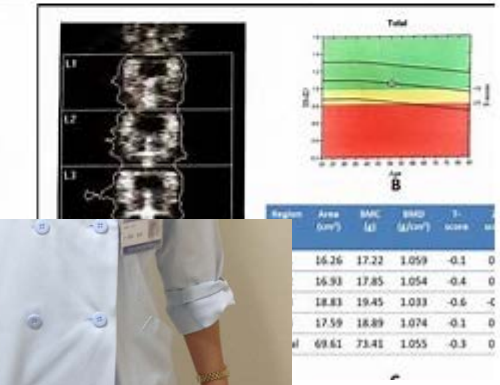
Landi F et al., Muscle loss: The new malnutrition challenge in clinical practice, Clinical Nutrition, https://doi.org/10.1016/j.clnu.2018.11.02

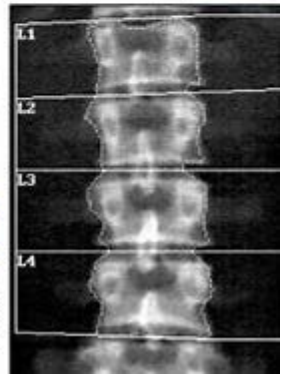
La Masse musculaire : Comment la définir et avec quel outil

- Masse Musculaire
  - Anthropométrie : masse musculaire appendiculaire / Taille au carré
  - Bioimpédancemétrie : Fat Free Mass = Minéraux, protéines, glycogènes
  - DXA : Lean Body Mass = Masse or grasse – Contenu minéral osseux
  - CT Scanner en L3
  - IRM

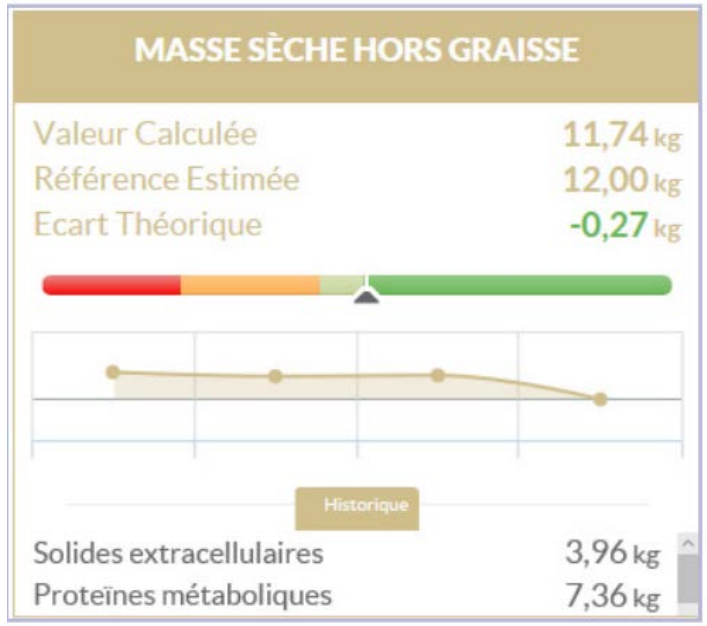



Densitometry Reference: Left Femur Total
BMD (g/cm²)
YA T-Score
Normal
Osteopenia
Osteoporosis
Age (years)






BIODY
MANAGER


MASSE SÈCHE HORS GRAISSE
Valeur Calculée 11,74 kg
Référence Estimée 12,00 kg
Ecart Théorique -0,27 kg
Historique
Solides extracellulaires 3,96 kg
Proteïnes métaboliques 7,36 kg


Angle de phase
6,7°

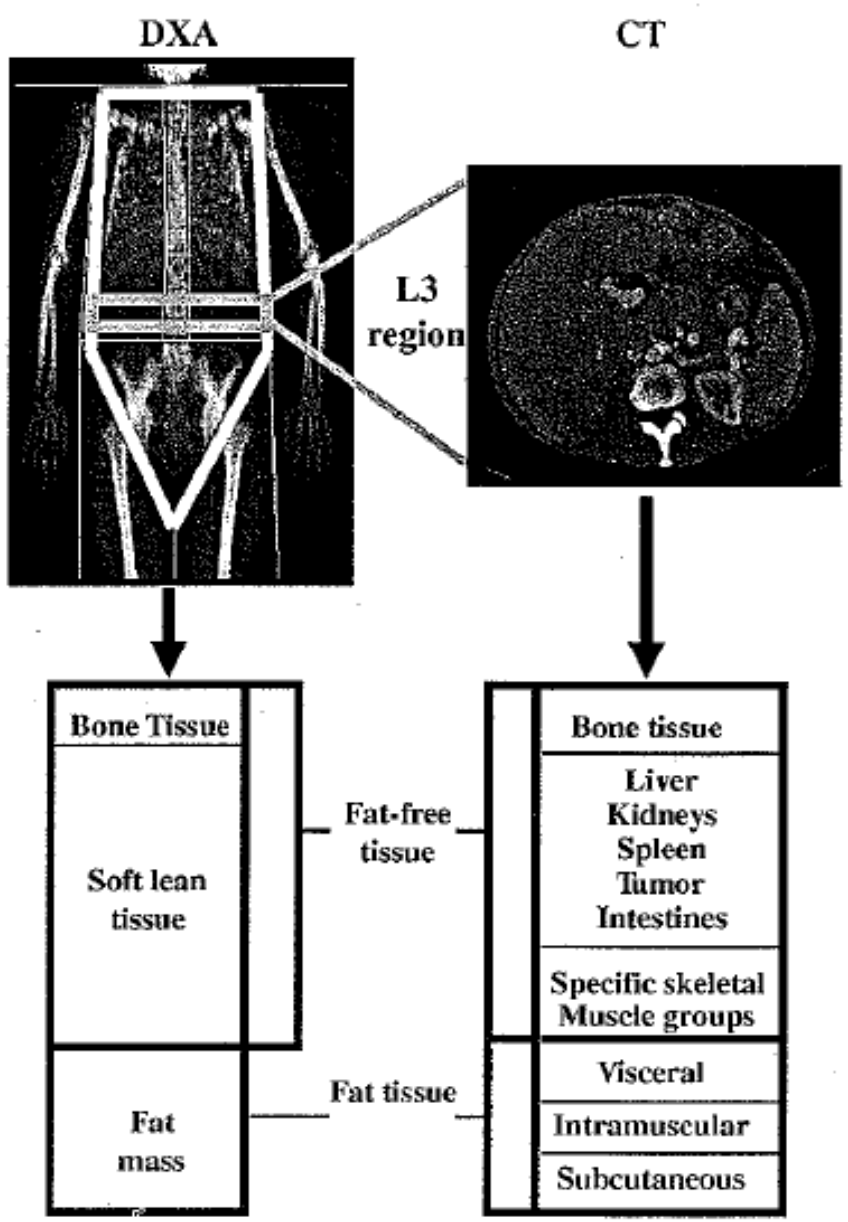
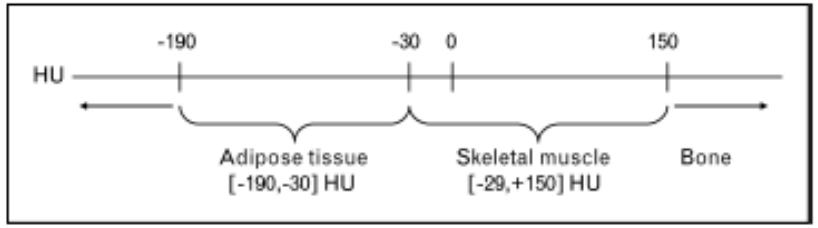


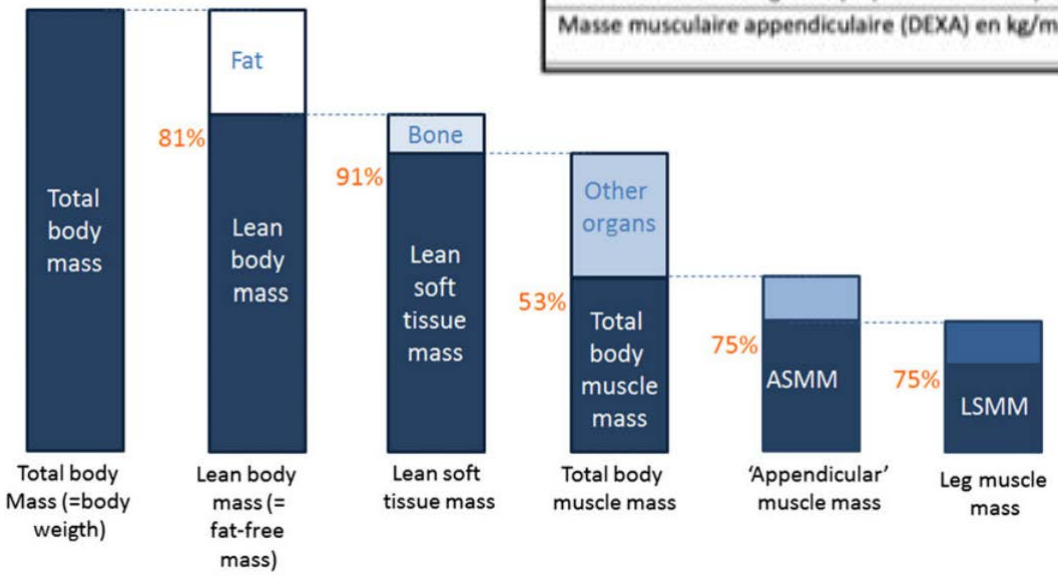
Figure 1 Hounsfield unit ranges for adipose and skeletal muscle tissue



The Hounsfield unit (HU) scale is a linear transformation of the attenuation coefficient measurement in which the radiodensity of distilled water at standard pressure and temperature is defined as zero HUs and the radiodensity of air at standard temperature and pressure (STP) is defined as −1000 HU. Typical HU values are for bone (+400 HU), skeletal muscle (+40 HU), and adipose tissue (−120 HU).

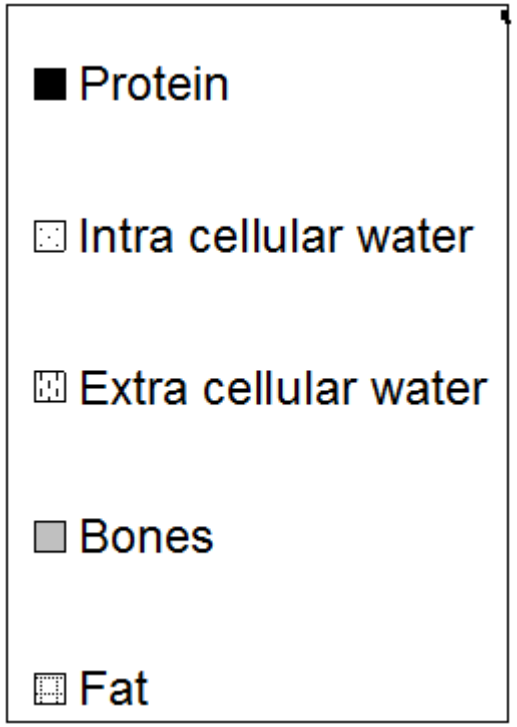
Les différents compartiments

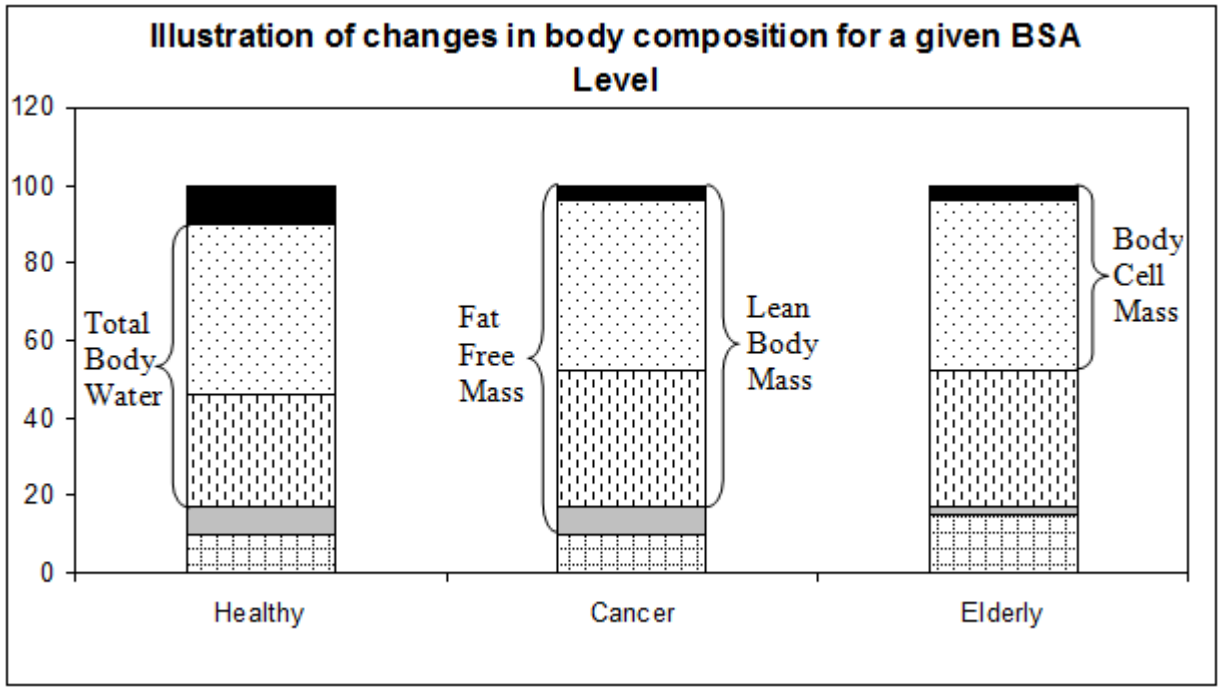
Méthodes de mesure	Hommes	Femmes
Indice de surface musculaire en L3 en cm^2/m^2 (scanner, IRM)	52,4	38,5
Indice de masse musculaire en kg/m^2 (impédancemétrie)	7,0	5,7
Indice de masse non grasse (impédancemétrie[a]) en kg/m^2	< 17	< 15
Masse musculaire appendiculaire (DEXA) en kg/m^2	7,23	5,67

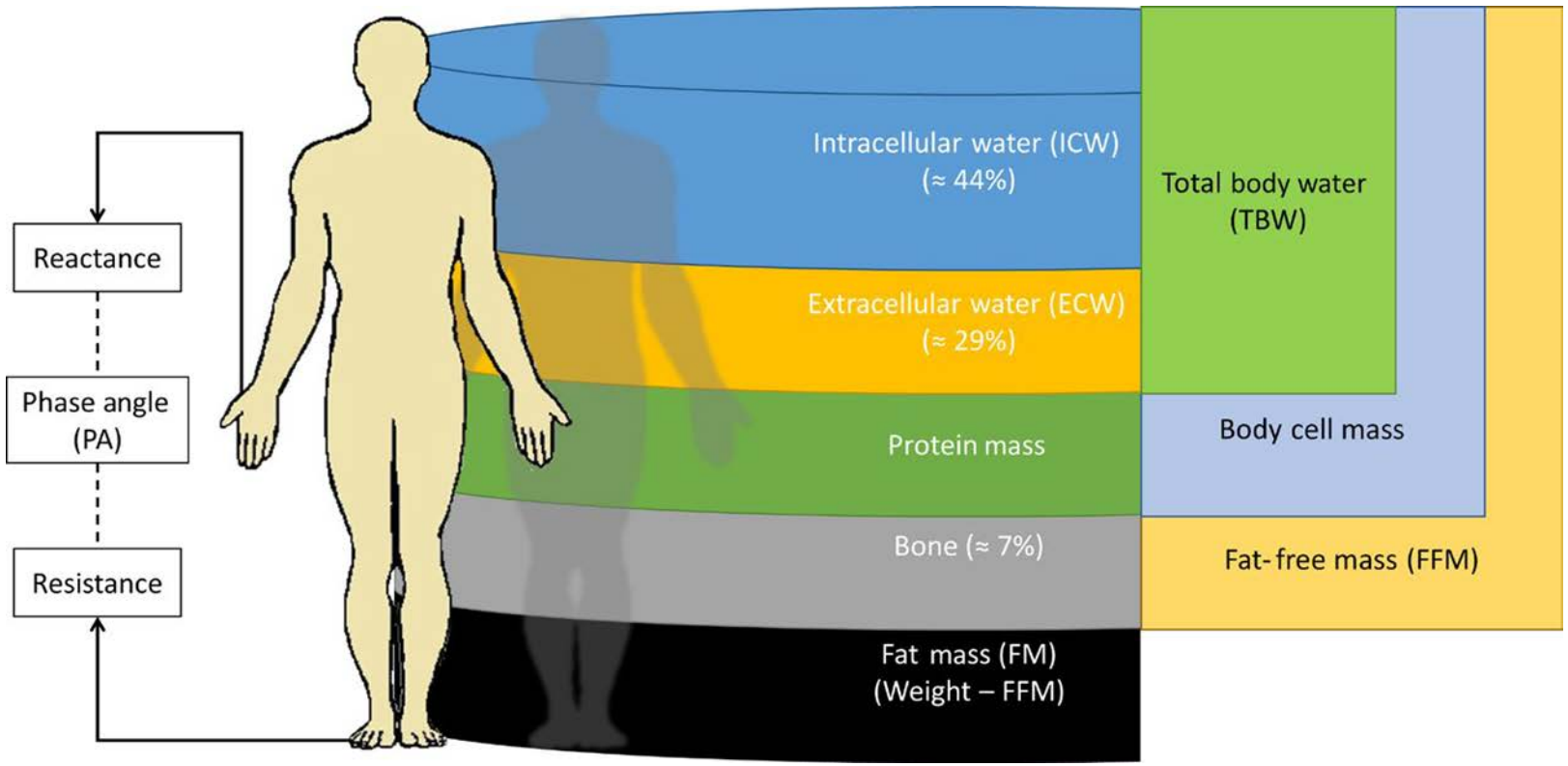


Journal of Cachexia, Sarcopenia and Muscle 2018; 9: 269–278

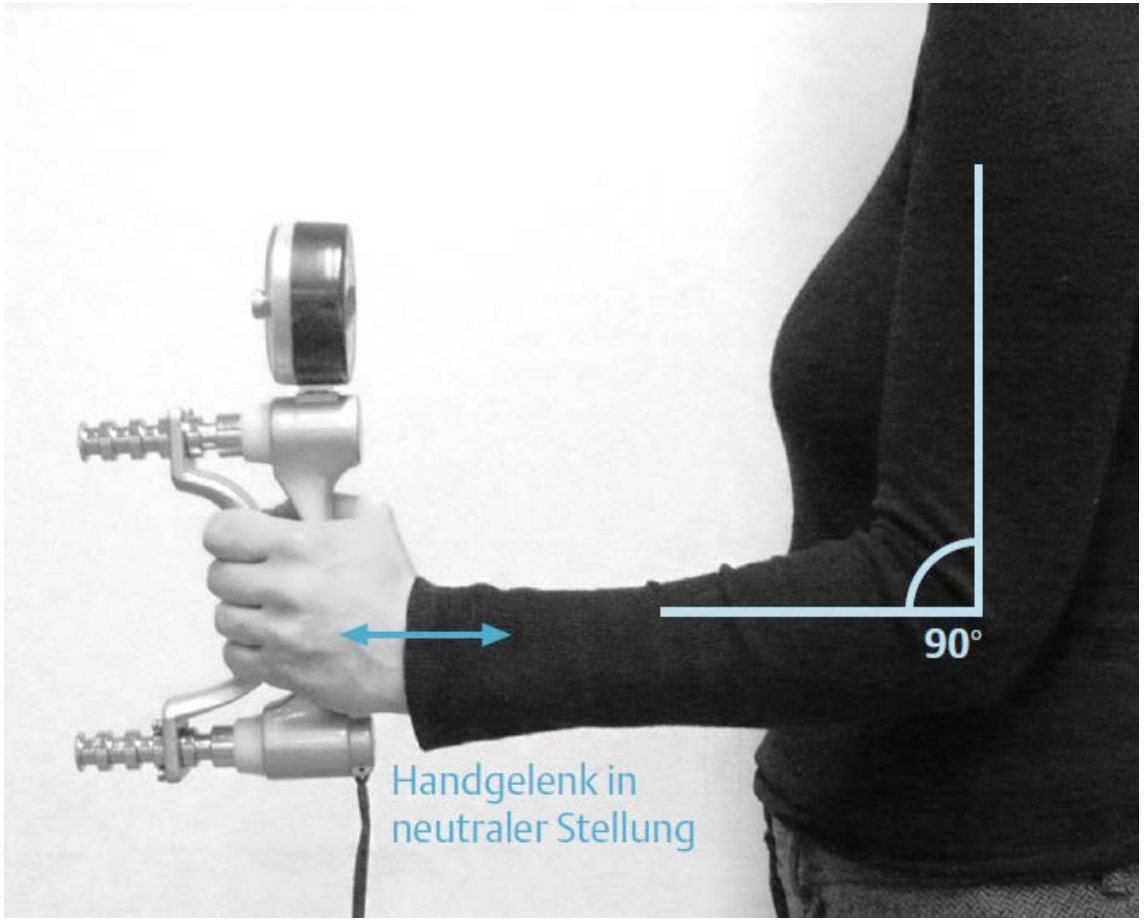
Les différents compartiments






Reactance
Phase angle (PA)
Resistance
Intracellular water (ICW) (≈ 44%)
Extracellular water (ECW) (≈ 29%)
Protein mass
Bone (≈ 7%)
Fat mass (FM) (Weight – FFM)
Total body water (TBW)
Body cell mass
Fat-free mass (FFM)

European Working Group On Sarcopenia: nouveau cutt off pour la définition de la sarcopénie



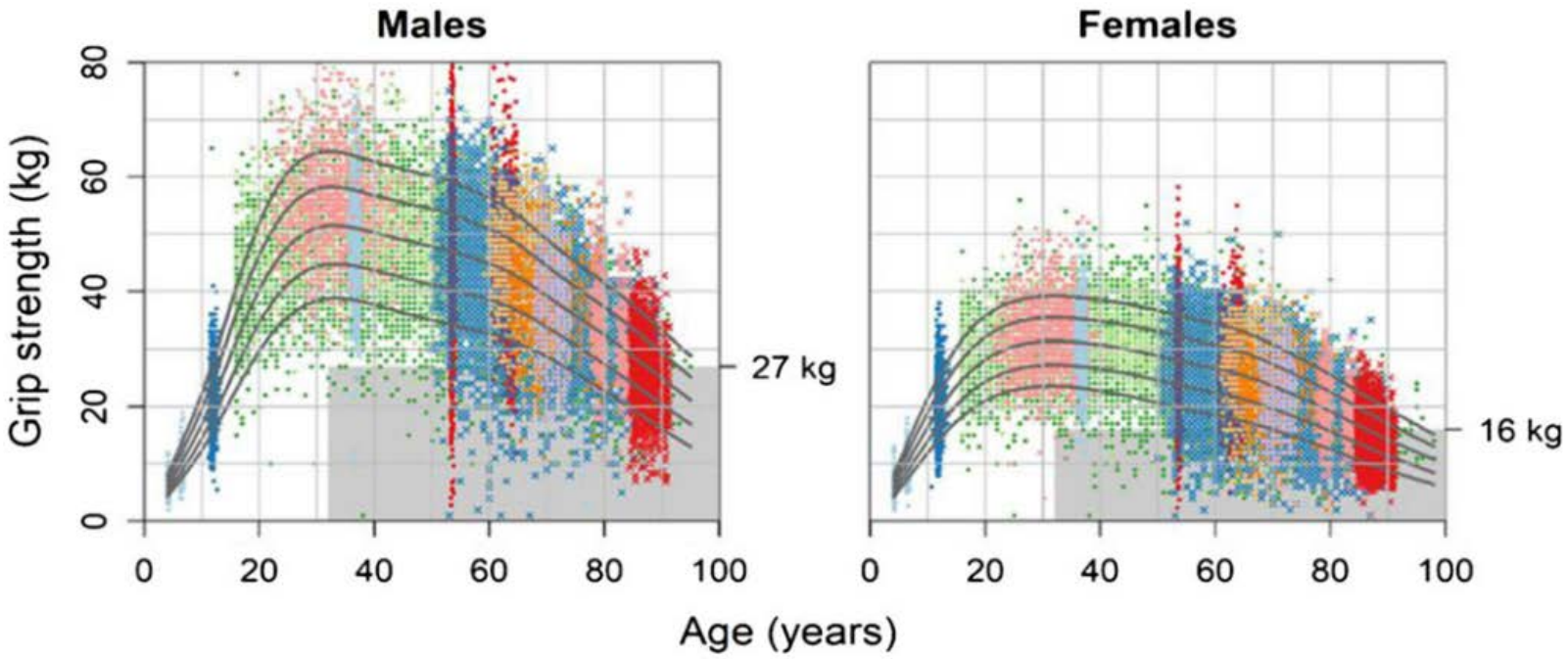
Sarcopénie Cut-Off

Homme: <27kg

Femme: <16kg

Cruz-Jentoft et al. Age and Aging. 2019

Hand Grip chez des anglais au cours de leur vie



Age and Ageing 2019; 48: 16–31

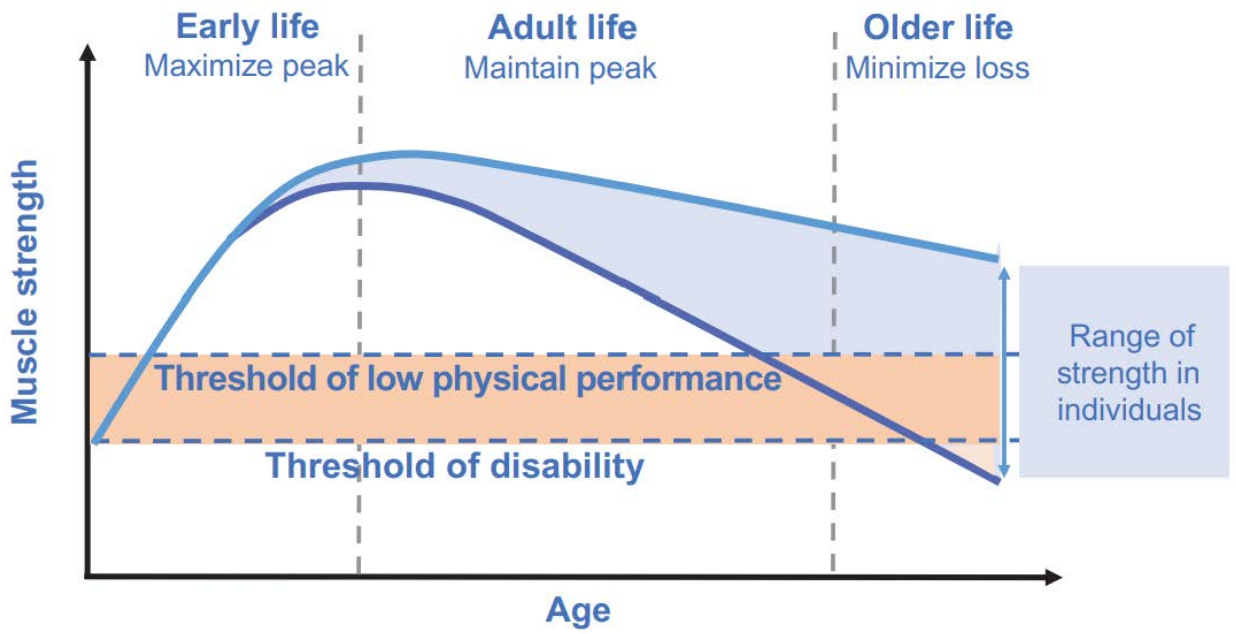
Performance of the EWGSOP2 Cut-Points of Low Grip Strength for Identifying Sarcopenia and Frailty Phenotype: A Cross-Sectional Study in Older Inpatients

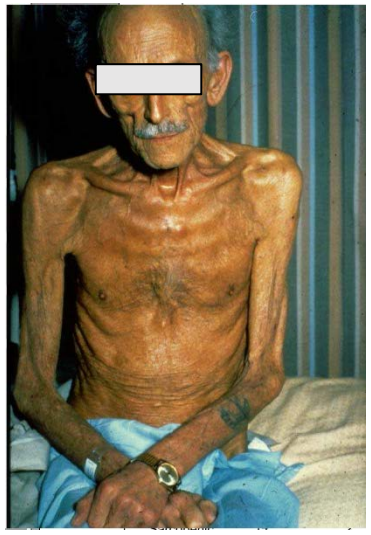
Table 3. Prevalence of low grip strength, sarcopenia, and frailty phenotype based on EWGSOP2 cut-off definition of low grip strength compared with other cut-off definitions of low grip strength (n = 98).

Name of Recommendation	Grip Strength Cut-Off Definition	Low Grip Strength, n (%)	p-Value [b]	Sarcopenia [c] n (%)	p-Value [b]	Frailty Phenotype [d] n (%)	p-Value [b]
EWGSOP2	Women <16 kg Men <27 kg	27 (27.6%)	Ref	10 (10.2%)	Ref	56 (57.1%)	Ref
AWGS1	Women < 18 kg Men <26 kg	32 (32.7%)	0.12	10 (10.2%)	1.00	56 (57.1%)	1.00
AWGS2	Women <18 kg Men <28 kg	37 (37.8%)	<0.01	12 (12.2%)	0.47	59 (60.2%)	0.25
EWGSOP1	Women <20 kg Men <30 kg	45 (45.9%)	<0.01	18 (18.4%)	0.02	64 (65.3%)	0.02
FNIH1	Women <16 kg Men <26 kg	26 (26.5%)	0.32	9 (9.2%)	0.63	55 (56.1%)	0.63
FNIH2	Women <19.99 kg Men <31.83 kg	50 (51.0%)	<0.01	19 (19.4%)	0.02	67 (68.4%)	<0.01
Fried	Women ≤17 to ≤21kg [a] Men ≤29 to ≤32 kg [a]	41 (41.8%)	<0.01	13 (13.3%)	0.33	62 (63.3%)	0.06
SDOC	Women <20 kg Men <35.5 kg	55 (56.1%)	<0.01	19 (19.4%)	0.02	69 (70.4%)	<0.01

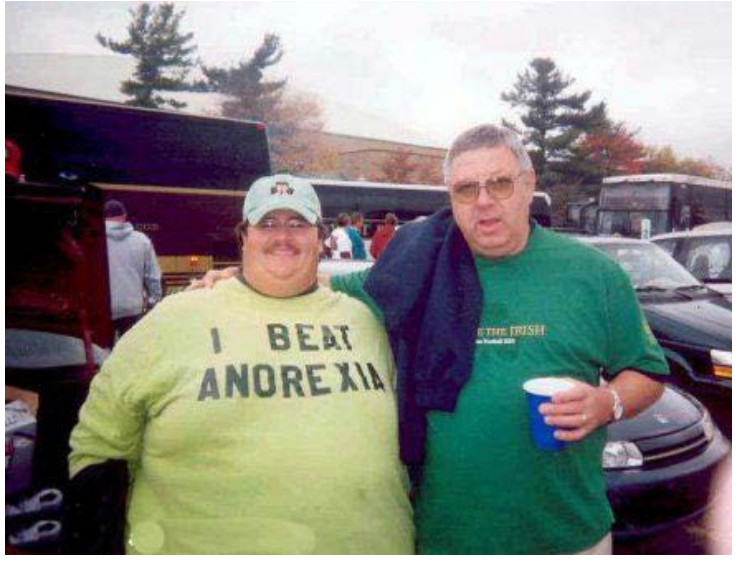
Int. J. Environ. Res. Public Health 2021, 18, 3498

Optimiser dès le jeun âge pour limiter la perte à un âge avancé

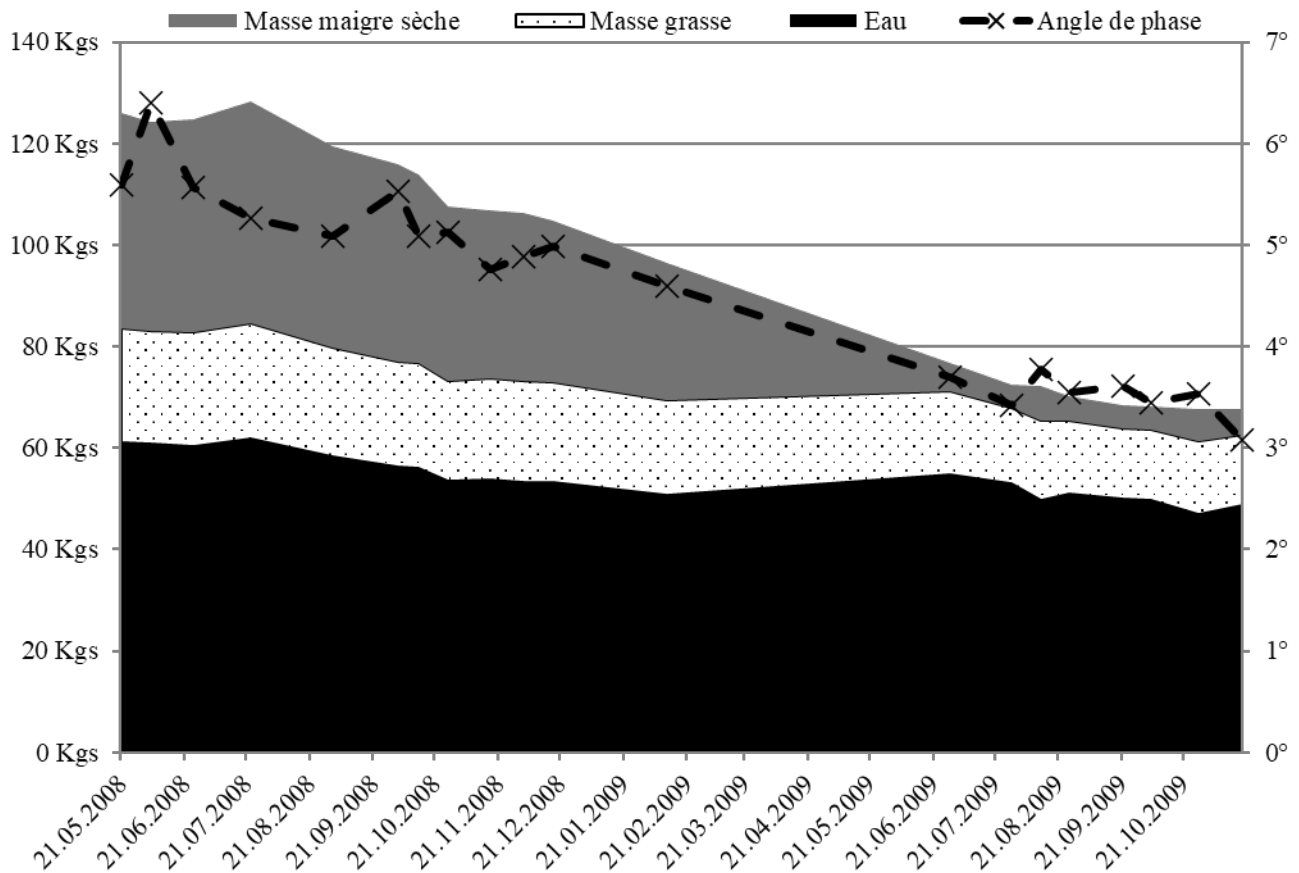




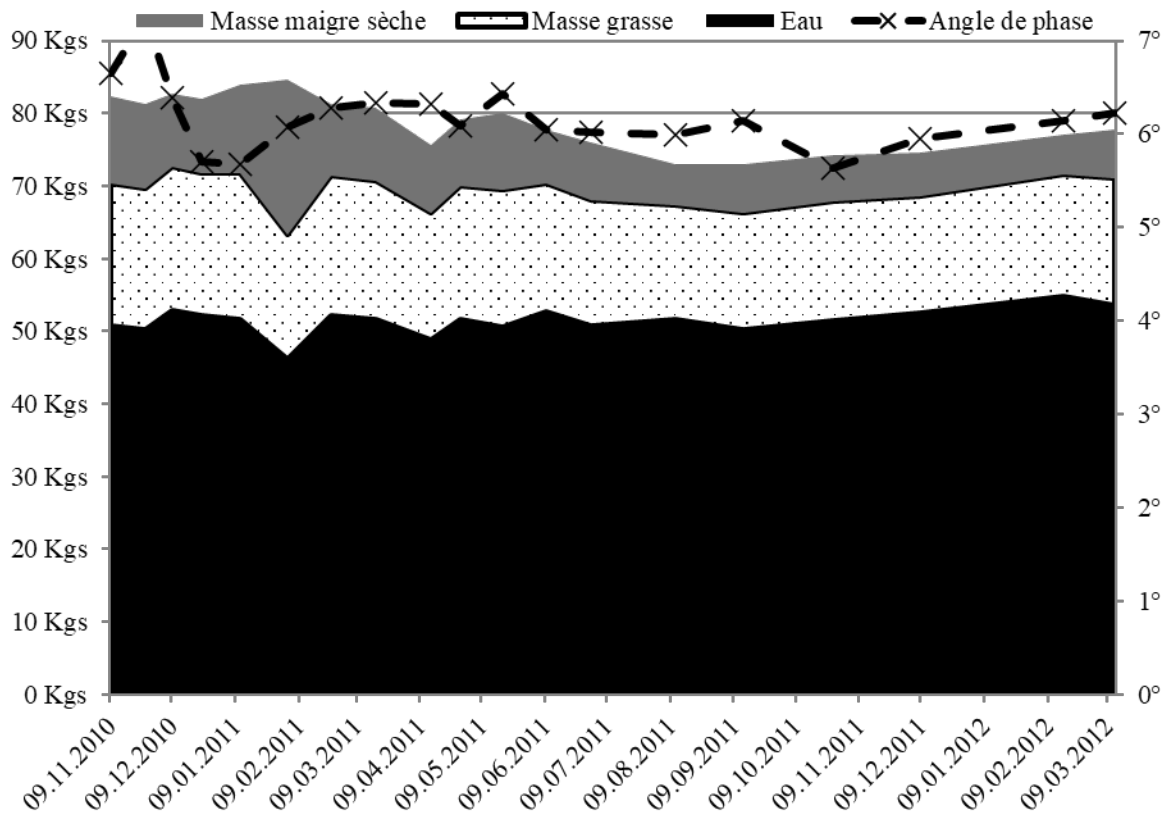
Masse Musculaire et devenir clinique ?

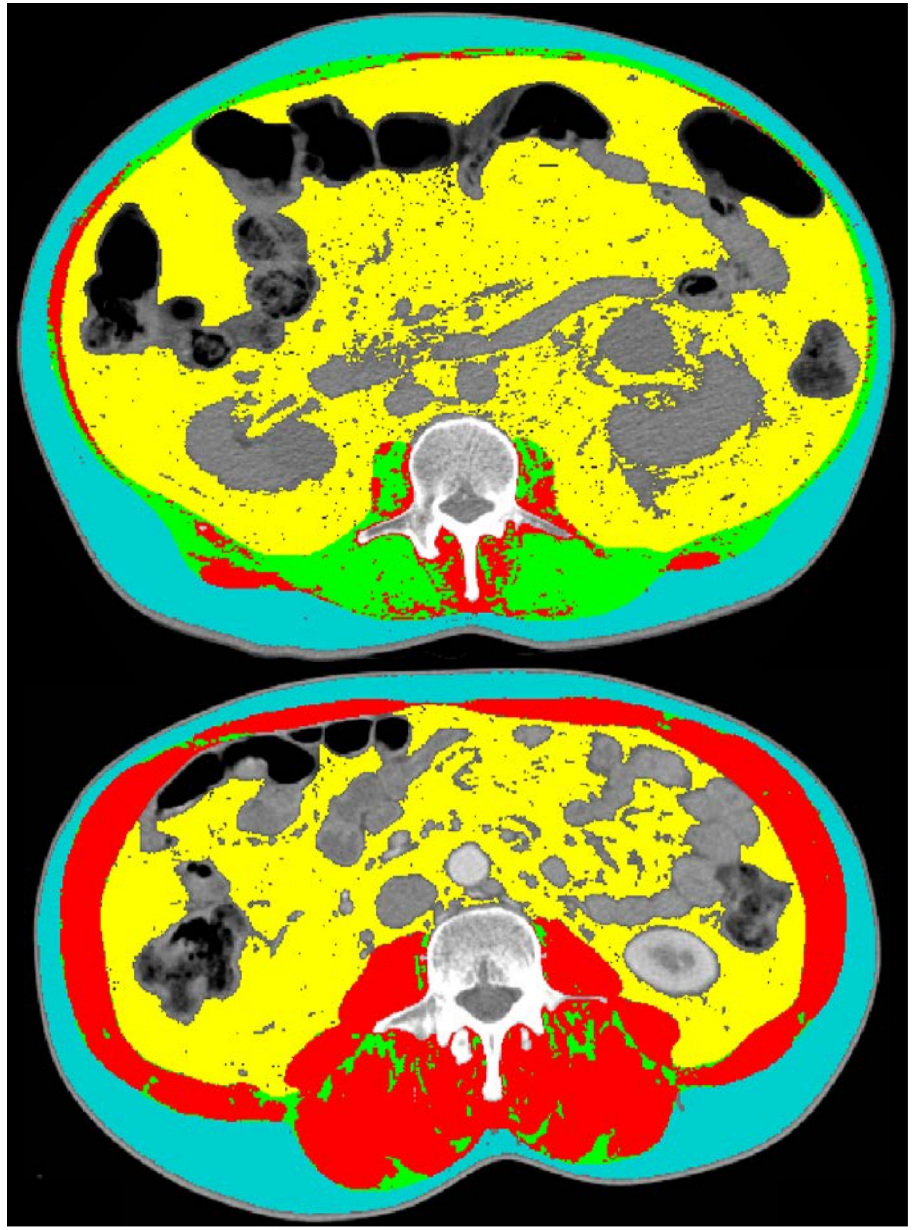


Evolution de la composition corporelle et de l'angle de phase chez un patient obèse non sarcopénique atteint d'un adénocarcinome du tiers de l'œsophage. Décédé en octobre 2011



Evolution de la composition corporelle et de l'angle de phase chez un patient atteintd'un adénocarcinome de la jonction oesogastrique ypT3pN2M0. En rémission actuellement





SM = 31.66 cm2
AT = 575.5 cm2

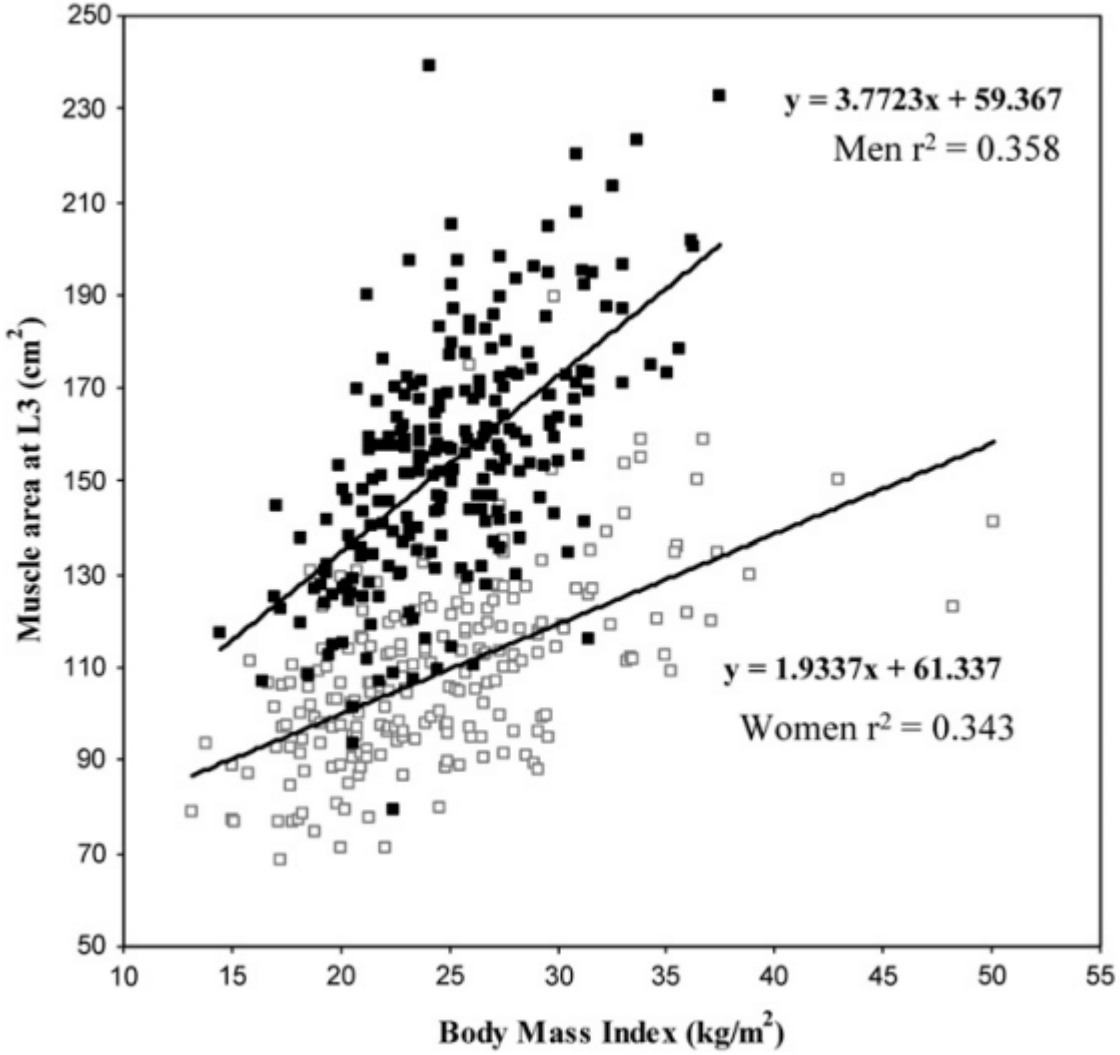
BMI = 24.4 kg/m2

SM = 177.0 cm2
AT= 303.1 cm2

Cut Off
55.4cm2/m2
38.9cm2/m2

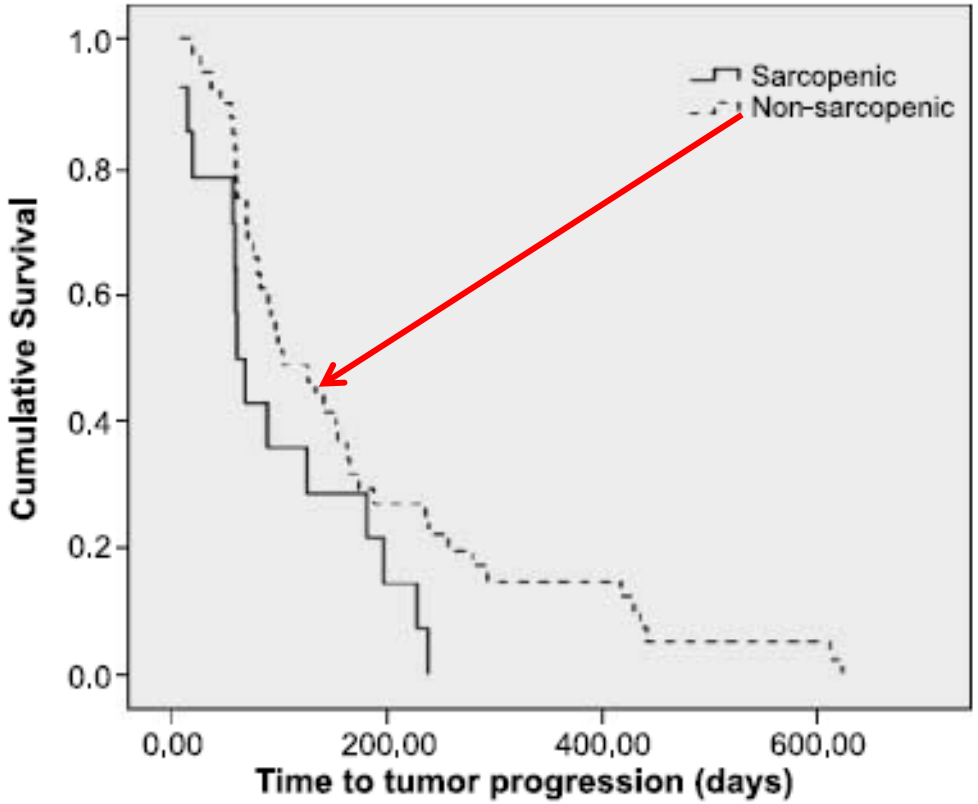
Variabilité du muscle & IMC :

25.0 < BMI < 25.9 ; 114 cm^2 < muscle area L3 < 205 cm^2 ; 37.4 cm2 /m2 < skeletal muscle index < 72.4 cm2/m2



Baracos, V. Am J Clin Nutr 2010 ; 91 : 1133S- 7S

Sarcopenie = ⬇ Survie chez les patiente métastatique avec cancer du sein

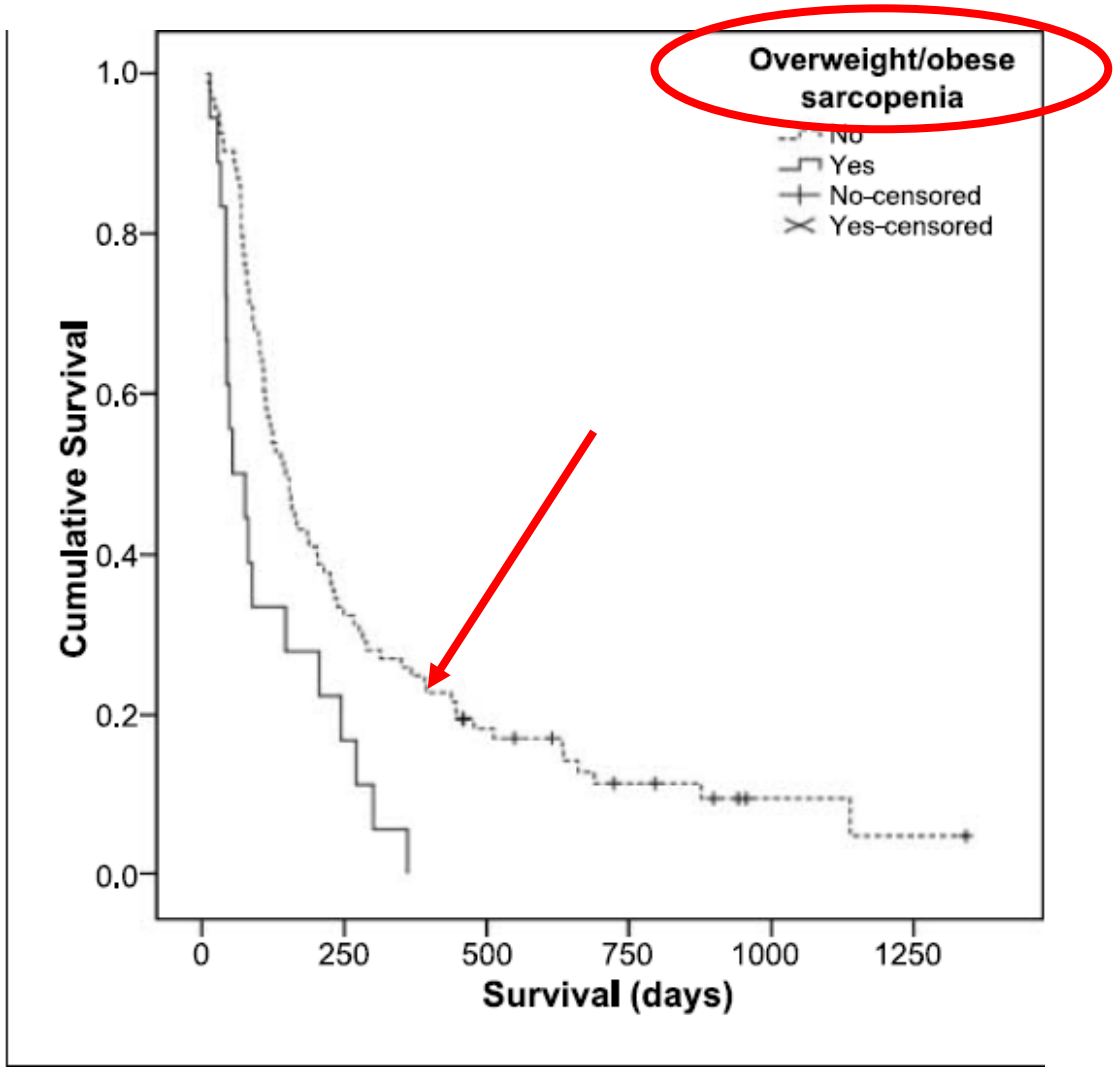


Number of patients at risk at each time point

Sarcopenic	14	2	0	0
Non sarcopenic	41	11	6	2

Prado MM. Clin Cancer Res ; 2009 : 2990-26

Survie & surpoids/obese sarcopénique (cancer pancreatic)



Prado MM. Clin Cancer Res ; 2009 : 2990-26

Sarcopenia as a Determinant of Chemotherapy Toxicity and Time to Tumor Progression in Metastatic Breast Cancer Patients Receiving Capecitabine Treatment

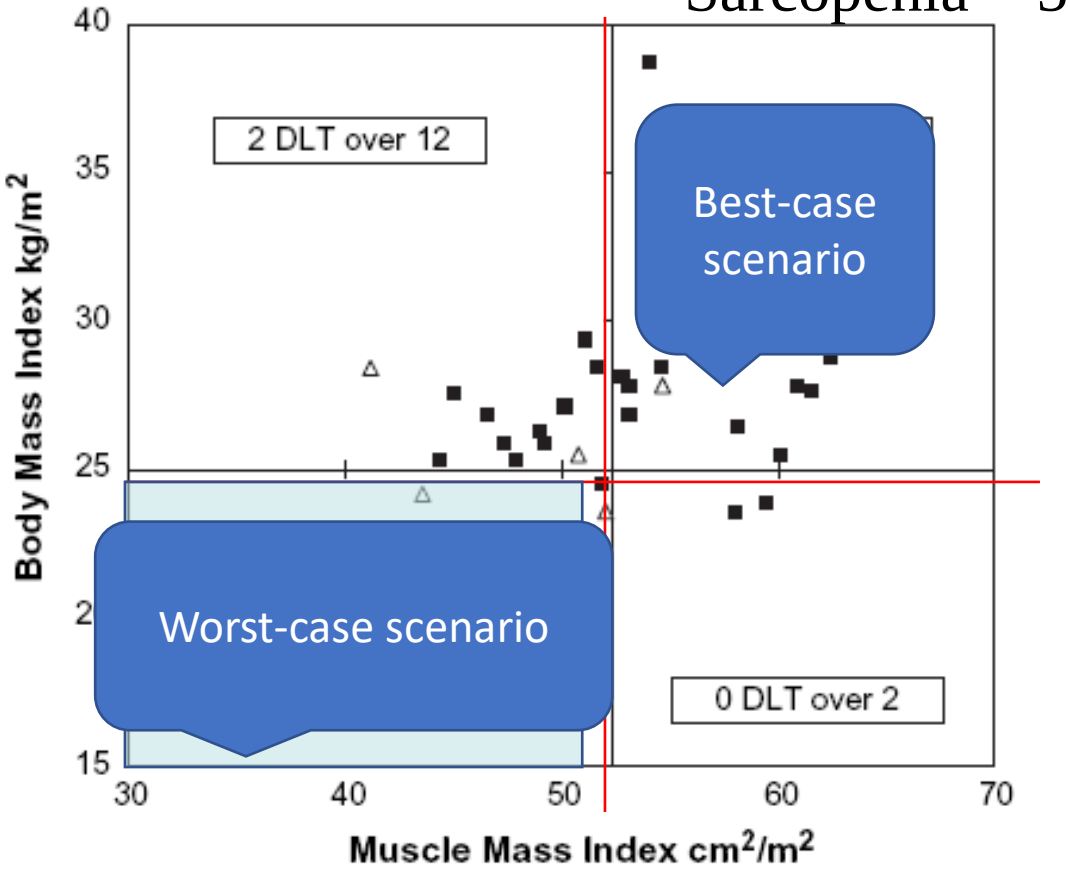
	Sarcopenic (*n* = 14; 25.5%)	Nonsarcopenic (*n* = 41; 74.5%)	*P*
Toxicity			
Present	7 (50.0%)	8 (20%)	0.03
Absent	7 (50.0%)	33 (80%)	
ECOG performance status*			
No performance impairment (scores 0-1)	9 (64%)	25 (65%)	1.00
Performance impairment (scores 2-3)	5 (36%)	14 (35%)	
Estrogen receptor status			
Positive	8 (57%)	31 (76%)	0.31
Negative	6 (43%)	10 (24%)	
HER-2 status			
Positive	3 (21%)	15 (37%)	0.35
Negative	11 (79%)	26 (63%)	
Characteristics mean (SD)			
Age	56.6 (11.4)	54.1 (10.1)	0.43
Weight (kg)	65.6 (11.4)	71.4 (16.7)	0.23
Height (m)	1.6 (0.1)	1.6 (0.1)	0.11
BMI (kg/m^2)	24.6 (4.0)	27.8 (5.7)	0.06
BSA (m^2)	1.7 (0.2)	1.8 (0.2)	0.42
Albumin†	39.8 (4.9)	39.1 (4.5)	0.60
Lumbar skeletal muscle index (cm^2/m^2)	35.0 (3.3)	47.4 (5.0)	<0.0001
Whole body lean mass (kg)	34.0 (3.3)	42.5 (5.0)	<0.0001
Mg capecitabine/kg LBM	104.2 (16.1)	86.9 (13.7)	<0.0001
Toxicity prevalence‡			
Hand-foot syndrome	3 (21%)	4 (8%)	0.35
Diarrhea	4 (29%)	1 (2.4)	0.01
Stomatitis	5 (36%)	2 (4.9%)	0.008
Nausea	3 (21%)	3 (7%)	0.17
Vomit	1 (7%)	1 (2.4)	0.45
Neutropenia	1 (7.1%)	0	0.25

Same BSA
Lower lumber skeletal muscle
Higher dose/kg LBM

Carla M.M.Prado. Clin Cancer Res 2009;15:2920-2926

Low body mass index and sarcopenia associated with dose-limiting toxicity of sorafenib in patients with renal cell carcinoma

Sarcopenia = 52.4cm2/m2



S.Antoun Annals Of Oncology 2010;21:1594-8

Dans cette étude :

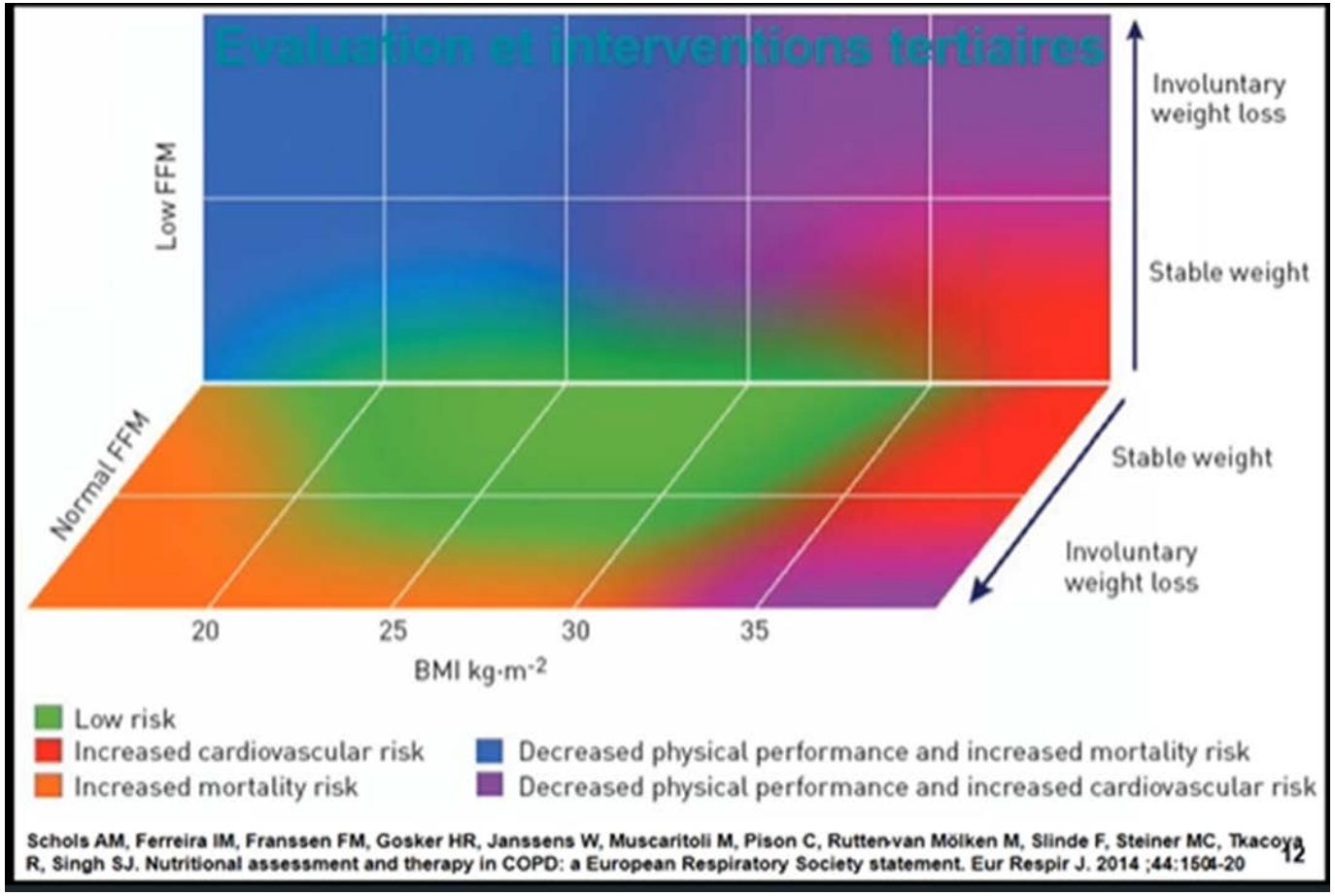
- 7% des patients auraient été considérés cliniquement dénutris selon les critères classiques (IMC<18.5Kg/m2)
- 67.6% des Hommes et 50.1% des femmes sont en surpoids ou obèses
- 54% sont sarcopéniques

Sarcopenic Obesity: The Confluence of Two Epidemics

Ronenn Roubenoff

BMI, Lean Body Mass, the confluence of two parameters which emerging as important in relation to outcomes of cancer ?

Chez Le Patient BPCO : Statut Nutritionnel et Risque, extrême hétérogénéité de la population



Intervention multimodale chez le BPCO

Evaluation et interventions secondaires

INTERCOM. ***van Wetering et al. Thorax 2010;65:7-13, ERJ 2010:35:79-87, J Am Med Dir Assoc 2010;11:179-187***

Patients 102, 66 ± 9 ans, VEMS 58 ± 17 %, IMC 26,1 ± 4,4
97,67 ± 9 ans, VEMS 60 ± 15 %, IMC 27,3 ± 4,7
Wmax < 70%, IMC bas chez 20%

Durée 2 ans

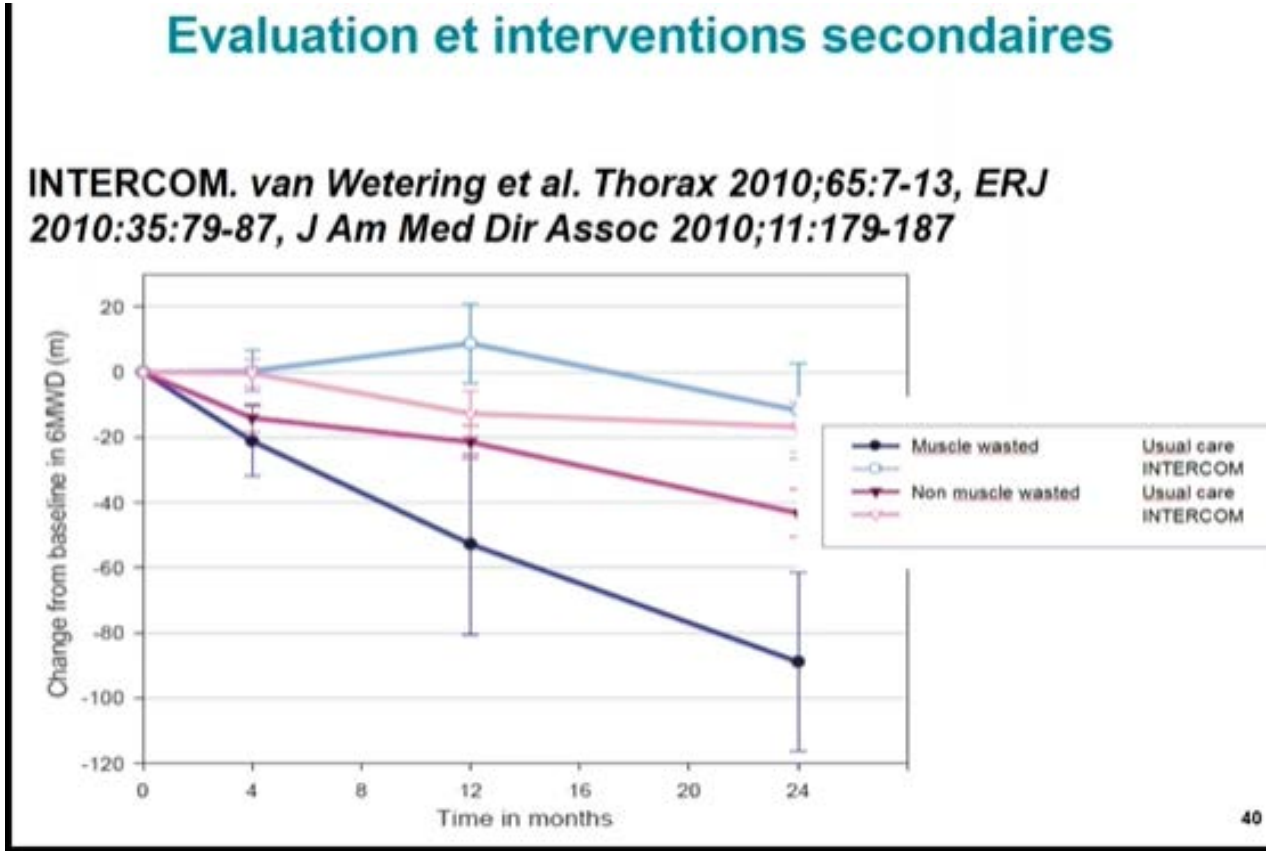
Intervention 4 mois d'intervention multimodale à domicile,
20 mois de soins de maintenance
versus soins habituels

Résultats

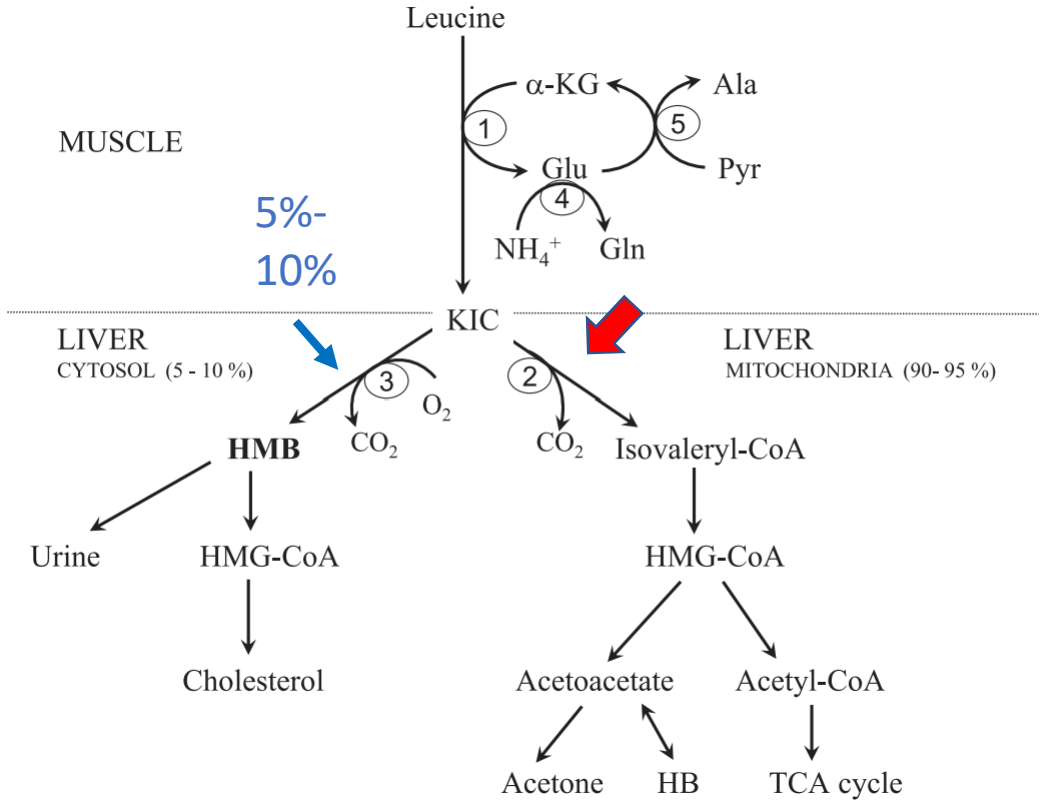
- 4 mois : ↑ masse musculaire, QdV, Wmax, endurance, MRC dyspnée, préhension, PM-6
- 2 ans : ↑ QdV, MRC dyspnée, endurance, PM-6

3

Intervention multimodale chez le BPCO : maintient du périmètre de marche



Le métabolisme de l'HMB

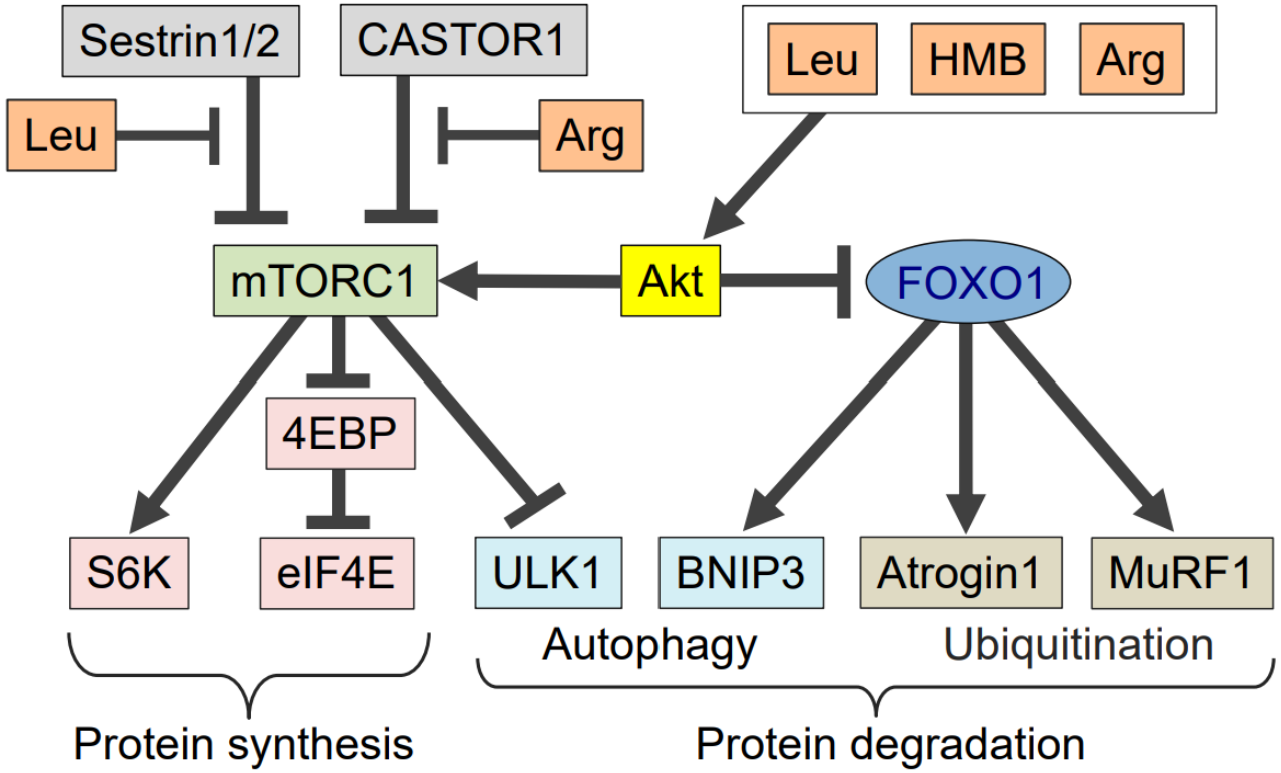


KIC est converti en majorité en Isovaleryl-CoA

Ingestion de 2.42g HMB => 400uM dans le plasma
Ingestion de 3.42g de leucine=> 10uM

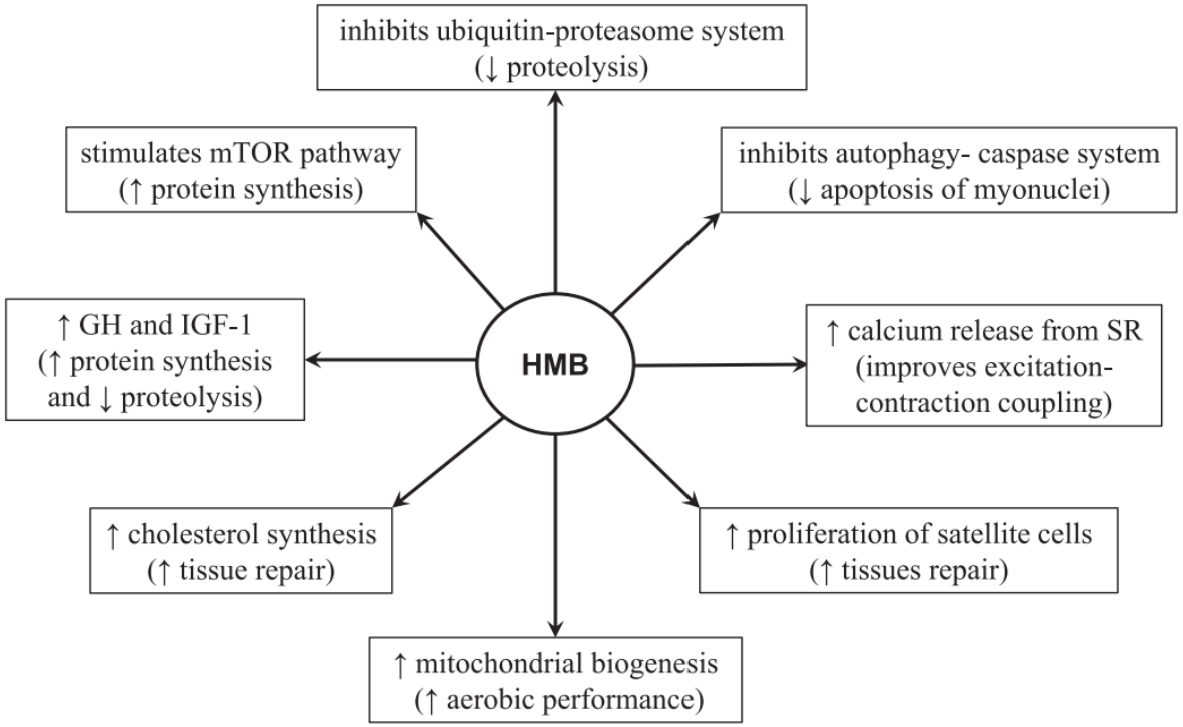
Holecek M Journal of Cachexia, Sarcopenia and Muscle 2017; 8: 529–541

Acides Aminés et régulation de la masse musculaire



Kamei Y, Nutrients 2020 12 261

Les effets potentiels de l'HMB sur la masse musculaire



Holecek M Journal of Cachexia, Sarcopenia and Muscle 2017; 8: 529–541

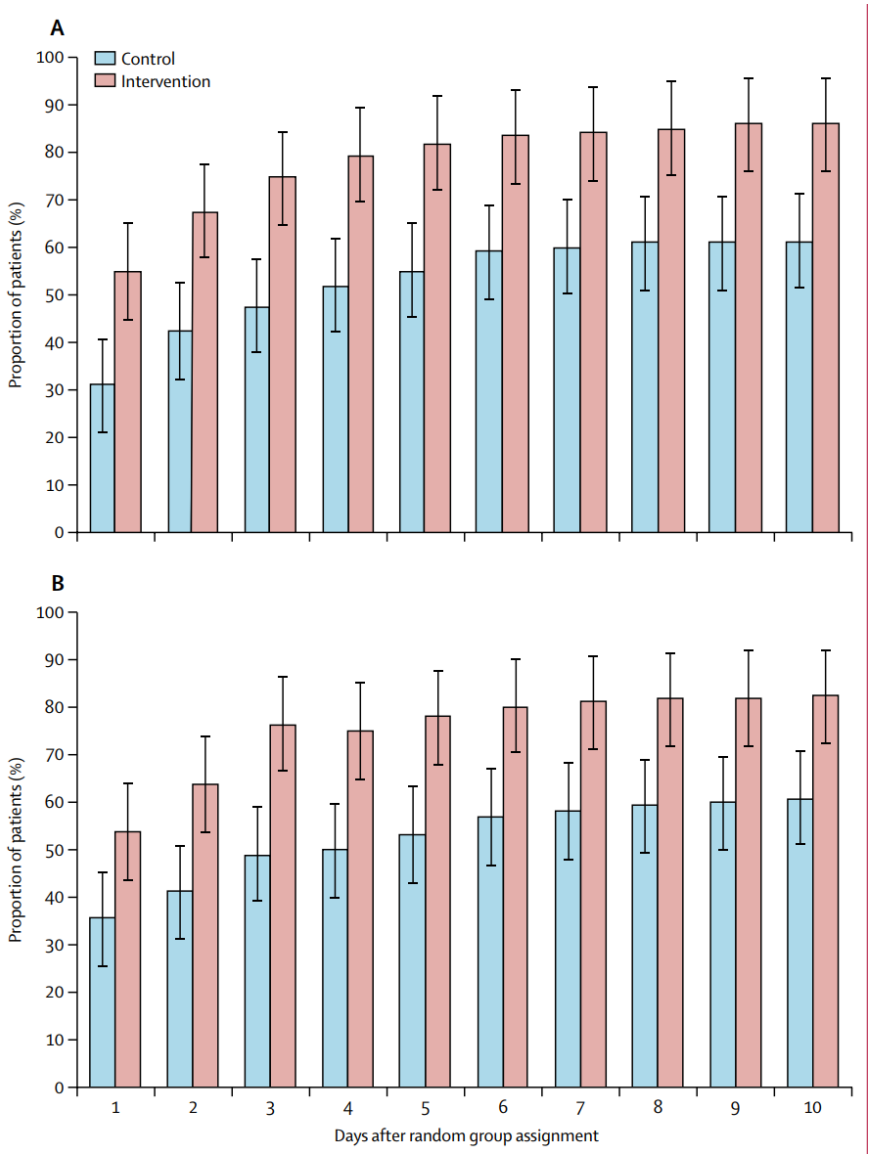
Effets de l'HMB dans des pathologies induisant une perte de masse musculaire

Origin of muscle loss	Study design	Effects	Reference
AIDS	HMB/Arg/Gln mixture (3/14/14 g per day) for 8 weeks	↑ lean body mass and improved immune status	Clark *et al.*[97]
Cancer	HMB/Arg/Gln mixture (3/14/14 g per day) for 24 weeks	↑ body weight and FFM	May *et al.*[98]
Cancer	HMB/Arg/Gln mixture (3/14/14 g per day) for 8 weeks	Trend towards an increased body mass	Berk *et al.*[99]
AIDS or cancer	HMB/Arg/Gln mixture (3/14/14 g per day) for 8 weeks	Decreased feeling of weakness, increased RBC, haematocrit, lymphocytes, eosinophils, and urea	Rathmacher *et al.*[100]
Chronic obstructive pulmonary disease	HMB (3 g/day) for 7 days	Improved pulmonary function, ↓CRP	Hsieh *et al.*[101]
Chronic cardiac or pulmonary disease	Oral supplementation with proteins and HMB (1.5 g HMB/day) for 90 days	Decreased mortality, improved indices of nutritional status	Deutz *et al.*[102]
Chronic pulmonary disease	Oral supplementation with proteins and HMB (1.5 g HMB/day) for 12 weeks	Improved body composition, health-related quality of life, and muscle strength	Olveira *et al.*[103]
Critically ill trauma patients, bed rest, enteral nutrition	HMB (3 g/day), HMB/Arg/Gln mixture or placebo via feeding tube for 28 days	Improvement in nitrogen balance	Kuhls *et al.*[104]
Total knee arthroplasty	HMB/Gln/Arg mixture (2.4/14/14 g per day) for 4 weeks	Prevention of reduction of maximal strength of quadriceps muscle	Nishizaki *et al.*[105]
Hip fracture	HMB (3 g)/vitamin D/protein combination for 30 days	Accelerated healing, shortening immobilization period, ↑ muscle strength	Ekinci *et al.*[106]
Gastric bypass	HMB/Gln/Arg mixture (1.5/7/7 g per day) for 8 weeks	No benefits when compared with controls	Clements *et al.*[107]
Renal failure	HMB (3 g/day) for 6 months	No benefits	Fitschen *et al.*[108]
Rheumatoid arthritis	HMB/Gln/Arg mixture (3/14/14 g per day) for 12 weeks	No benefits when compared with placebo	Marcora *et al.*[109]

Holecek M Journal of Cachexia, Sarcopenia and Muscle 2017; 8: 529–541

EFFORT

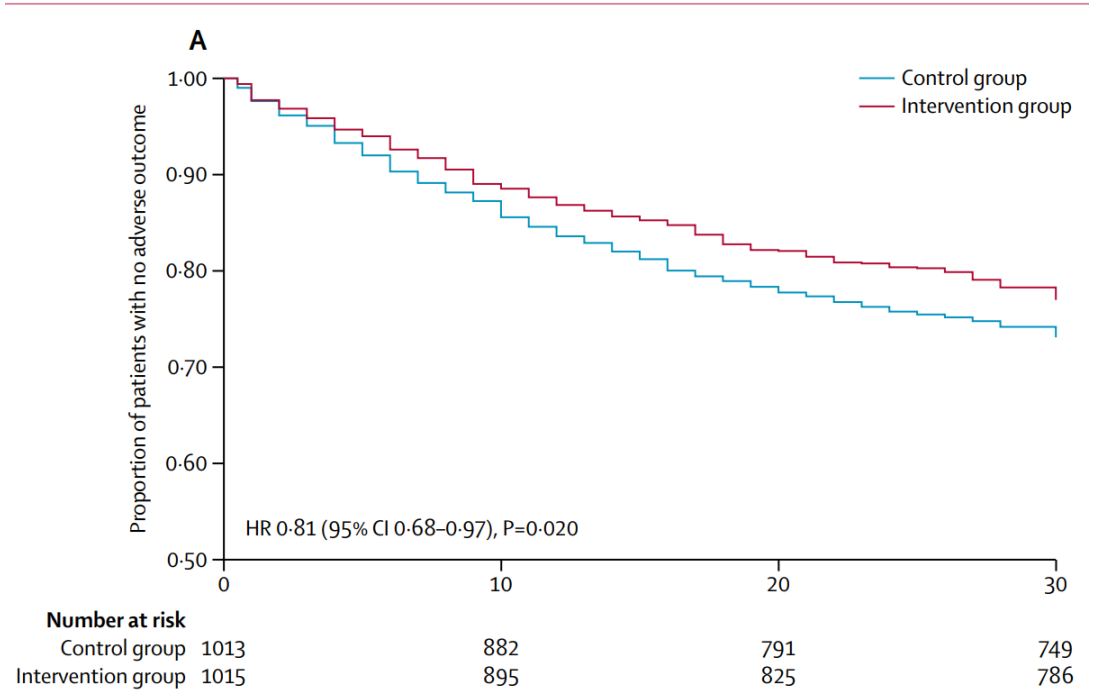
- Patients NRS ≥ 3, hospitalisation >4J
- **Intervention**: Ad cible protéines et calories par un support nutritionnel, dans les 48h post-admission et suivi du team nutrition, NE ou NP si < 75% de la cible àJ5
- **Contrôle** : alimentation standard de l'hôpital sans team nutrition
- **Outcome** composite: Mortalité, réadmission non programmée, complication majeure, admission soin intensif, déclin fonctionnel à 30J
- 2088 patients en 4 ans 2014-2018, cible calorique atteinte (HB) à 79% et protéique à 76% (1.2-1.5g/kg/24h)



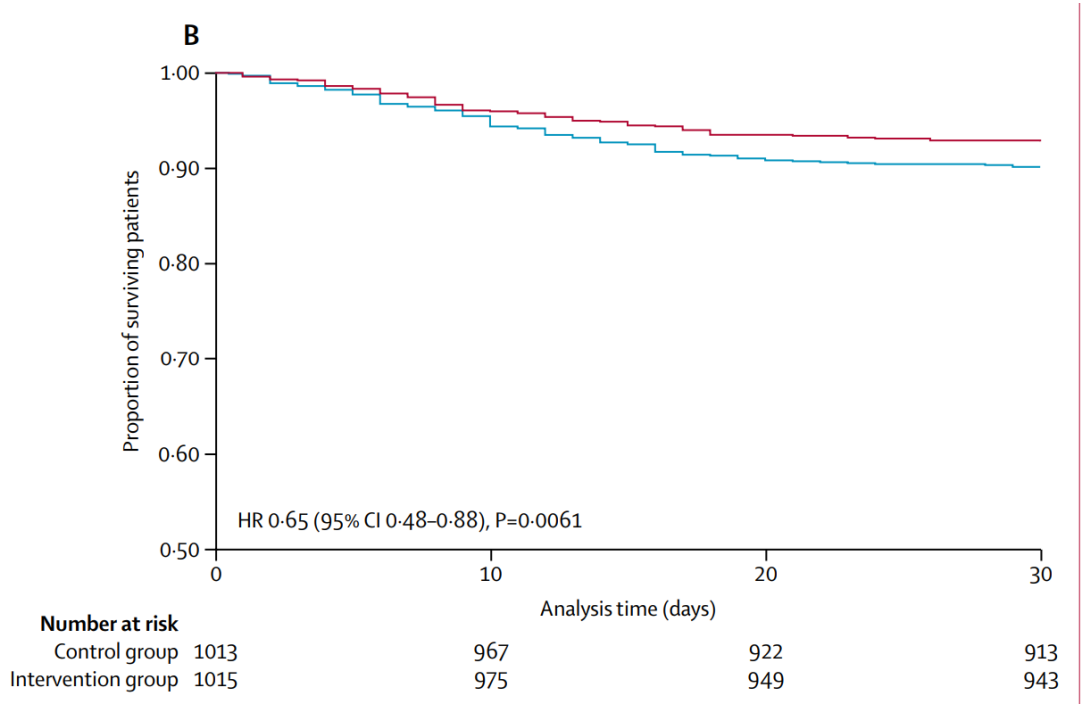
Schuetz P et al. Lancet 2019;393:2312-21

EFFORT

Proportion de patients sans adverse event



Proportion de patients survivants



Schuetz P et al. Lancet 2019;393:2312-21

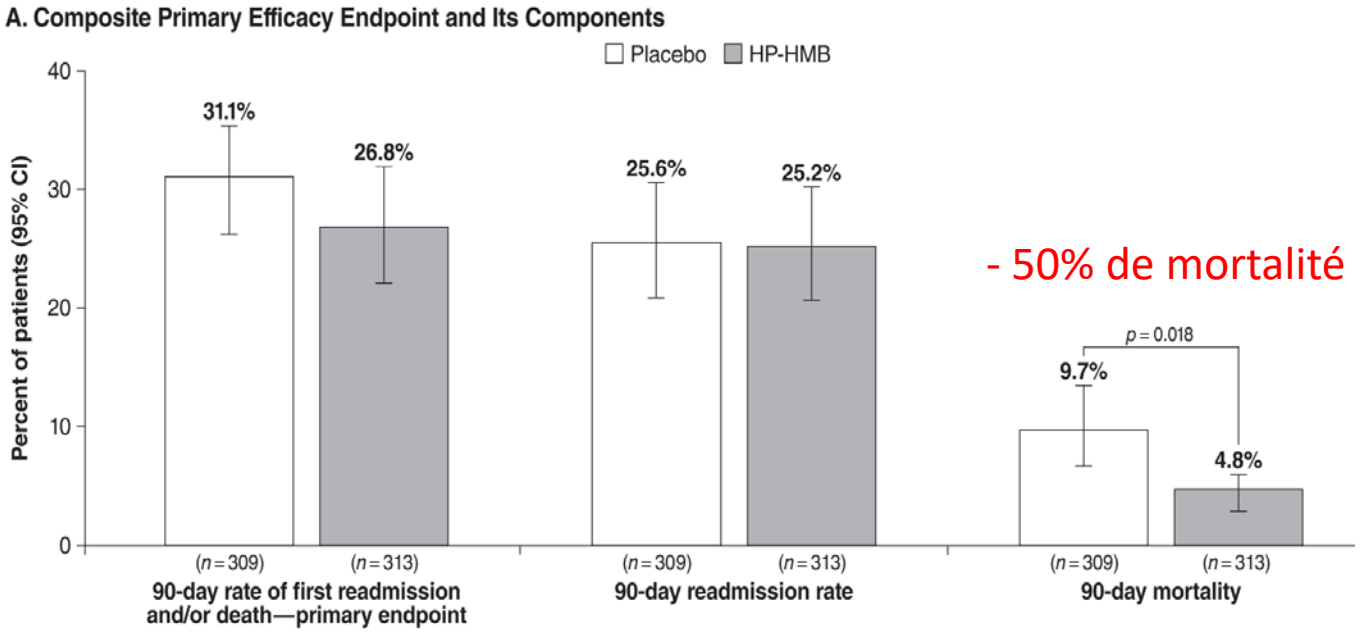
EFFORT

	Intervention group (n=1015)	Control group (n=1013)	Odds ratio or coefficient (95% CI)	p value
Outcomes				
Primary outcome				
Adverse outcome within 30 days	232 (23%)	272 (27%)	0·79 (0·64 to 0·97)	0·023
Single components of primary outcome				
All-cause mortality	73 (7%)	100 (10%)	0·65 (0·47 to 0·91)	0·011
Admission to the intensive care unit	23 (2%)	26 (3%)	0·85 (0·48 to 1·51)	0·58
Non-elective hospital readmission	89 (9%)	91 (9%)	0·99 (0·73 to 1·35)	0·96
Major complications				
Any major complication	74 (7%)	76 (8%)	0·95 (0·68 to 1·34)	0·79
Nosocomial infection	40 (4%)	39 (4%)	1·01 (0·63 to 1·59)	0·98
Respiratory failure	14 (1%)	13 (1%)	1·06 (0·49 to 2·28)	0·89
Major cardiovascular event	8 (1%)	7 (1%)	1·11 (0·40 to 3·11)	0·84
Acute kidney failure	32 (3%)	31 (3%)	1·01 (0·61 to 1·69)	0·96
Gastrointestinal events	9 (1%)	15 (1%)	0·57 (0·25 to 1·31)	0·19
Decline in functional status of ≥10%*	35 (4%) of 942	55 (6%) of 913	0·62 (0·40 to 0·96)	0·034
Additional secondary outcomes				
Mean length of stay (days)	9·5 (7·0)	9·6 (6·1)	−0·21 (−0·76 to 0·35)	0·46
Mean Barthel score (points)*	88 (26)	85 (30)	3·26 (0·93 to 5·60)	0·006
Mean EQ-5D VAS (points)†	59 (26)	56 (29)	3·06 (0·53 to 5·59)	<0·0001
Mean EQ-5D index (points)	0·75 (0·32)	0·73 (0·34)	0·13 (0·09 to 0·17)	0·018

Schuetz P et al. Lancet 2019;393:2312-21

NOURISH:HP-HMB

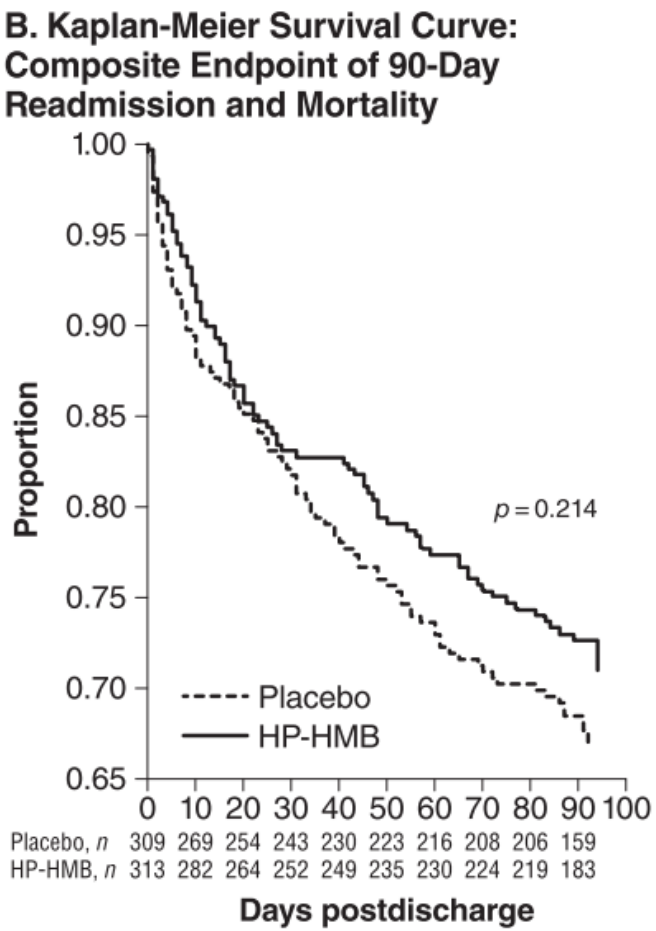
- Groupe **intervention** : HP HMB SNO : 350 Kcal, 20g de protéines, 11g de lipides, 44g d'Hydrate de carbone, 1.5g de calcium-HMB, 160 IU de vit D
- **Placebo** : 48Kcal, 12g d'hydrate de carbone, 10mg de VitC
- Patients>65, dénutris (SGA B ou C), hospitalisés pour : insuffisance cardiaque congestive, syndrome coronarien aigu, pneumopathie ou BPCO
- Outcome : A 90 Jours post sortie pourcentage de mortalité , de réadmission

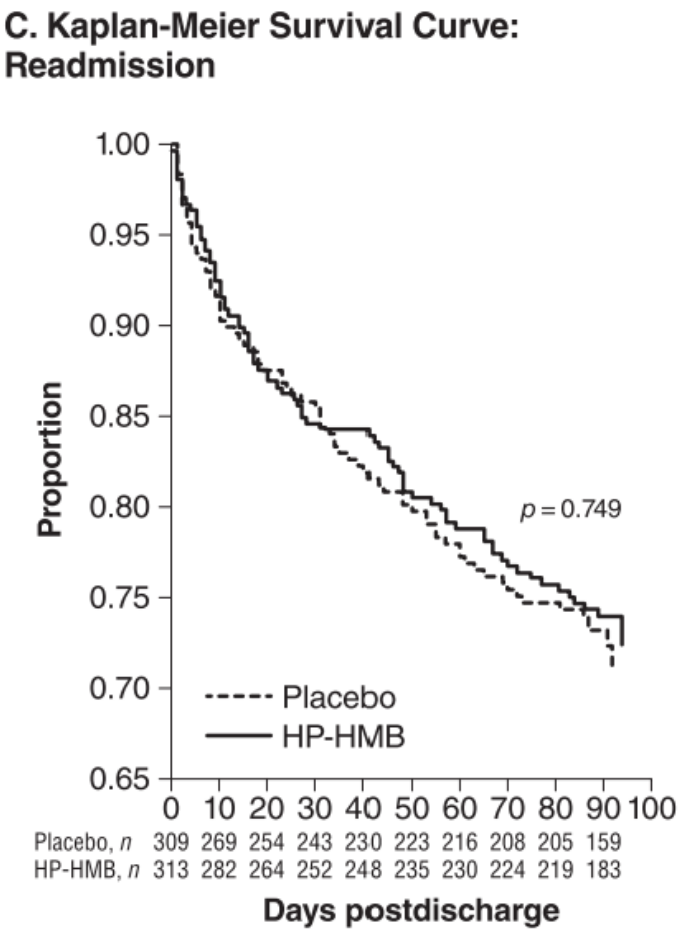


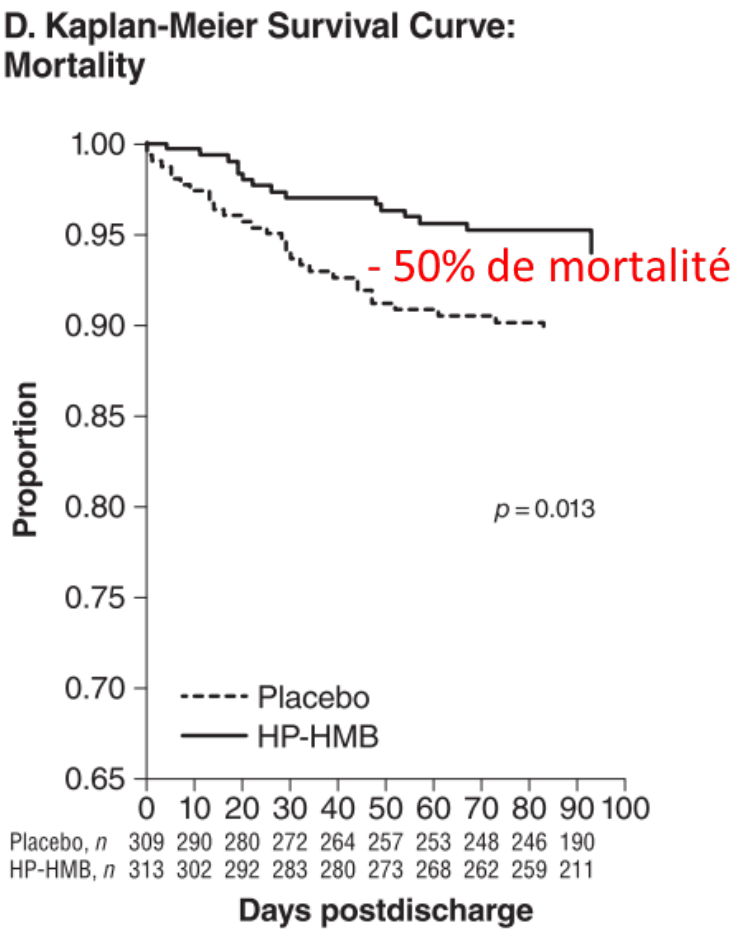
- 50% de mortalité

N.E. Deutz et al. Clinical Nutrition.2016; 35: 18-26

L'étude NOURISH : Effet d'un HP-HMB



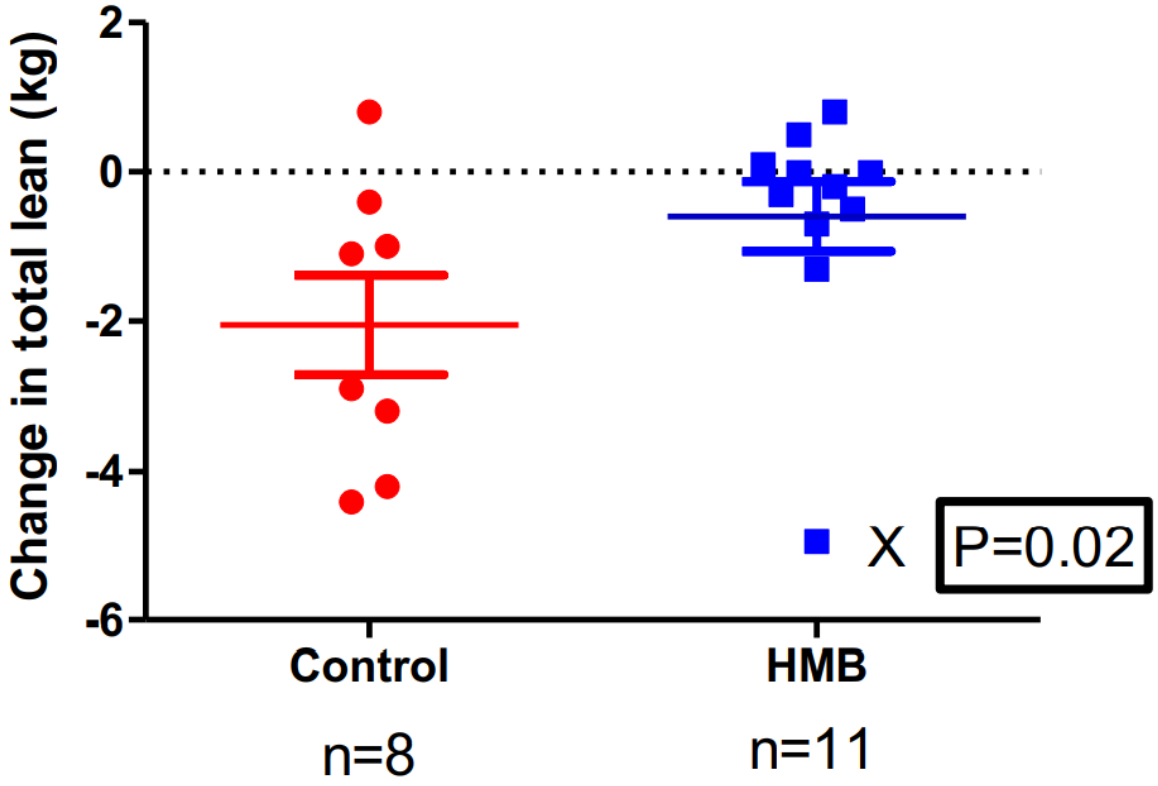




N.E. Deutz et al. Clinical Nutrition.2016; 35: 18-26

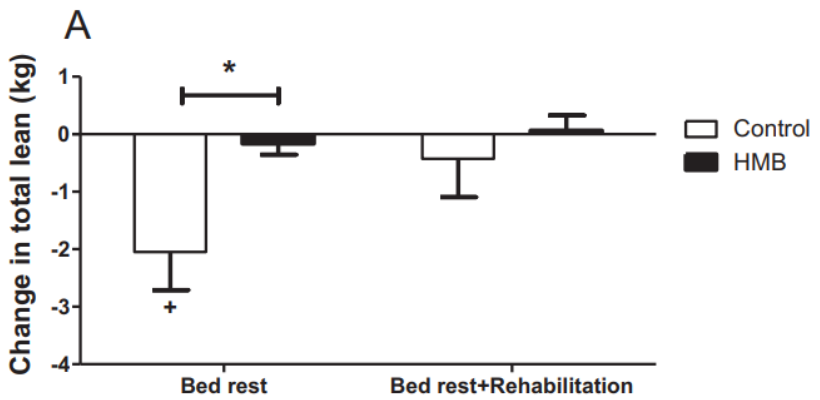
HMB chez des patients âgés>65 ans alités 10J

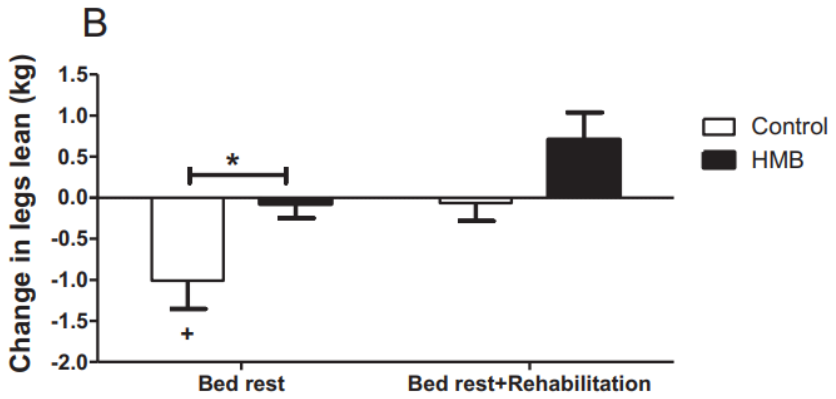
- Patients **sains**>65ans, confiné au lit 10J, suivi d'une réhabilitation musculaire contre résistance 8sem
- **Intervention**: sachet poudre HMB- Ca+ 2X1.5g/Jj(3g/j), 4g maltodextrin, 200mg de calcium
- **Contrôle** : sachet de 4g de maltodextrin et 200mg de calcium
- **Masse musculaire**, T0, T10J, puis une fois par semaine. DXA
- **Fonction** : SPPB, TUG, 5 items de l'échelle PBMS (performance Bases mesures screening
- Force sur différents exercices

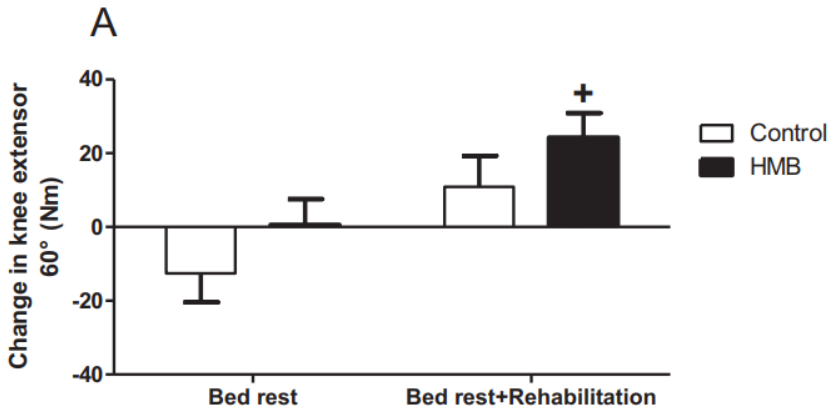


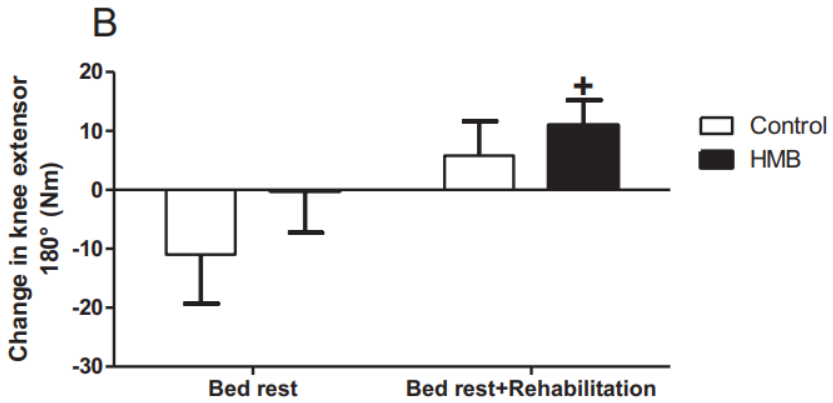
Deutz et al. Clinical Nutrition;2013;32:704-12

HMB chez des patients âgés>65 ans alités 10J





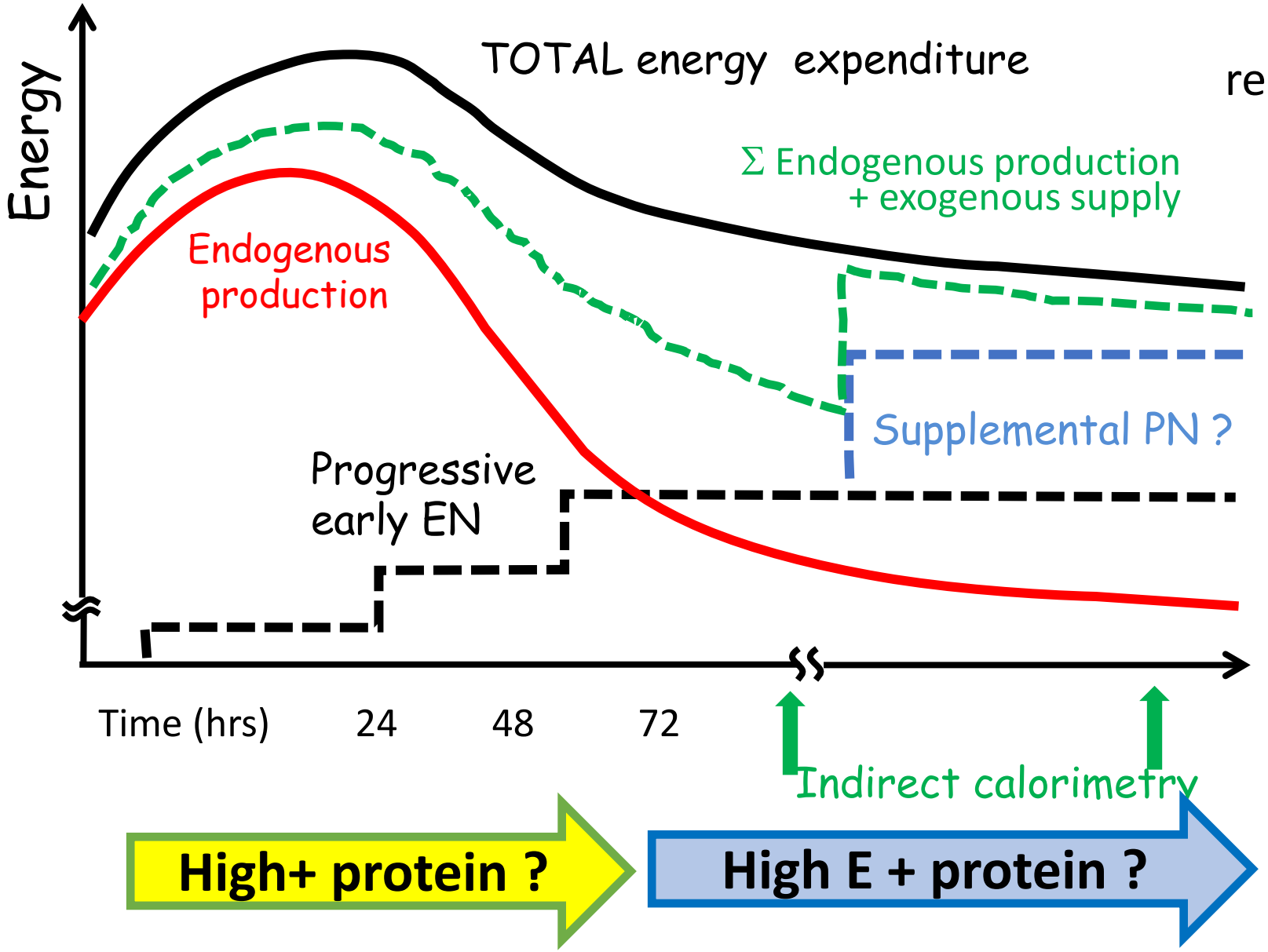




Deutz et al. Clinical Nutrition;2013;32:704-12

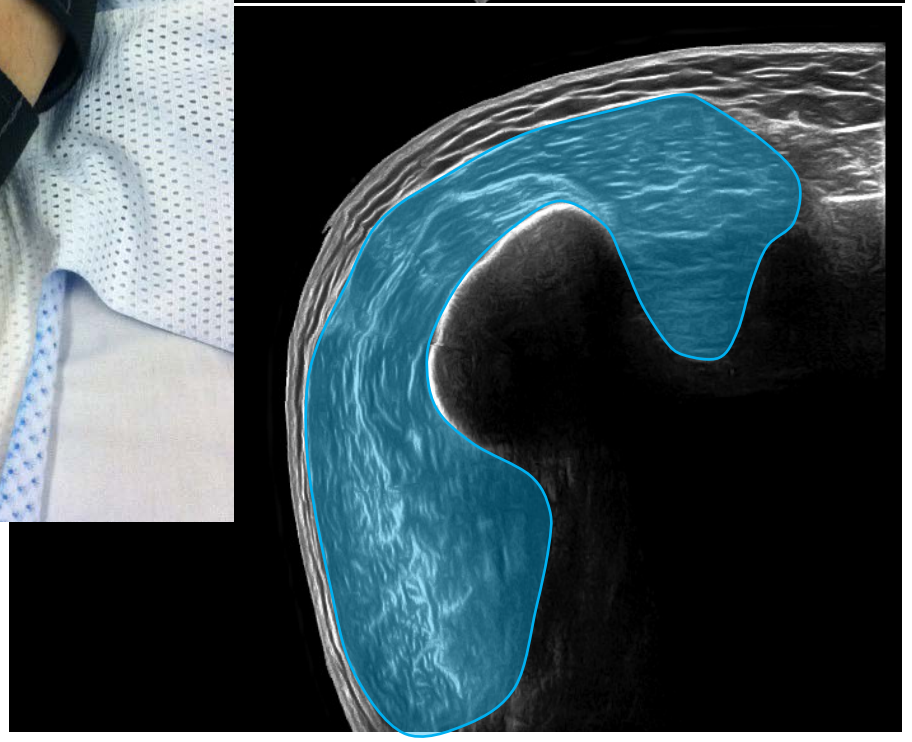
Proposed Feeding strategy in the ICU

43% des patients restent > 72 heures au SMIA



Adapted from Oshima et al, Clin Nutr 2017;36:651

CSA – SPN2

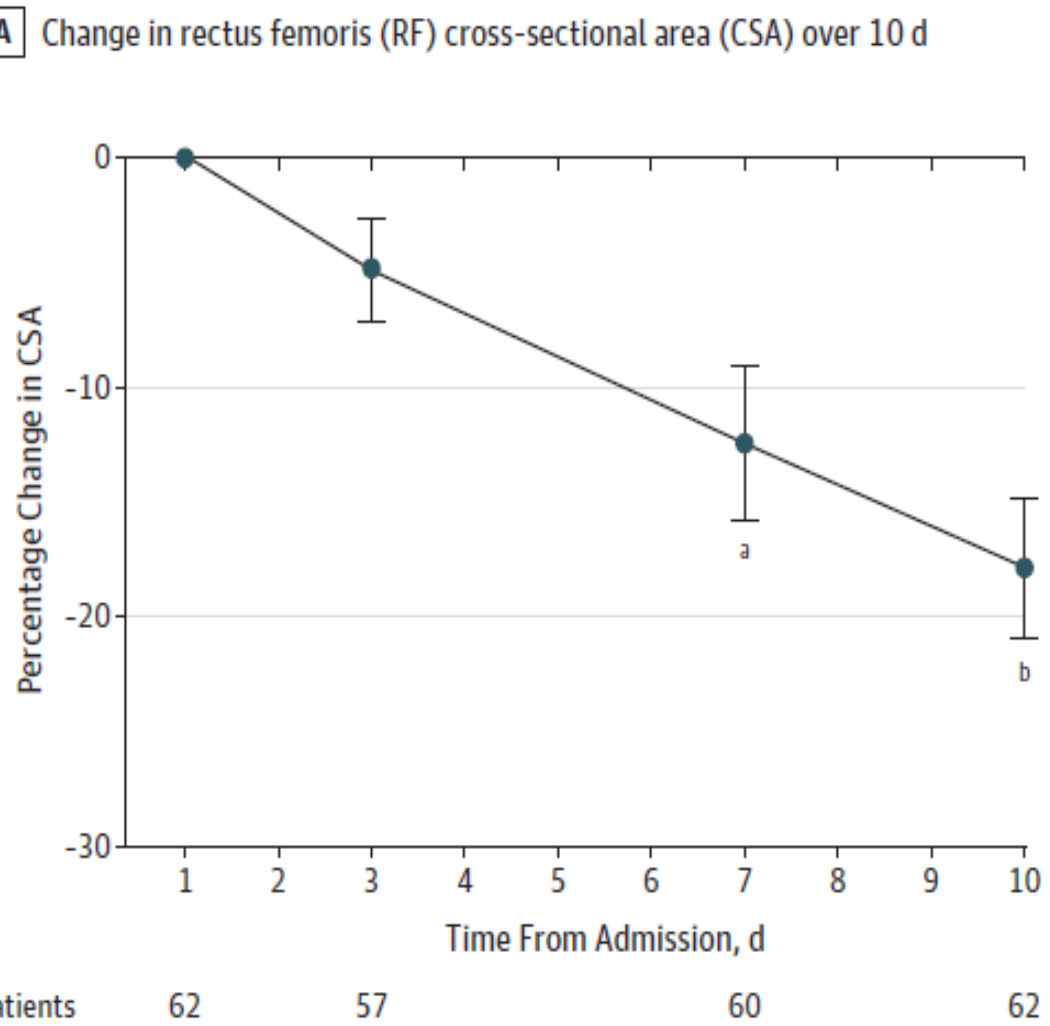


Acute Skeletal Muscle Wasting in Critical Illness

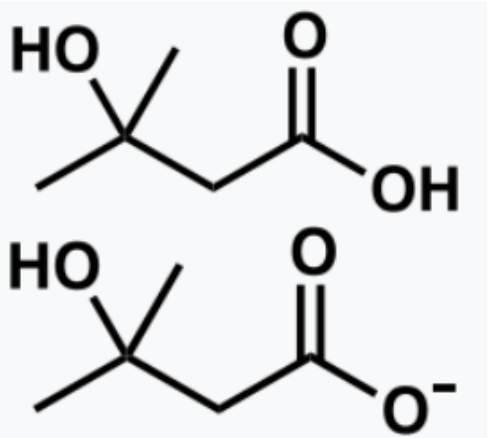
Puthucheary et al, JAMA 2013; 310:1591

Muscle mass (by CSA) ↓ by nearly 20% in 10 days

Worse in case of multiple organ failure



β-hydroxy-β-methylbutyrate (HMB)



Top: β-Hydroxy β-methylbutyric acid
Bottom: β-Hydroxy β-methylbutyrate

- HMB = metabolite of **L-leucine**
- HMB produced through oxidation of the ketoacid of L-leucine (α-ketoisocaproic acid).
- Only a small fraction of L-leucine is metabolized into HMB → pharmacologically active concentrations of the compound in blood and muscle can only be achieved by supplementing HMB directly
- effects of HMB on human skeletal muscle were first discovered by Steven L. Nissen at Iowa State University in the mid-1990s.

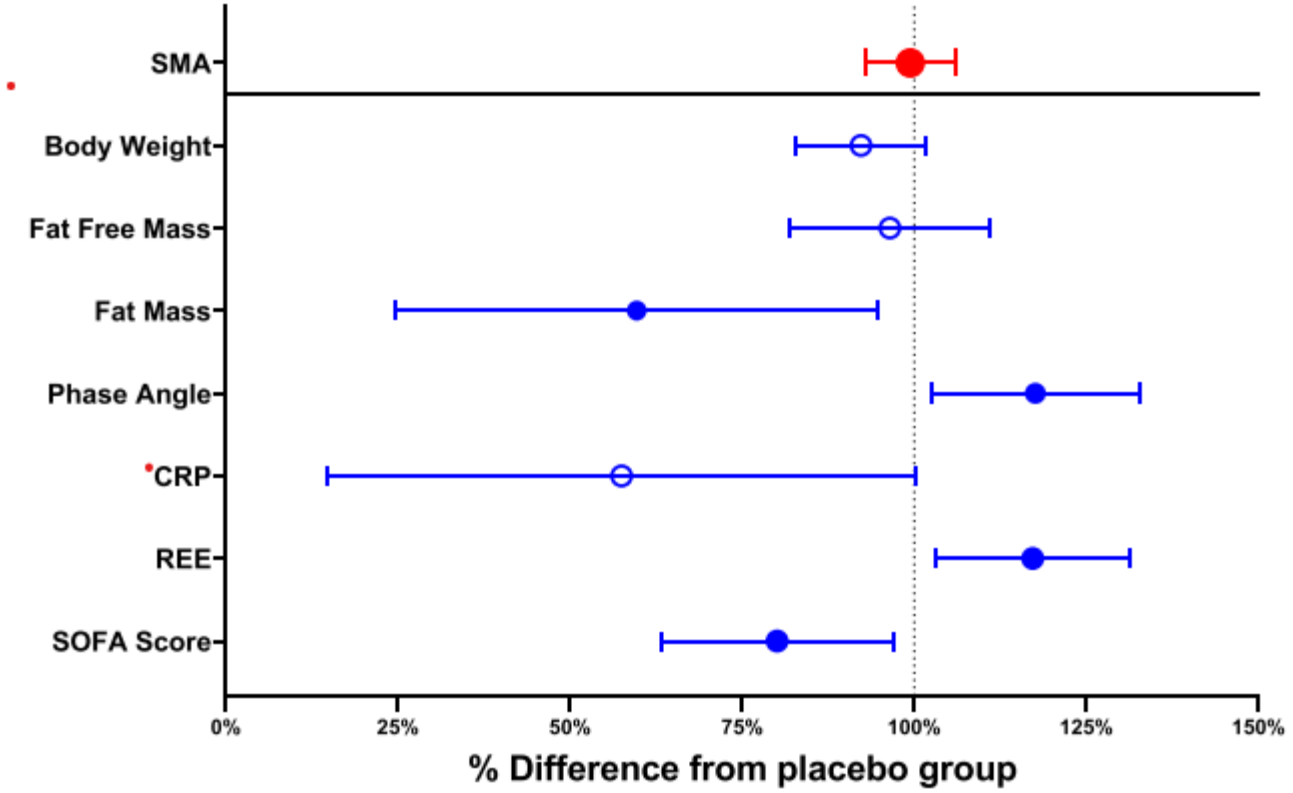
Hypothèse testée

L'administration d'un supplément en HMB dès le 4^{e} jour (et pendant au moins 10 jours) en sus d'une NE assurant 1.2-1.3 g/protéines / j

- Modifie la production d'acides aminés totale
- Atténue la fonte de la masse maigre
- Atténue la perte de force musculaire des patients de soins intensifs.

HMB sur la perte musculaire et le métabolisme protéique chez des patients des soins intensifs

- **Méthode**: patients soins intensifs, ventilation mécanique, tube digestif fonctionnel à J3
- Groupe **intervention**: HMB 3g de J4 à J30
- Groupe **contrôle** : 1.5g maltodextrin de J4 à J30
- **Loss of SMA** (skeletal muscle area) mesurée par US quadriceps femoris à J4 et J15
- **Other outcomes**: Composition corporelle (BIA), métabolisme protéique et santé à 60J
- **Cible** calorique : 20Kcal/kg/J puis à J4 Calorimétrie indirecte
- Cible protéique: 1.2g/kg-1.3g/kg (poids préadmission si BMI<30 et poids idéal si>30



Berger M et al. Clinical Nutrition 2021;40:4878-87

Article

Effect on an Oral Nutritional Supplement with β-Hydroxy-β-methylbutyrate and Vitamin D Morphofunctional Aspects, Body Compositic Angle in Malnourished Patients

Isabel Cornejo-Pareja [1,2,*], Maria Ramirez [3], Maria Camprubi-Robles [3], Ricard
Isabel Maria Vegas-Aguilar [1,2] and Jose Manuel Garcia-Almeida [1,2,*]

	S-ONS N = 240		ONS N = 43	
	Basal	**Final**	**Basal**	**Final**
Anthropometrics				
Body weight (kg)	63.2 (12.9)	67.2 (13.5) *	62.6 (13.3)	66.2 (14.6) *
BMI (kg/m^2)	23.2 (4.5)	24.7 (4.8) *	23.1 (4.3)	24.4 (4.8) *
Biceps fold (mm)	10.7 (5.0) #	12.2 (5.3) *	9.0 (2.6)	10.4 (3.6) *
Arm circumference (cm)	25.7 (3.9) #	27.5 (4.1) *#	24.1 (3.5)	25.7 (4.3) *
Handgrip strength				
Dynamometry (kg)	18.3 (13.0)	25.2 (14.4) *	20.4 (12.6)	24.9 (14.7) *
Body composition				
Fat mass (kg)	15.5 (7.9)	18.1 (9.0) *	14.5 (6.5)	17.0 (8.4) *
Fat-free mass (kg)	47.9 (9.1)	49.1 (9.0) *	48.1 (9.3)	49.0 (8.8)
Total body water (kg)	35.1 (6.6)	35.9 (6.5) *	35.1 (6.8)	36.0 (6.6) *
Biochemistry				
Albumin (g/dL)	2.9 (0.7)	3.8 (0.5) *	2.9 (0.6)	3.6 (0.4) *
Prealbumin (mg/dL)	18.9 (6.4)	24.7 (6.7) *	20.7 (6.8)	24.4 (7.1) *
CRP (mg/L)	32.6 (50.9)	10.8 (34.0) *	30.2 (51.7)	9.3 (29.9) *
CRP/Prealbumin	0.25 (0.52)	0.08 (0.40) *	0.18 (0.33)	0.15 (0.82)
Cholesterol (mg/dL)	151.1 (40.7)	178.7 (48.4) *	144.5 (44.5)	165.1 (36.9) *
Lymphocytes (mm^3 × 10^{-3})	1.5 (1.1)	1.9 (0.9) *	1.4 (0.5)	1.8 (0.8) *

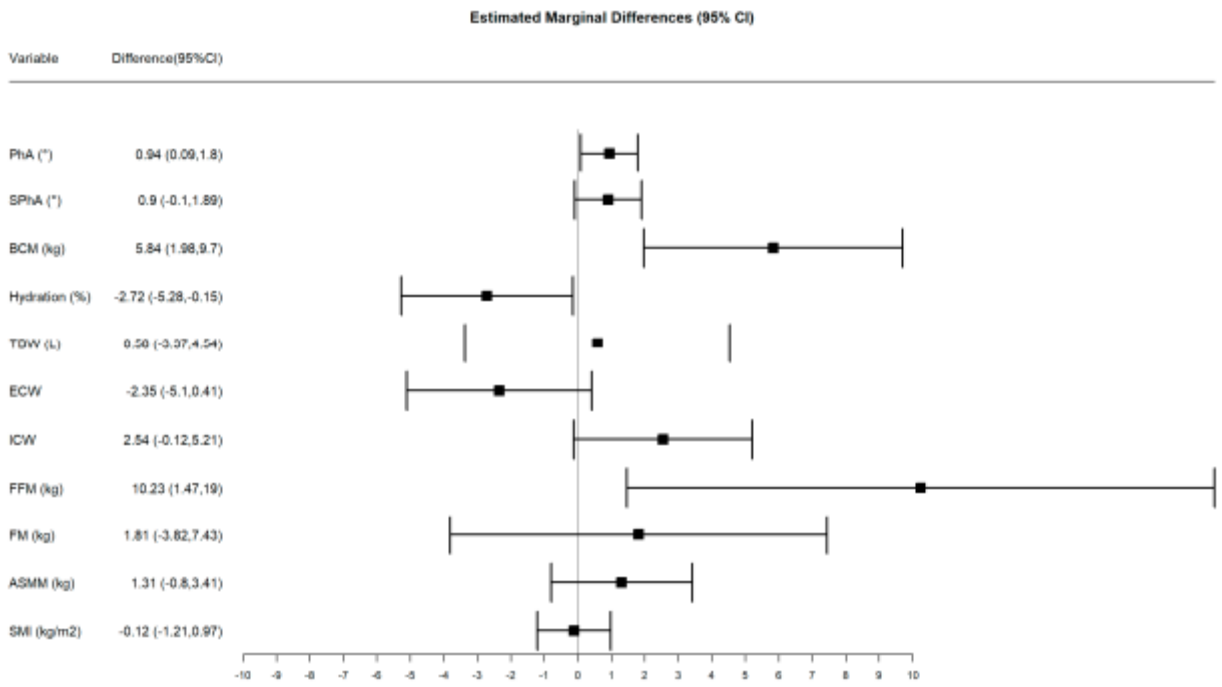
Data are mean (SD). ONS: standard oral nutritional supplement; S-ONS: specialized oral nutritional supplement; BMI: body mass index; CRP: C reactive protein. *: $p < 0.05$ vs. Basal. #: $p < 0.05$ vs. ONS obtained from the adjusted model.

Intervention :

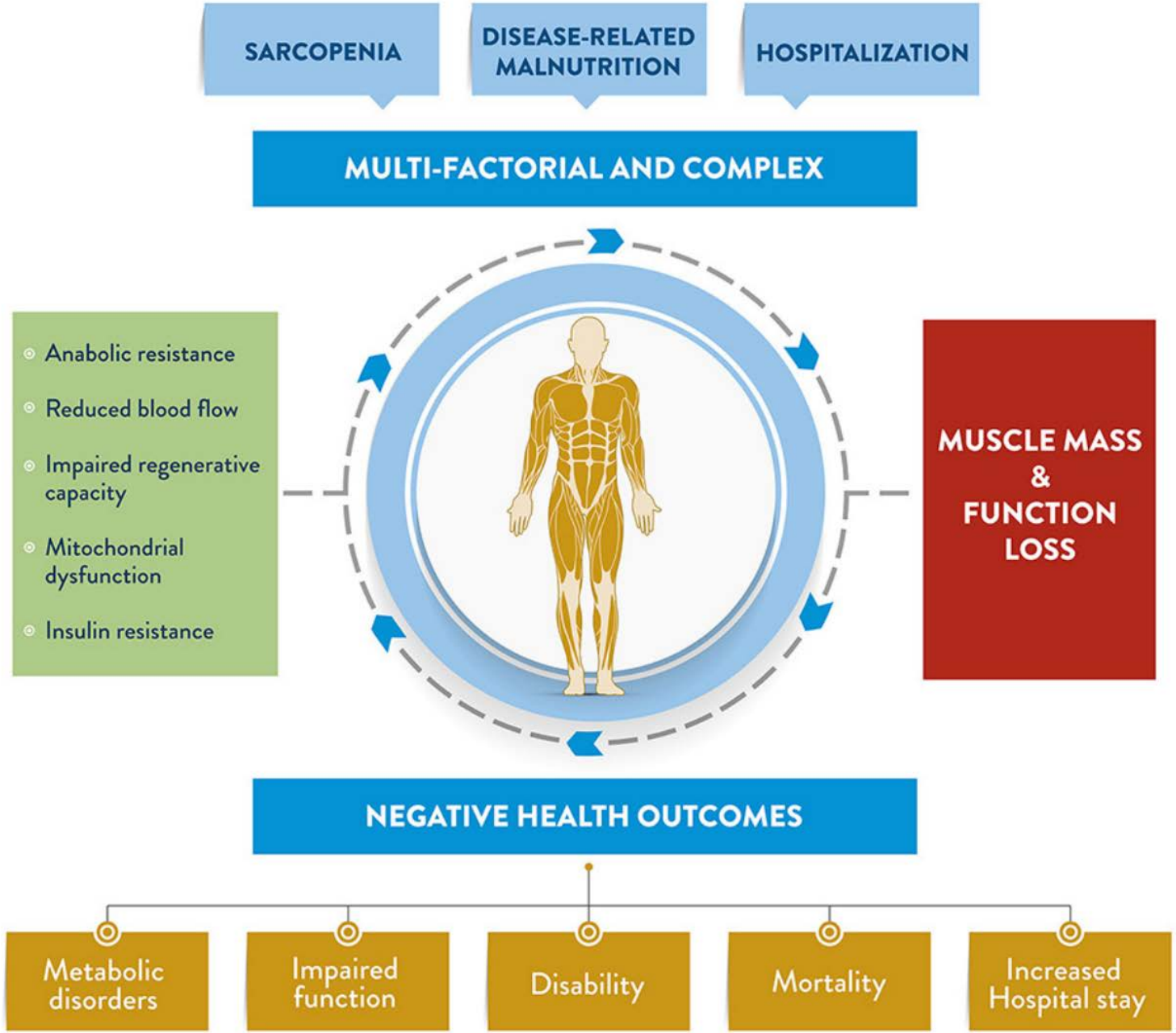
- Cible : Patient dénutri, oncologique ++
- Pour tout le monde : alimentation enrichie avec 30-35 Kcal/Kg et 1.2 – 1.3 g/Kg/24h de protéines.
- SNO – S = 330 Kcal, 20 g P, 11g F 37g C
- SNO : 206-320 Kcal, 10 à 20g P, 7.8 à 13g F 25-37g de C

Isabel Cornejo-Pareja et al. Nutrients 2021;13:4355

Différence Maginale entre les deux groupes à la visite finale



Isabel Cornejo-Pareja et al. Nutrients 2021;13:4355



Sanz-Paris et al. J Nutr Health Aging. 2018;22:664-75

WHO Technical Report Series
935

PROTEIN AND AMINO ACID REQUIREMENTS IN HUMAN NUTRITION

Report of a Joint
WHO/FAO/UNU Expert Consultation

UNITED NATIONS
UNIVERSITY

Les apports recommandés selon l'âge

Table 46
Safe level of protein intake for adult men and women[a]

Body weight (kg)	Safe level of protein intake (g/kg per day)[b]
40	33
45	37
50	42
55	46
60	50
65	54
70	58
75	62
80	66

[a] All ages >18 years.
[b] 0.83 g/kg per day of protein with a protein digestibility-corrected amino acid score value of 1.0.

Table 47
Safe level of protein intake for infants, children and adolescent boys and girls

Age (years)	Boys			Girls		
	Weight [a] (kg)	Safe level of protein intake[b] (g/kg/day)	Safe level of protein intake (g/day)	Weight[a] (kg)	Safe level of protein intake[b] (g/kg/day)	Safe level of protein intake (g/day)
0.5	7.8	1.31	10.2	7.2	1.31	9.4
1	10.2	1.14	11.6	9.5	1.14	10.8
1.5	11.5	1.03	11.8	10.8	1.03	11.1
2	12.3	0.97	11.9	11.8	0.97	11.4
3	14.6	0.90	13.1	14.1	0.90	12.7
4–6	19.7	0.87	17.1	18.6	0.87	16.2
7–10	28.1	0.92	25.9	28.5	0.92	26.2
11–14	45.0	0.90	40.5	46.1	0.89	41.0
15–18	66.5	0.87	57.9	56.4	0.84	47.4

[a] WHO reference values (*1*).
[b] From Tables 33a and 33b.

Report of a Joint WHO/FAO/UNU Expert Consultation 2007

ACIDES AMINES RECOMMANDATIONS

Table 49
Amino acid requirements of adults[a]

Amino acid	mg/kg per day	mg/g protein
Histidine	10	15
Isoleucine	20	30
Leucine	39	59
Lysine	30	45
Methionine	10	16
Cystine	4	6
Methionine + cysteine	15	22
Phenylalanine + tyrosine	25	30
Threonine	15	23
Tryptophan	4	6
Valine 26	26	39

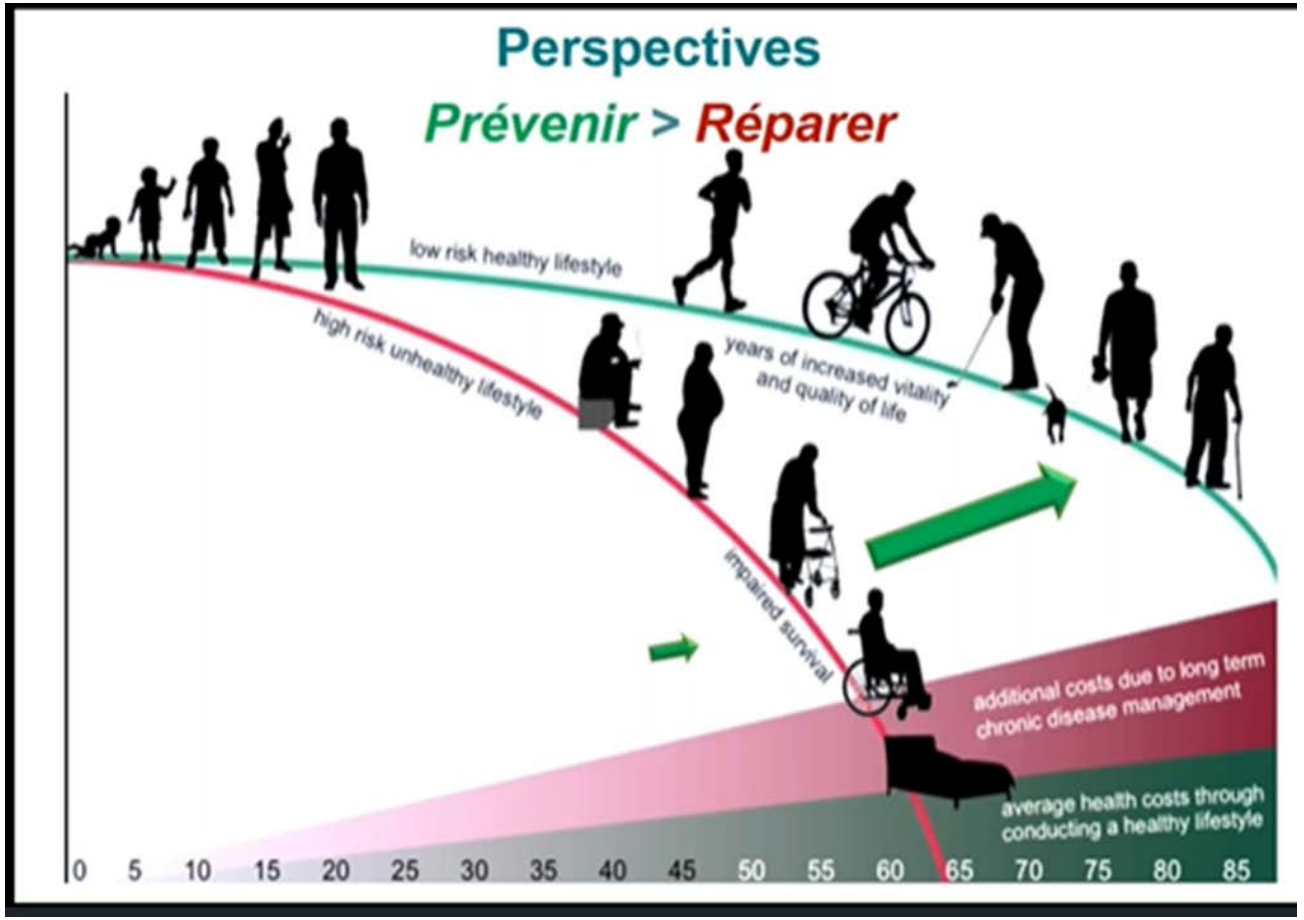
[a] From Table 23.

Report of a Joint WHO/FAO/UNU Expert Consultation 2007

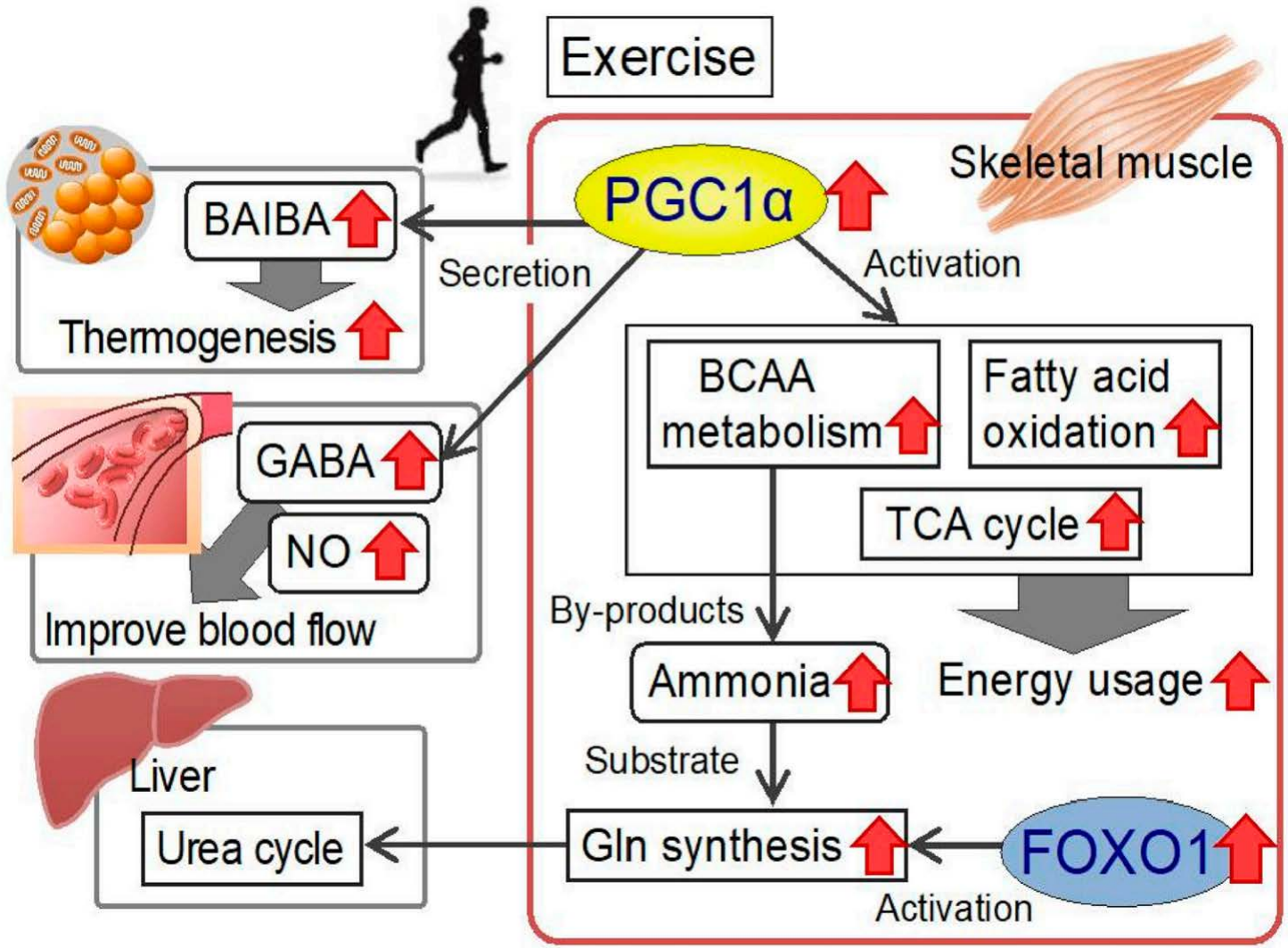
ET Les Produits Laitiers alors :

- Deux méta analyses démontrent que consommation de PL est inversement associé au risque de syndrome métabolique
- Optimiser les apports protéiques : protéines issues des PL comme la betalactoglubuline et protéines du lactoserum, : composition en AA plus riche en Lysine, idéale pour le muscule.
- Importance de la matrice alimentaire : Problème de mastication des personnes âgées : La viande, matrice solide, est plus difficile que le lait, matrice liquide => Source de protéines rapides dans une matrice liquide (Lactoserum) => améliore la cinétique d'apparition dans le sang des AA…

Prévenir coute 40 fois moins chère que réparer



Les effets systémiques de l'exercice : changement du métabolisme musculaire et effet systémique des métabolites des acides aminés



Kamei Y, Nutrients 2020 12 261

MERCI!