Journées GLN
Les lipides pour les seniors
Paris 6 novembre 2018
Physiologie et physiopathologie

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Les différents modes de vieillissement

Vieillissement réussi

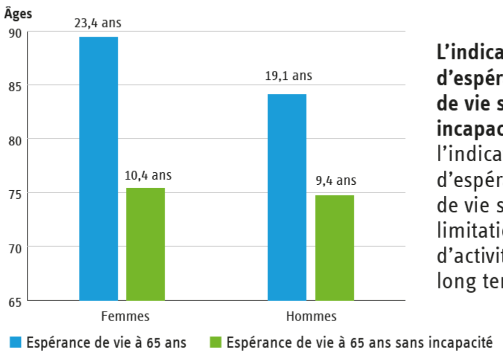
Fragilité(s)

Pathologies chroniques

Incapacités

Espérance de vie à 65 ans, en 2012

Source : Eurostat 2014.

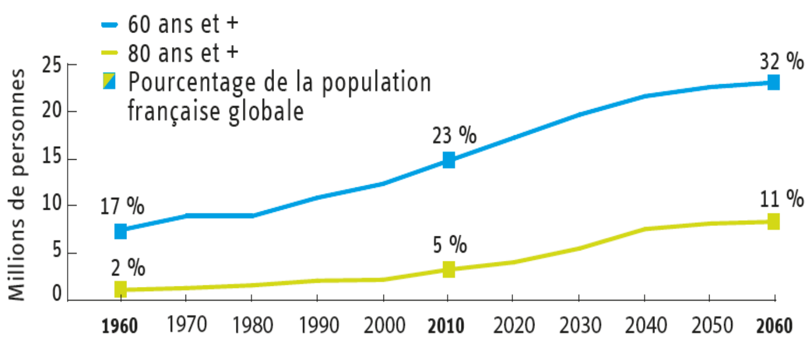


L'indicateur d'espérance de vie sans incapacité est l'indicateur d'espérance de vie sans limitations d'activité à long terme.

Vieillissement de la population française

Source : INSEE, 2010, projections de population 2007-2060, scénario central.

Champ : France métropolitaine.



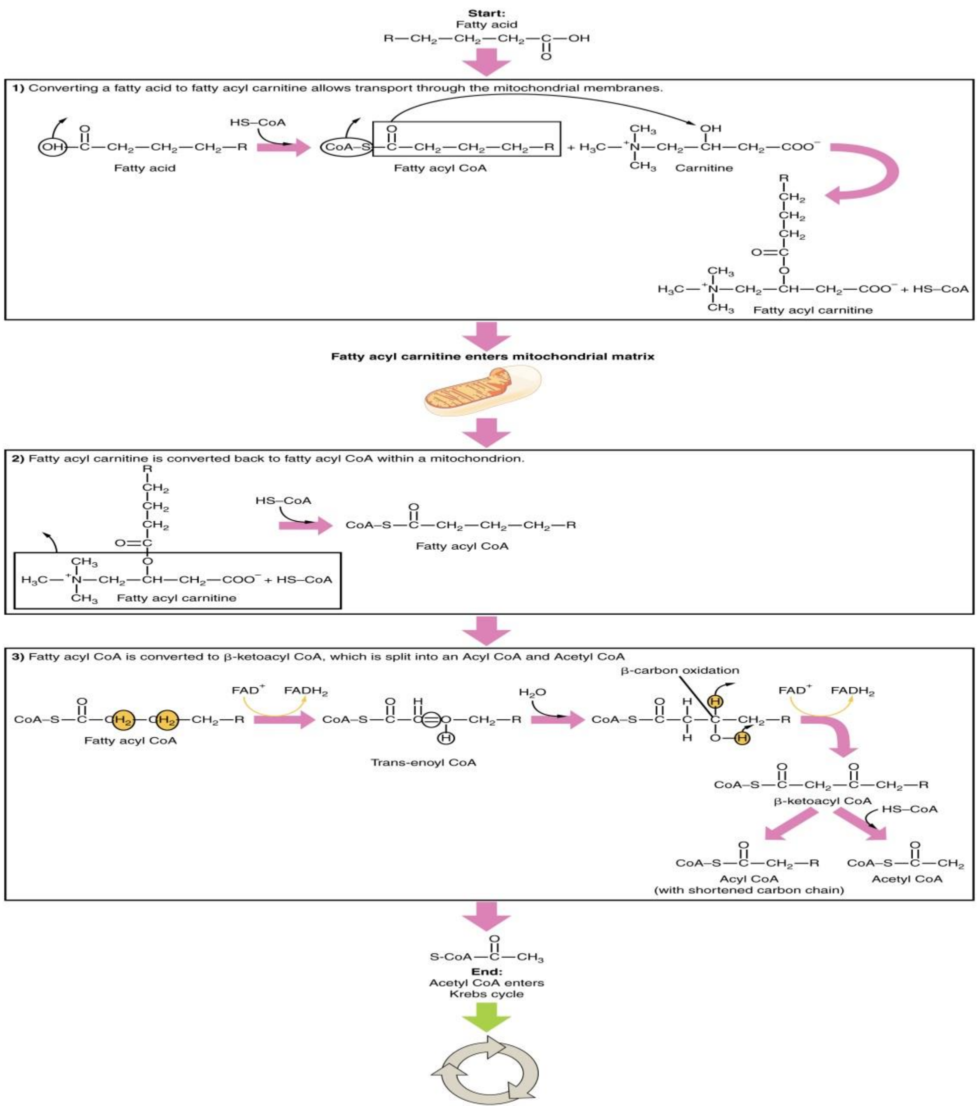
Rôle des lipides :

Fourniture et stockage de l'énergie (triglycérides)

Rôle structural dans les membranes cellulaires (phospholipides)

Rôle dans les processus de vieillissement *Role of sphingolipids in senescence*

Treyssac M JCI 2018



- AGPI n-3 (oméga 3) :
  - ✓ Effets neuro protecteurs
  - ✓ Inhibition de la croissance tumorale
  - ✓ Prévention cardio-vasculaire
  - ✓ Rôle sur le muscle
  - ✓ Rôle sur l'inflammation..

Recommandations ANSES :
35 à 40% des apports énergétiques

	Acide gras	ANC
AG indispensables	Acide linoléique	4 %
	Acide α-linolénique	1 %
	Acide docosahexaenoïque, DHA	250 mg
	Acide eicosapentaénoïque, EPA	250 mg
AG non indispensables	**Acides laurique + myristique + palmitique**	≤ 8 %
	Acides gras saturés totaux	≤12 %
	Acide oléique	15-20 %

Apports nutritionnels chez le sujet de plus de 80 ans
Données des cohortes européennes

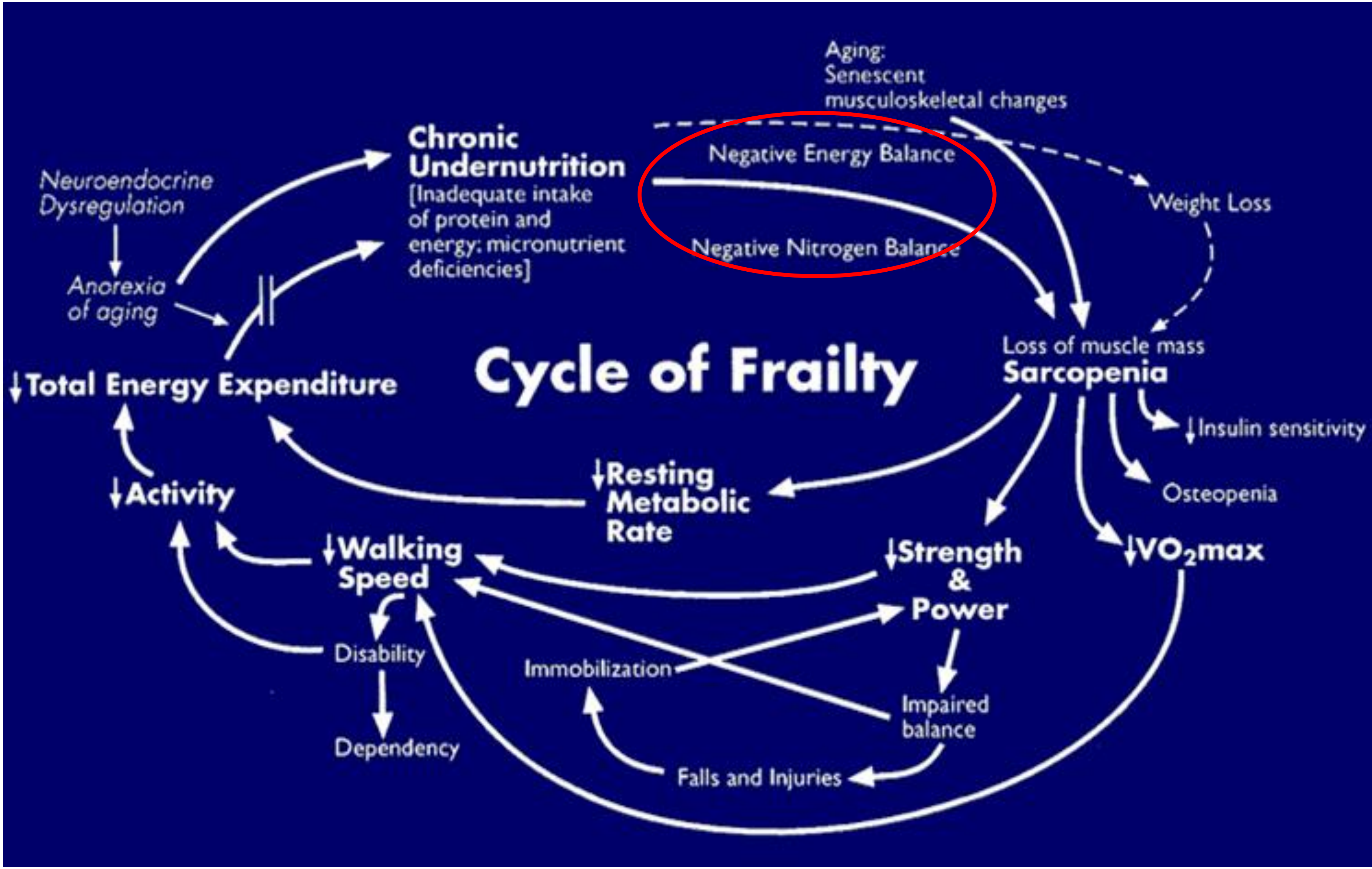
Granic a Nutrients 2018

Table 2. Energy and nutrient intake in European and European descendent older adults aged ≥ 80 and ≥85 [1].

Cohort	Men										Women									
	Energy	Carb	Fat	Protein	Fibre	Folate	B12	D	Ca	Iron	Energy	Carb	Fat	Protein	Fibre	Folate	B12	D	Ca	Iron
	MJ/d	%	%	%	g/day	µg/day	µg/day	µg/day	mg/day	mg/day	MJ/day	%	%	%	g/day	µg/day	µg/day	µg/day	mg/d	mg/d
NDNS 65+	6.99 [3]	48.5	36.3	15.2	11.4 [4]	219	3.8	2.8	717	9.7	5.60 [3]	48.4	36.8	14.5	9.4 [4]	170	2.9	2.0	619	7.5
EPIC [1]	9.84	49.7	31.4	15.5	24.5 [4]	466	7.5	4.2	1157	18.1	9.02	50.3	31.5	16.3	24.0 [4]	461	7.5	4.0	1147	17.0
DNFCS	7.40	41.4	34.0	16.4	20.0	46 [5]	4.9	3.9	1016	9.6	7.30	41.0	35.0	15.6	16.2	34 [5]	4.4	2.9	2030	8.3
InCHIANTI [2]	7.38	50.0	29.0	16.0	17.2	228	-	-	778	11.5	6.36	50.0	32.0	16.0	15.3	200	-	-	701	9.6
GNS	9.34	44.2	33.2	16.3	23.7	123 [6]	-	3.8	721	13.3	8.07	42.6	35.0	16.2	19.9	106 [6]	-	2.7	729	12.6
ANS	7.40	44.0	40.0	14.0	15.0	174 [6]	4.0	3.4	642	10.0	7.10	43.0	40.0	16.0	16.0	166 [6]	3.9	3.1	649	11.1
NC85+	7.73 [3]	46.8	36.4	15.9	11.3 [4]	245	3.4	2.3	829	10.5	6.15 [3]	46.8	37.2	15.5	9.3 [4]	189	2.6	1.8	683	7.8
LiLACS NZ [7]	7.90 [3]	44.3	36.2	15.6	22.8	245	3.6	4.1	731	11.6	6.27 [3]	46.4	37.2	15.3	20.4	215	2.6	3.4	679	9.3

[1] Adapted from Hill et al. [100]. Values are medians unless indicated otherwise. NDNS 65+, National Diet and Nutrition Survey of people aged ≥ 65 [113]; EPIC, European Prospective Investigation into Cancer and Nutrition [114]; DNFCS, Dutch National Food Consumption Survey [115]; InCHIANTI, Aging in the Chianti Area [116]; GNS, German Nutrition Survey [117]; ANS, Austrian Nutrition Survey [118]; NC85+, Newcastle 85+ Study [97,98]; LiLACS NZ, Life and Living in Advanced Age New Zealand: Te Puāwaitanga o Nga Tapuwae Kia Ora Tonu [119,120]; Carb, carbohydrates; B12, vitamin B12; D, vitamin D; Ca, calcium; -, not available. [2] Values are means. [3] Without alcohol intake. [4] Non-starch polysaccharides (NSP). [5] Only folic acid. [6] Dietary folate equivalents: 1 µg DFE = 1 µg food folate = 0.5 µg folic acid supplement (fasting) = 0.6 µg folic acid from fortified food or as supplement (non-fasting). [7] Non-Māori participants (European descendants).

"The Syndromic Cycle Theory"



3- Fried et al., J Gerontol 56:M146-56; Bandeen-Roche et al., J Gerontol, 2006

Dietary intake of macronutrients in NHANES III adults ages 60 years and older by frai
†

	Frail n = 1,028		Pre-frail n = 1,294		Not frail n = 2,409	
	Mean	SE	Mean	SE	Mean	SE
Energy, kJ*	6648	128	6966	81	7286	84
Fat, g ††	61.8	0.7	61.3	0.4	60.8	0.6
% of energy	31.8	0.4	31.8	0.2	31.9	0.4
Saturated fatty acids, g ††	20.9	0.4	20.4	0.2	19.9	0.3
% of energy	10.7	0.2	10.6	0.1	10.5	0.1
Monounsaturated fatty acids, g ††	23.3	0.3	23.3	0.1	23.3	0.3
% of energy	11.9	0.2	12.0	0.1	12.2	0.2
Polyunsaturated fatty acids, g ††	12.8	0.4	12.8	0.2	12.8	0.2
% of energy	6.6	0.2	6.6	0.1	6.7	0.1
Carbohydrates, g ††	211.0	2.1	213.3	1.3	215.5	1.6
% of energy	51.7	0.5	51.9	0.3	52.0	0.4
Protein, g ††	67.0	0.8	66.9	0.5	66.9	0.6
% of energy	16.5	0.2	16.4	0.1	16.3	0.2
Animal protein, g ††	64.5	0.8	64.1	0.5	63.6	0.5
% of energy	10.8	0.2	10.7	0.2	10.6	0.2
Plant protein, g ††	35.5	0.8	35.9	0.5	36.4	0.5
% of energy	5.2	0.1	5.3	0.1	5.4	0.0

† Adjusted for age, gender, race-ethnicity, smoking, education, income, BMI, and co-morbidity

†† Also adjusted for energy intake

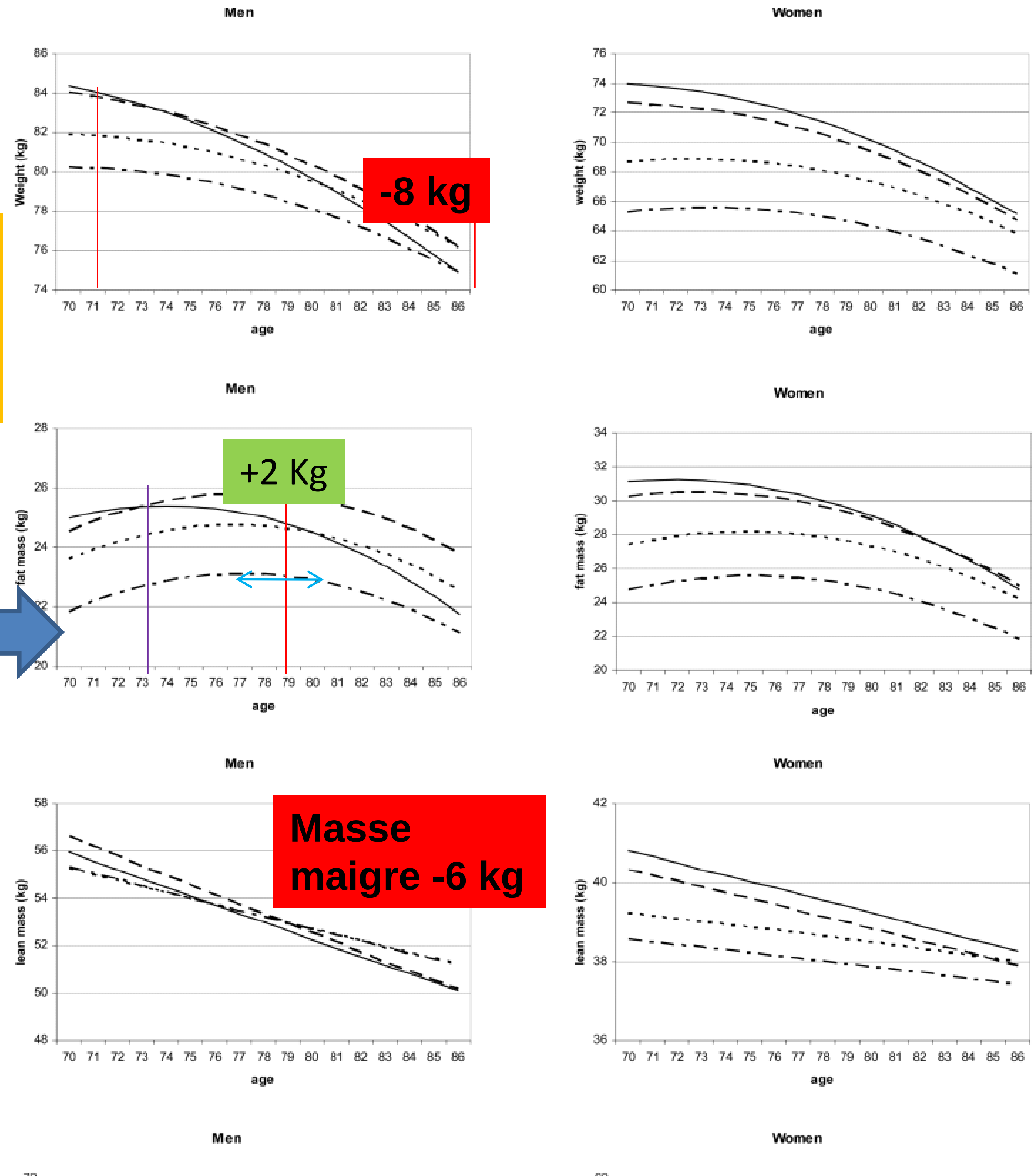
* $p<0.001$

Apports énergétiques et fragilité NHANES III

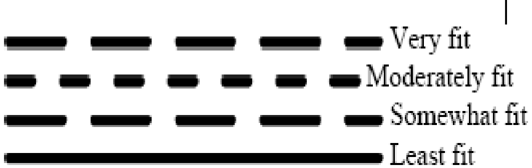
Smit E Br J Nutr 2013

2949 sujets non obèses
70-79 ans → 86 ans
Suivi 8 ans DEXA

la masse grasse augmente jusqu'à 78/80 ans



Health ABC study



De la fonction musculaire à la fonction

Quadriceps muscle function in relation to habitual physical activity and VO2max in men and women aged more than 65 years.
Kostka T[1], Rahmani A, Berthouze SE, Lacour JR, Bonnefoy M. J Gerontol A Biol Sci Med Sci. 2000 Oct;55(10):B481-8

Relations oméga 3 et performances physiques

MAPT Study *B Fougere Clin Nutr 2018*

Table 1
Characteristics of subjects according to omega-3 index quartiles (Q).

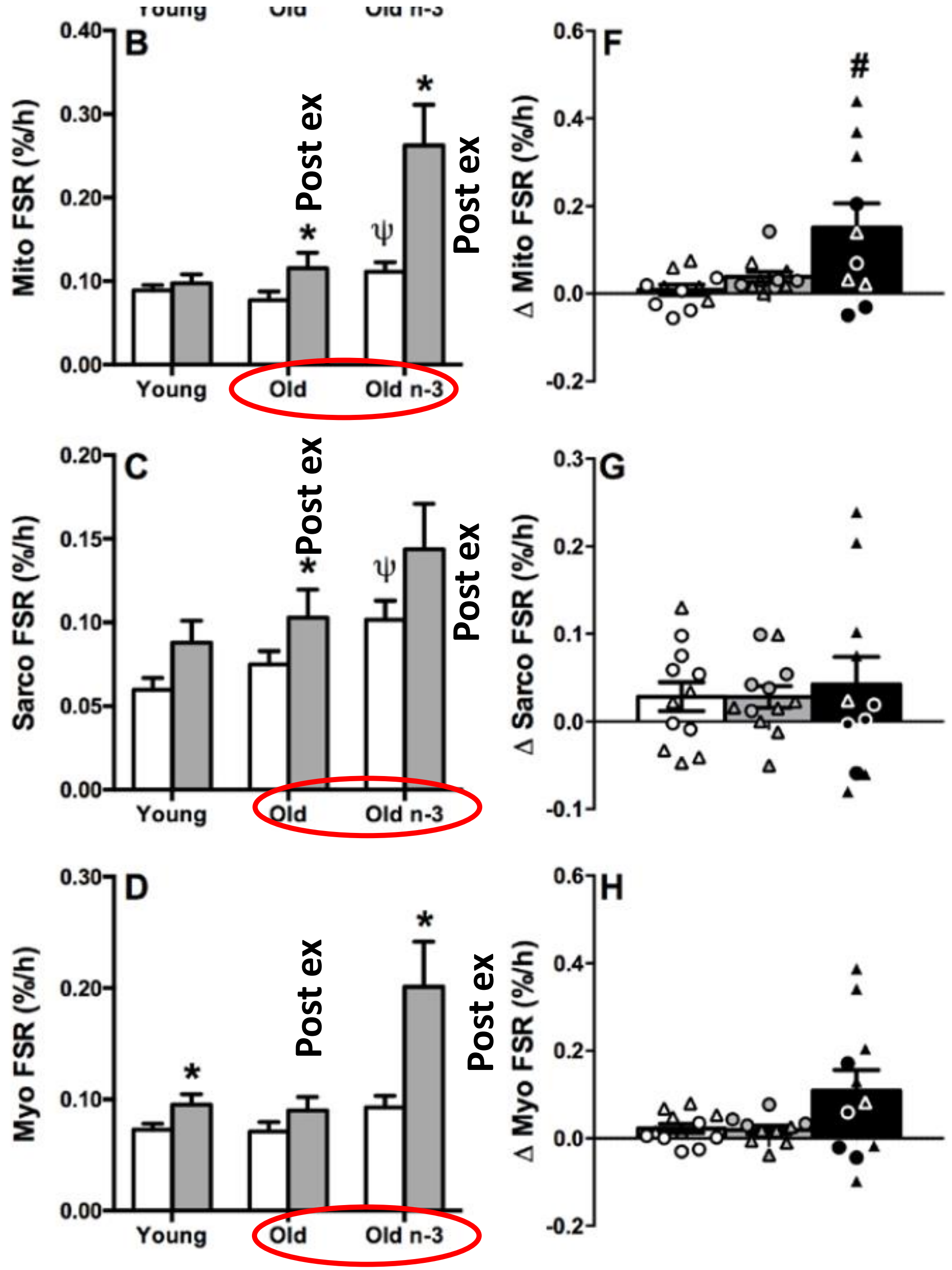
	All (n = 1449)	DHA + EPA Q1 ≤ (n = 362)	DHA + EPA Q1 > (n = 1087)	p
	Mean ± SD or % (n)	Mean ± SD or % (n)	Mean ± SD or % (n)	
Subject characteristics				
Gender (female)	64.46% (934)	63% (228)	64.9% (706)	0.50
Age (years old)	75.25 ± 4.38	75.60 ± 4.43	75.14 ± 4.31	0.08
BMI (kg/m^2)	26.13 ± 4.04	26.49 ± 3.73	26.03 ± 4.13	**0.04**
Cognition				
MMS/30	28.11 ± 1.58	27.95 ± 1.63	28.17 ± 1.56	**0.02**
GDS/15	3.21 ± 2.60	3.42 ± 2.77	3.17 ± 2.55	0.38
Physical performance				
SPPB/12	10.61 ± 1.63	10.43 ± 1.76	10.69 ± 1.64	**0.03**
4-m Gait speed (m/s)	1.09 ± 0.26	1.09 ± 0.27	1.10 ± 0.26	0.30

BMI, Body Mass Index; DHA, docosahexaenoic acid; EPA, eicosapentaenoic acid; GDS, Geriatric Depression Scale; MMS, Mini Mental State; SPPB, Short Physical Performance Battery. Bold values are significance for p-value < 0.05.

Table 2
Multivariate linear regression analyses between low omega-3 index and SPPB scores in the MAPT cohort (n = 1449).

	SPPB					
	Model 1			Model 2		
	Coeff.	95% CI	p	Coeff.	95% CI	p
Low omega-3 index (Ref. Q2–Q4)	−0.263	−0.455; −0.072	0.007	−0.166	−0.346; 0.013	0.07

Model 1. Unadjusted
Model 2. Adjusted for age, gender, GDS score, BMI, MMS score, grip strength
BMI, Body Mass Index; GDS, Geriatric Depression Scale; MMS, Mini Mental State; SPPB, Short Physical Performance Battery.



Influence d'une supplémentation en oméga 3 sur la synthèse des protéines musculaires après exercice

Lalia AZ aging 2017

Supplémentation 4g/j pendant 4 mois
12 sujets jeunes
12 sujets âgés 65-85

Figure 4. Postabsorptive and exercise-stimulated muscle protein synthesis.

Une supplémentation en n-3 PUFA de 6 mois Améliore la masse et la force musculaire chez le sujet âgé

Smith GI Am J Clin Nutr 2015

40 supplémentés
20 contrôles
1,86 g EPA
1,5 g DHA

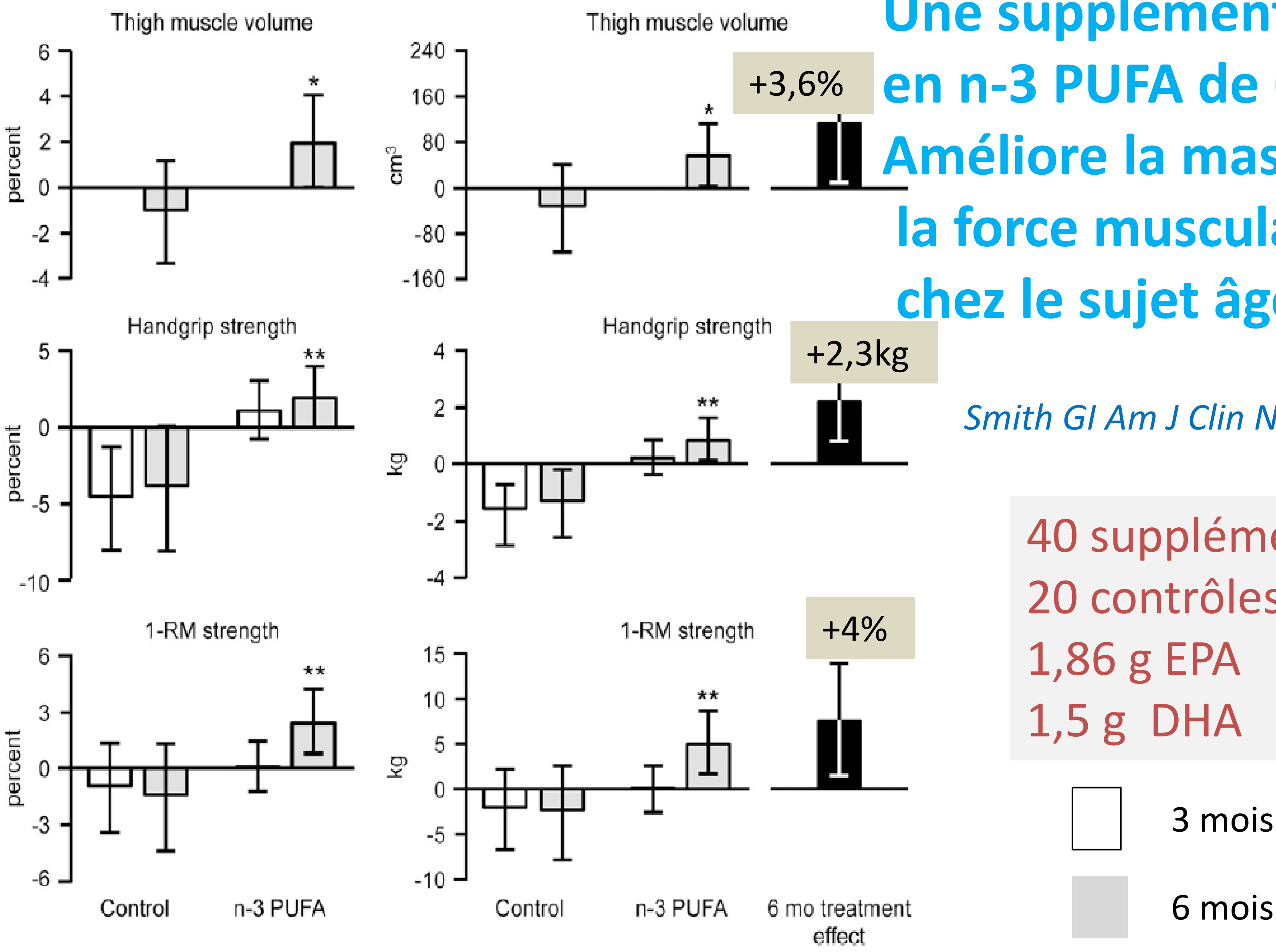


FIGURE 2 Changes (95% CIs) in thigh muscle volume, handgrip strength, and 1-RM muscle strength in the n–3 PUFA and control groups. Data represent average absolute and relative changes from baseline after 3 mo (white bars) and 6 mo (gray bars) of treatment with corn oil (control) and fish oil–derived n–3 PUFA

Nutriments et vieillissement cérébral

(Zamroziewicz MK Frontiers in Neuroscience 2016)

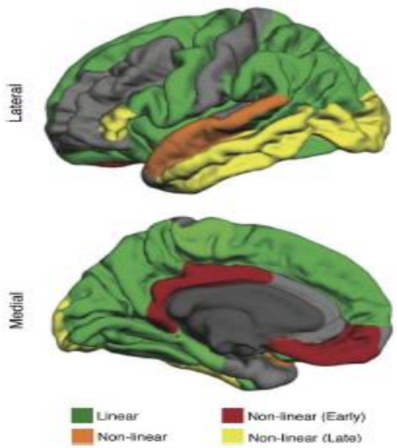


FIGURE 1 | The effect of aging on brain structure (cortical thickness) in healthy older adults (mean age 63.38 ± 12.23 years). Regions highlighted in green follow a linear rate of atrophy. Regions highlighted in orange show decline early in aging, stabilize, and then decline again late in aging. Regions highlighted in red show decline early in aging (decrease quickly early in aging but stabilize late in aging). Regions highlighted in yellow show decline late in

TABLE 2 | Summary of evidence examining the role of nutrition in structural changes associated with brain aging.

Structural component	Dietary component
WHOLE BRAIN MEASURES	
Brain volume	Docosahexaenoic acid (Tan et al., 2012)
	Mediterranean diet (Gu et al., 2015)
	Vitamin E (Mangialasche et al., 2013)
	Vitamin C (Whalley et al., 2003)
Cortical thickness	Vitamin D (Walhovd et al., 2014)
	Mediterranean diet (Gu et al., 2015)
	Vitamin E (Mangialasche et al., 2013)
REGIONAL MEASURES	
Temporal cortex volume	Vitamin D (Hooshmand et al., 2014)
	Omega-3 polyunsaturated fats (Conklin et al., 2007)
	Eicosapentaenoic acid (Samieri et al., 2012)
Parietal cortex volume	Vitamin B6 (Erickson et al., 2008)
	Vitamin B12 (Erickson et al., 2008)
	Mediterranean diet (Gu et al., 2015)
Cingulate cortex volume	Vitamin B6 (Erickson et al., 2008)
	Omega-3 polyunsaturated fats (Conklin et al., 2007)
	Mediterranean diet (Gu et al., 2015)
Frontal cortex volume	Vitamin B6 (Erickson et al., 2008)
	Omega-3 polyunsaturated fats (Zamroziewicz et al., 2015)
	Mediterranean diet (Gu et al., 2015)
White matter lesions	Vitamin D (Annweiler et al., 2014)
	Vitamin B12 (de Lau et al., 2009)
	Docosahexaenoic acid (Tan et al., 2012)
	Choline (Poly et al., 2011)
	Mediterranean diet (Gardener et al., 2012)
	Marine omega-3 polyunsaturated fats (Bowman et al., 2012)
Intracerebral hemorrhage volume	Calcium (Inoue et al., 2013)

J Nutr Health Aging. 2018;22(6):718-725

ASSOCIATIONS BETWEEN PLASMATIC POLYUNSATURATED FATTY ACIDS CONCENTRATIONS AND COGNITIVE STATUS AND DECLINE IN NEUROCOGNITIVE DISORDERS

M. HAUTION-BITKER[1], T. GILBERT[1], A. VIGNOLES[1,2], C. LECARDONNEL[1], S. WATELET[1], E. BLOND[2,3], J. DRAI[2], M. BONNEFOY[1,3,4]

	Univariate analysis	
	Estimate ± SE	p
Demographic variables		
Age (per 1 year)	-0.02 ± 0.05	0.70
Female gender	0.01 ± 0.7	0.99
Weight (per 1 kg)	-0.02 ± 0.03	0.55
MNA (per 1 point)	0.04 ± 0.1	0.73
Plasma ω-3 PUFA (per 1 mg/l)		
Alpha Linolenic.PL	0.08 ± 0.31	0.8
Alpha Linolenic.EC	0.07 ± 0.18	0.69
EPA.PL	0.08 ± 0.03	0.01
EPA.EC	0.12 ± 0.04	<0.01
DHA.PL	0.04 ± 0.02	0.04
DHA.EC	0.12 ± 0.1	0.25
Plasma ω-6 PUFA (per 1 mg/l)		
Linoleic.PL	0 ± 0.01	0.83
Linoleic.EC	0 ± 0	0.64
Arachidonic.PL	-0.01 ± 0.01	0.46
Arachidonic.EC	0.01 ± 0.02	0.62
Plasma Saturated FA (per 1 mg/l)		
Palmitic.PL	0 ± 0.01	0.46
Palmitic.EC	0.01 ± 0.01	0.43
Other nutritonal variables		
Leptine (per 1 mg/l)	0 ± 0.01	0.74
Albumine (per 1 g/l)	-0.06 ± 0.09	0.54

Comparison of variables according to cognitive decline status during follow-up

	Cognitive decline (n =27)	No cognitive decline (n = 43)	p
Demographic variables			
Age (years)	80.31 ± 6.85	80.04 ± 6.22	0.81
Female gender	36 (58.1%)	55 (70.5%)	0.18
Weight (kg)	60.19 ± 11.21	63.40 ± 14.50	0.33
MNA	23.33 ± 3.47	23.24 ± 5.15	0.95
Erythrocyte ω-3 PUFA (in mg/l)			
α linolenic acid.CPG	0.76 ± 0.72	0.81 ± 0.55	0.77
α linolenic acid.EPG	0.47 ± 0.45	0.39 ± 0.43	0.51
EPA.CPG	1.68 ± 2.7	1.61 ± 1.77	0.9
EPA.EPG	1.15 ± 1.28	1.78 ± 2.07	0.14
DHA.CPG	2.83 ± 2.35	6.9 ± 9.83	0.02
DHA.EPG	2.64 ± 1.93	6.57 ± 9.83	0.02

Data are reported as mean ± SD or count (percentage); CPG: choline phosphoglycerides; DHA: docosahexaenoic acid; EPA: eicosapentaenoic; EPG: ethanolamine phosphoglycerides; FA: fatty acids; MMSE: mini mental state examination; MNA: mini nutritional assessment; ω-3 PUFA: omega-3 polyunsaturated fatty acid; ω-6 PUFA: omega-6 polyunsaturated fatty acid; PL: phospholipid portion; SD: standard deviation.

Supplémentation acides gras n-3 et cognition (24mois)

(Dangour A D Am J Clin Nutr 2010)

Etude contrôlée : 867 volontaires; 250mg EPA+500mg DHA vs PCB ; 24 mois

Changes within randomized treatment arms in secondary cognitive function test scores between baseline and 24 mo[1]

	Fish oil			Placebo		
	n	Baseline	24 mo	*n*	Baseline	24 mo
Memory						
Story recall						
Immediate (number of story items recalled)	374	11.1 ± 3.9[2]	11.0 ± 4.3	367	10.7 ± 3.9	10.9 ± 3.9
Delayed (number of story items recalled)	374	8.9 ± 3.8	9.3 ± 4.2	366	8.8 ± 3.7	9.1 ± 3.8
Spatial memory (number of correct images)						
Immediate (number of correct images)	373	5.3 ± 2.6	5.3 ± 2.5	368	5.3 ± 2.5	5.2 ± 2.5
Delayed (number of correct images)	373	4.6 ± 2.5	4.4 ± 2.4	368	4.6 ± 2.6	4.4 ± 2.5
Processing speed						
Letter search/cancellation (number correct as a percentage of total attempts)	374	78.8 ± 12.6	79.2 ± 12.5	369	78.9 ± 13.3	79.2 ± 12.8
Symbol letter modality (number correct)	369	43.0 ± 9.6	41.7 ± 10.4	369	44.3 ± 9.2	42.7 ± 10.0
Reaction time (s)						
Simple	363	0.29 ± 0.07	0.29 ± 0.08	357	0.31 ± 0.24	0.29 ± 0.15
Choice	357	0.75 ± 0.58	0.71 ± 0.35	344	0.72 ± 0.52	0.68 ± 0.10
Executive function						
Digit span						
Forward (number of correct sequences)	364	8.3 ± 2.4	7.9 ± 2.3	355	8.2 ± 2.3	8.0 ± 2.4
Backward (number of correct sequences)	361	6.5 ± 2.0	6.4 ± 2.0	355	6.5 ± 2.1	6.4 ± 2.0
Verbal fluency (number of animals named)	374	19.8 ± 5.1	19.1 ± 5.4	369	19.9 ± 5.0	19.5 ± 5.3

Prévention troubles cognitifs oméga 3 *Cochrane 2012*

Analysis 1.1. Comparison 1 Mini-Mental State Examination Score, Outcome 1 MMSE score.

Review: Omega 3 fatty acid for the prevention of cognitive decline and dementia

Comparison: 1 Mini-Mental State Examination Score

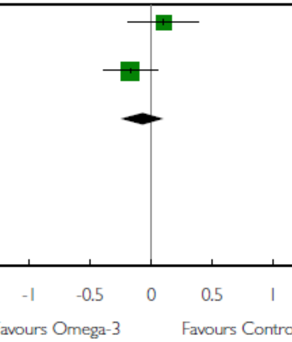
Outcome: 1 MMSE score

Study or subgroup	Control N	Control Mean(SD)	Omega-3 N	Omega-3 Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dangour 2010	363	28.3 (2.2)	365	28.2 (1.8)		35.3 %	0.10 [-0.19, 0.39]
Geleijnse 2011	627	27.56 (2.45)	1866	27.73 (2.17)		64.7 %	-0.17 [-0.39, 0.05]
Total (95% CI)	**990**		**2231**			**100.0 %**	**-0.07 [-0.25, 0.10]**

Heterogeneity: Chi^2 = 2.12, df = 1 (P = 0.14); I^2 =53%

Test for overall effect: Z = 0.85 (P = 0.40)

Test for subgroup differences: Not applicable



Analysis 2.2. Comparison 2 Memory - Word learning test, Outcome 2 Delayed Recall.

Review: Omega 3 fatty acid for the prevention of cognitive decline and dementia

Comparison: 2 Memory - Word learning test

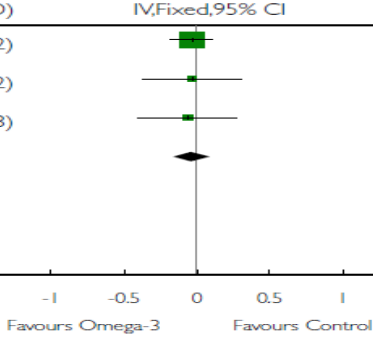
Outcome: 2 Delayed Recall

Study or subgroup	Control N	Control Mean(SD)	Omega-3 N	Omega-3 Mean(SD)	Std. Mean Difference IV,Fixed,95% CI	Weight	Std. Mean Difference IV,Fixed,95% CI
Dangour 2010	369	7.5 (3)	375	7.6 (3.2)		73.4 %	-0.03 [-0.18, 0.11]
Van de Rest 2008 (High)	51	9 (3.2)	96	9.1 (3.2)		13.1 %	-0.03 [-0.37, 0.31]
Van de Rest 2008 (Mod)	52	9 (3.2)	100	9.2 (3)		13.5 %	-0.06 [-0.40, 0.27]
Total (95% CI)	**472**		**571**			**100.0 %**	**-0.04 [-0.16, 0.09]**

Heterogeneity: Chi^2 = 0.03, df = 2 (P = 0.98); I^2 =0.0%

Test for overall effect: Z = 0.58 (P = 0.56)

Test for subgroup differences: Not applicable



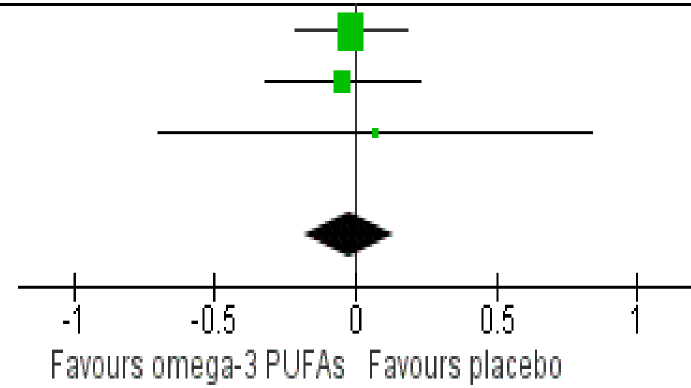
traitement troubles cognitifs oméga 3 *Cochrane 2016*

	Omega-3 PUFAs			Placebo				Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Quinn 2010 (1)	26.55	11.02	238	26.73	10.67	164	62.8%	-0.02 [-0.22, 0.18]
Freund-Levi 2006 (2)	27.78	11.11	103	28.3	10.9	101	33.0%	-0.05 [-0.32, 0.23]
Shinto 2014 (3)	33.67	9.2	13	33.1	6.13	13	4.2%	0.07 [-0.70, 0.84]
Total (95% CI)			**354**			**278**	**100.0%**	**-0.02 [-0.18, 0.13]**

Heterogeneity: $Chi^2 = 0.09$, df = 2 (P = 0.96); $I^2 = 0\%$

Test for overall effect: Z = 0.29 (P = 0.78)

Std. Mean Difference
IV, Fixed, 95% CI



Footnotes

(1) ADAS-Cog, unpublished PP data

(2) ADAS-Cog extended version (score range 0-85)

(3) ADAS-Cog; unpublished LOCF data

5. Forest plot of comparison: Omega-3 PUFA versus placebo for mild to moderate Alzheimer's disease. Published and unpublished. Sensitivity analysis 1.15 Alzheimer's Disease Assessment Scale - Cognitive subscale (ADAS-Cog; 6 months' follow-up, imputed means for missing data. Assumption: values of missing data = values of control group). LOCF: last observation carried forward; PP: per protocol.

Burckhardt M, Herke M, Wustmann T, Watzke S, Langer G, Fink A. Omega-3 fatty acids for the treatment of dementia. Cochrane Database of Systematic Reviews 2016, 4. Art. No.: CD009002. DOI: http://dx.doi.org/10.1002/14651858.CD009002.pub3

Effets interactifs des nutriments

(Zamroziewicz MK Frontiers in Neuroscience 2016)

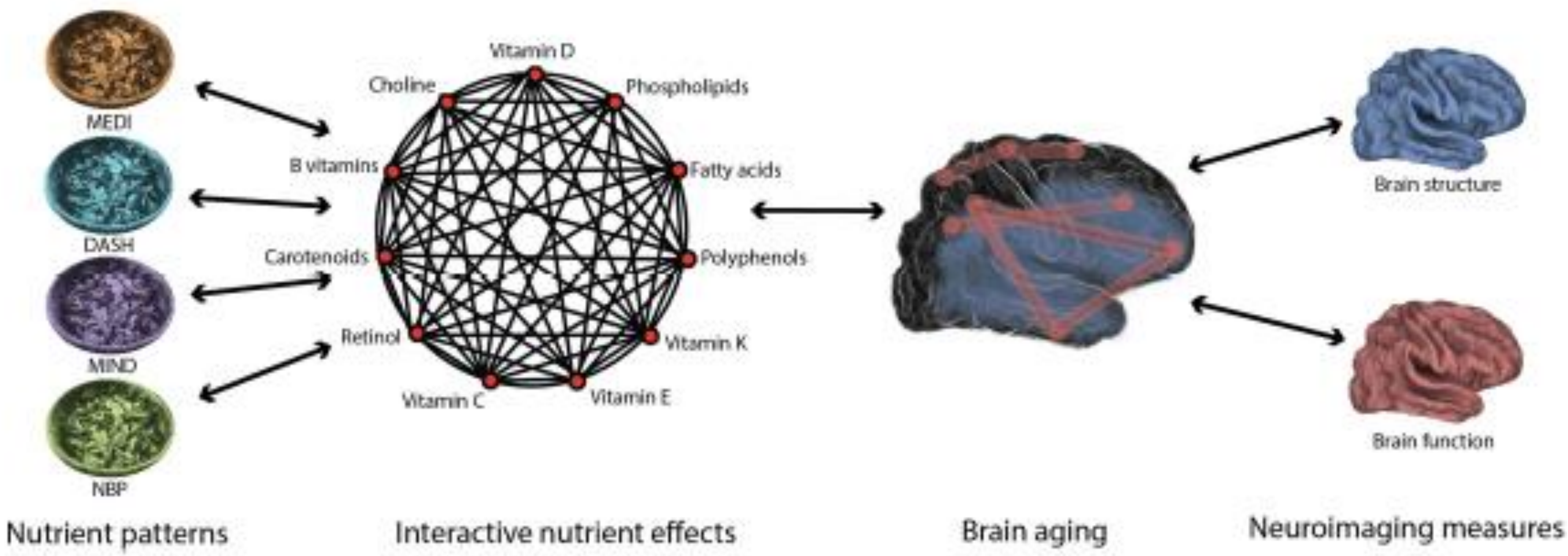


FIGURE 3 | Diet and brain aging are multifaceted in nature. The interactive effects of nutrients in the diet may be captured using nutrient patterns, such as the Mediterranean diet (MEDI; Willett et al., 1995), the Dietary Approach to Stop Hypertension (DASH; Smith et al., 2010), the Mediterranean-Dietary Approach to Systo Hypertension Diet (MIND; Morris et al., 2015), and Nutrient Biomarker Patterns (NBPs; Bowman et al., 2012). Likewise, the widespread changes in brain structure ai function associated with age may be best measured using high-resolution neuroimaging methods. In order to understand the beneficial effects of nutrition on the aging brain, each of these complex entities must be characterized using precise methods.

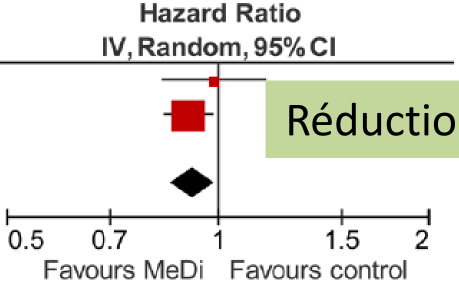
Association régime méditerranéen et MA- Meta-analyse études prospectives

Singh B JAD 2014

Score continu de 0 à 9

Study or Subgroup	log[Hazard Ratio]	SE	AD Total	CN Total	Weight	Hazard Ratio IV, Random, 95% CI
Feart 2009	-0.0147	0.0876	51	1410	18.8%	0.99 [0.83, 1.17]
Scarmeas 2006	-0.0988	0.0422	219	1759	81.2%	0.91 [0.83, 0.98]
Total (95% CI)			**270**	**3169**	**100.0%**	**0.92 [0.85, 0.99]**

Heterogeneity: Tau² = 0.00; Chi² = 0.75, df = 1 (P = 0.39); I² = 0%
Test for overall effect: Z = 2.18 (P = 0.03)

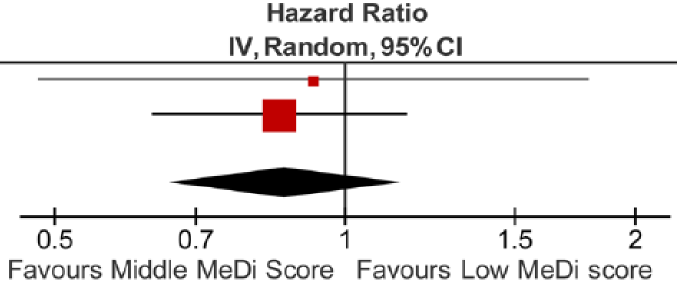


Réduction de 10%

3.2 Middle vs Lowest MeDi tertile

Study or Subgroup	log[Hazard Ratio]	SE	AD Total	CN Total	Weight	Hazard Ratio IV, Random, 95% CI
Feart 2009	-0.0759	0.3358	51	1410	17.7%	0.93 [0.48, 1.79]
Scarmeas 2006	-0.1568	0.1557	219	1759	82.3%	0.85 [0.63, 1.16]
Total (95% CI)			**270**	**3169**	**100.0%**	**0.87 [0.66, 1.14]**

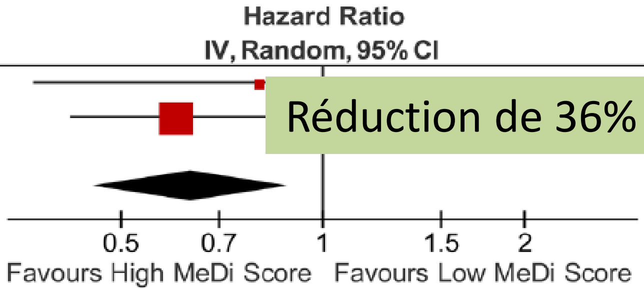
Heterogeneity: Tau² = 0.00; Chi² = 0.05, df = 1 (P = 0.83); I² = 0%
Test for overall effect: Z = 1.01 (P = 0.31)



3.3 Highest vs Lowest MeDi tertile

Study or Subgroup	log[Hazard Ratio]	SE	AD Total	CN Total	Weight	Hazard Ratio IV, Random, 95% CI
Feart 2009	-0.2169	0.3966	51	1410	18.0%	0.81 [0.37, 1.75]
Scarmeas 2006	-0.5034	0.1858	219	1759	82.0%	0.60 [0.42, 0.87]
Total (95% CI)			**270**	**3169**	**100.0%**	**0.64 [0.46, 0.89]**

Heterogeneity: Tau² = 0.00; Chi² = 0.43, df = 1 (P = 0.51); I² = 0%
Test for overall effect: Z = 2.69 (P = 0.007)



Réduction de 36%

Nutrition et Inflammation: les omega-3

Ticinesi A Nutrients 2016

Table 2. Summary of observational (cross-sectional) and intervention (randomized controlled trials) studies exploring the association of *n*-3 polyunsaturated fatty acids (PUFA) and inflammatory markers in older individuals.

First Author, Journal, Year [ref]	Country	Study Design	Sample Size	Setting/Health Status	Male (%)	Mean Age (Year)	Mean BMI (Kg/m^2)	Intervention	Duration (Weeks)	Primary Outcomes	Secondary Outcomes	Results
Observational studies												
Ferrucci L, J Clin Endocrinol Metab, 2006 [86]	Italy	CS	1123	Community-dwelling	44.8	68	27	-	-	Association between serum concentrations of fatty acids and IL-6, IL-1ra, IL-10, IL-6r, TNF-α, TGFβ, CRP	-	Total *n*-3 fatty acids are independently associated with lower levels of IL-6, IL-1ra, TNF-α, CRP and higher levels of IL-1ra
de Batlle J, J Nutr Biochem, 2012 [87]	Spain	CS	250	Outpatients with stable COPD	93.6	68	-	-	-	Association between dietary *n*-3 PUFA intake and CRP, IL-6, IL-8, TNF-α	-	Higher intake of α-linolenic acid is associated with lower TNF-α concentrations; higher intake of arachidonic acid is associated with higher IL-6 and CRP concentrations
Kiecolt-Glaser JK, Psychosom Med, 2007 [88]	United States	CS	43	Community-dwellers	41.8	67	-	-	-	Association between serum concentrations of fatty acids, depressive symptoms and TNF-α, IL-6 and sIL-6r	-	Increased serum *n*-6/*n*-3 PUFA ratio is associated with higher TNF-α and IL-6 concentrations

In Chianti

Nutrition et Inflammation: les omega-3

Ticinesi A Nutrients 2016

Etudes d'intervention

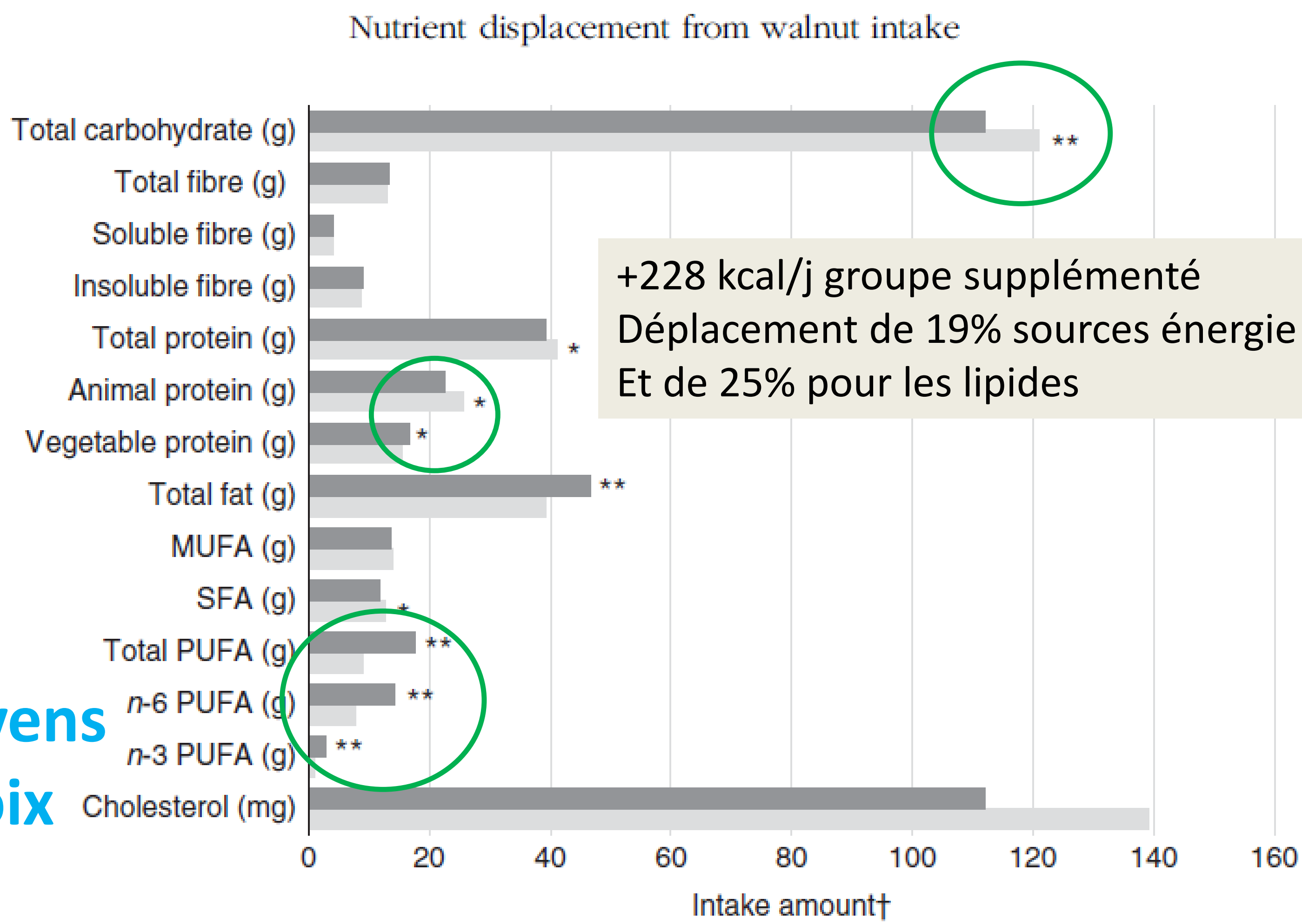
First Author, Journal, Year [ref]	Country	Study Design	Sample Size	Setting/Health Status	Male (%)	Mean Age (Year)	Mean BMI (Kg/m^2)	Intervention	Duration (Weeks)	Primary Outcomes	Secondary Outcomes	Results
							Intervention studies					
Gopinath R, Indian J Surg, 2013 [96]	India	RCT	40	Inpatients undergoing hip surgery	60	70	-	Intravenous omega-3 fish oil supplement continuous infusion for 3 days *vs.* placebo	1	Serum CRP, IL-6, IL-8, IL-10	-	Decrease in IL-6 and IL-10 concentrations, increase in IL-8 concentrations, prevention of CRP increase in intervention group
Barros KV, J Parenter Enteral Nutr, 2014 [97]	Brazil	RCT	40	Critically ill patients in ICU	60	71	-	Intravenous fish-oil lipid emulsion 0.2 g/kg of body weight over 6 h for 3 days *vs.* placebo	0.5 (72 h)	Serum IL-1β, IL-2, IL-6, IL-8, IL-10, IL-17, IL-22, TNF-α	-	Lower serum TNF-α and IL-8 concentrations, higher IL-10 concentrations in intervention group
Berger MM, Am J Clin Nutr, 2013 [98]	Switzerland	RCT	28	Patients undergoing elective cardiac surgery	89.2	66	28	Fish oil *vs.* saline infusion 0.2 g/kg 12 h and 2 h before and immediately after surgery	0.2 (1 day)	Serum CRP, IL-6, IL-8, IL-10	Other physiologic and laboratory parameters	Fish oil prevented post-operative increase in IL-6 concentrations
Troseid M, Metab Clin Exp, 2009 [99]	Norway	2 × 2 RCT	563	Community-dwelling	100	70	27	*n*-3 PUFA supplement and/or structured dietary counseling	156 (3 years)	Serum CRP, TNF-α, IL-6, IL-18, adiponectin	BMI and waist circ.	All pro-inflammatory cytokines decreased in intervention groups; IL-18 decreased only in subjects under PUFA

+2,4g/j/3 ans

Favourable nutrient intake and displacement with long-term walnut supplementation among elderly: results of a randomised trial

Br J Nutr 2017

Edward Bitok[1], Karen Jaceldo-Siegl[1], Sujatha Rajaram[1], Mercè Serra-Mir[2,3], Irene Roth[2,3],

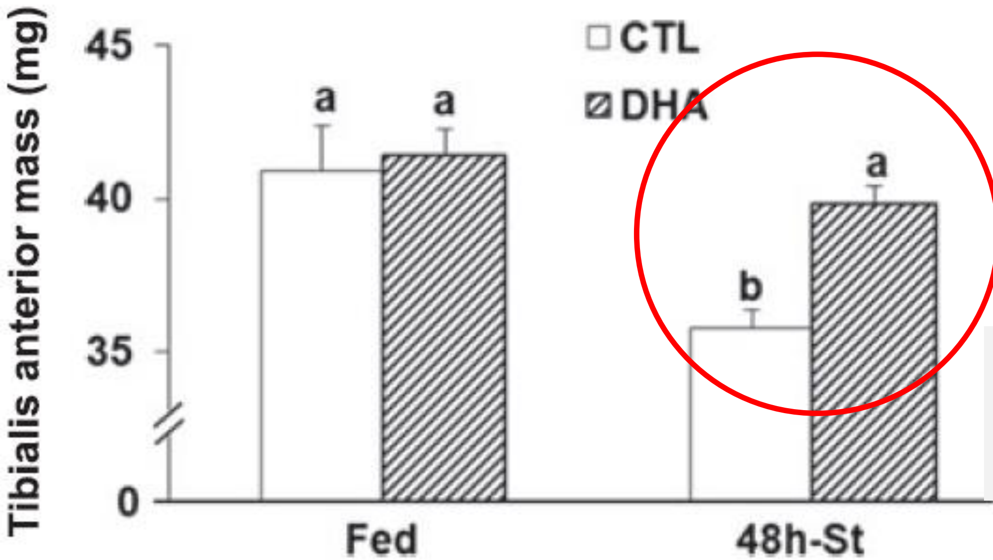


+228 kcal/j groupe supplémenté
Déplacement de 19% sources énergie
Et de 25% pour les lipides

Apports moyens de 43g de noix sur 2 ans

Fig. 2. Mean daily intake of dietary macronutrients after a 2-year supplementation with 43 g of walnuts. ▩, Walnut diet; ▢, control diet. intake/4184 kJ of five 24-h diet recalls obtained over the 2-year study period. * $P < 0.05$; ** $P < 0.001$ (*t* test).

Figure 2 Feeding the mice a docosahexaenoic acid-enriched diet prior to 48 h fasting preserves muscle mass. Tibialis anterior muscle mass was measured in each group ($n = 10$ mice/group). Values are means ± SEM. Statistical differences were assessed by analysis of variance. Bars with different superscript letters are statistically different.

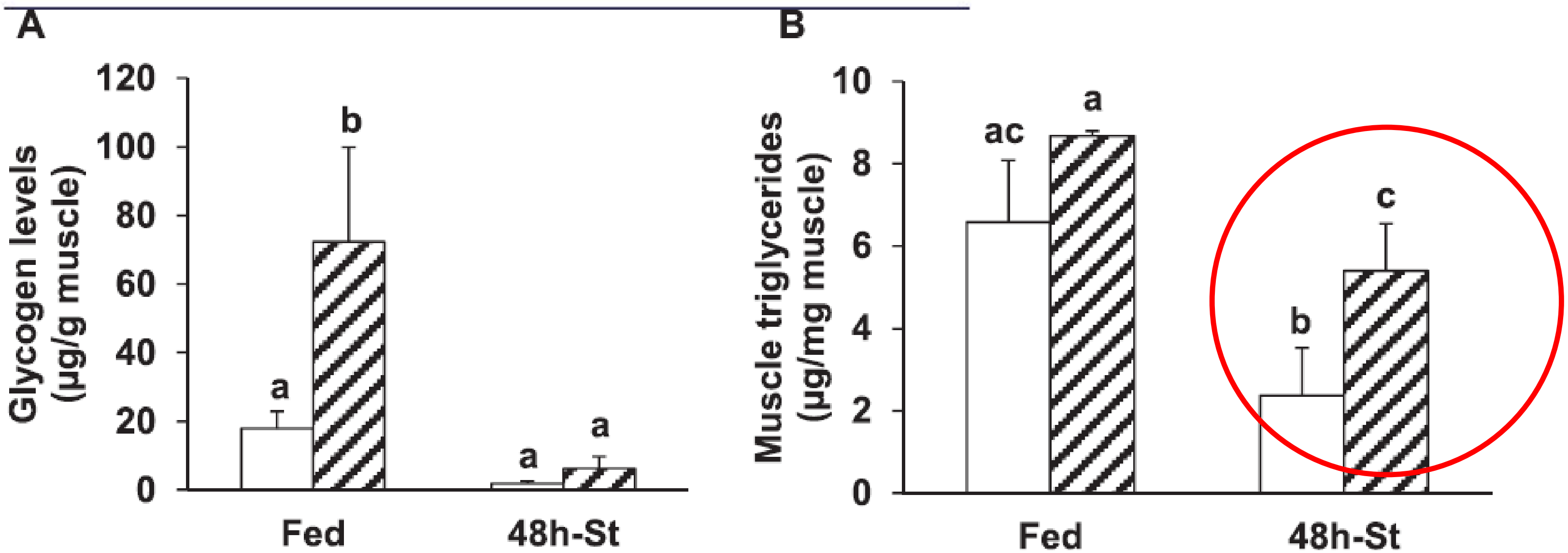


Journal of Cachexia, Sarcopenia and Muscle 2016; 7: 587–603
Published online 15 February 2016 in Wiley Online Library (wileyonlinelibrary.com) **DOI:** 10.1002/jcsm.12103

Docosahexaenoic acid-supplementation prior to fasting prevents muscle atrophy in mice

Christiane Deval[1,2], Frédéric Capel[1,2], Brigitte Laillet[1,2], Cécile Polge[1,2], Daniel Béchet[1,2], Daniel Taillandier[1,2], Didier Attaix[1,2] & Lydie Combaret[1,2*]

8 semaines de supplémentation
Avant jeune de 48 heures



Phenotypic and etiologic criteria for the diagnosis of malnutrition.

Phenotypic Criteria[g]			Etiologic Criteria[g]	
Weight loss (%)	Low body mass index (kg/m^2)	Reduced muscle mass[a]	Reduced food intake or assimilation[b,c]	Inflammation[d–f]
>5% within past 6 months, or >10% beyond 6 months	<20 if < 70 years, or <22 if >70 years Asia: <18.5 if < 70 years, or <20 if >70 years	Reduced by validated body composition measuring techniques[a]	≤50% of ER > 1 week, or any reduction for >2 weeks, or any chronic GI condition that adversely impacts food assimilation or absorption[b,c]	Acute disease/injury[d,f] or chronic disease-related[e,f]

Risk screening

At risk for malnutrition
- Use validated screening tools

Diagnostic Assessment

Assessment criteria
- **Phenotypic**
  - Non-volitional weight loss
  - Low body mass index
  - Reduced muscle mass
- **Etiologic**
  - Reduced food intake or assimilation
    Disease burden/inflammatory condition

Diagnosis

Meets criteria for malnutrition diagnosis
- Requires at least 1 Phenotypic criterion and 1 Etiologic criterion

Severity Grading

Determine severity of malnutrition
- Severity determined based on Phenotypic criterion

Clinical Nutrition xxx (2018) 1–9

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ELSEVIER

ESPEN Endorsed Recommendation

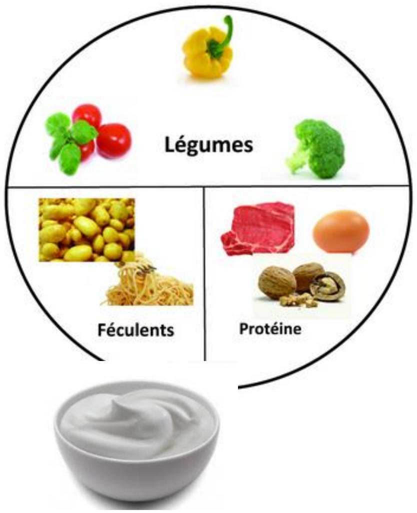
GLIM criteria for the diagnosis of malnutrition – A consensus rep from the global clinical nutrition community☆

T. Cederholm [a, b, *, 1], G.L. Jensen [c, 1], M.I.T.D. Correia [d], M.C. Gonzalez [e], R. Fukushima

LA DENUTRITION : une chronologie de décisions

Un travail en équipe

1 Ajuster les repas



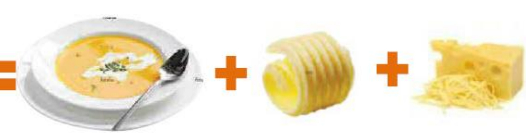
3 Compléments Nutritionnels Oraux (CNO)

4

5 Nutrition parentérale

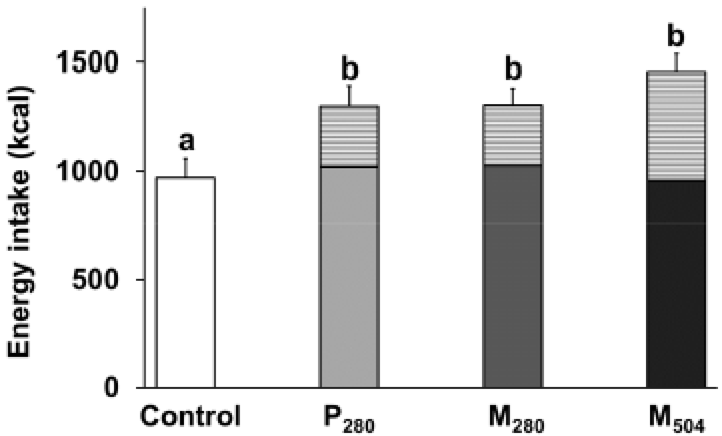
2 Augmenter les apports : alimentation enrichie et fractionnée

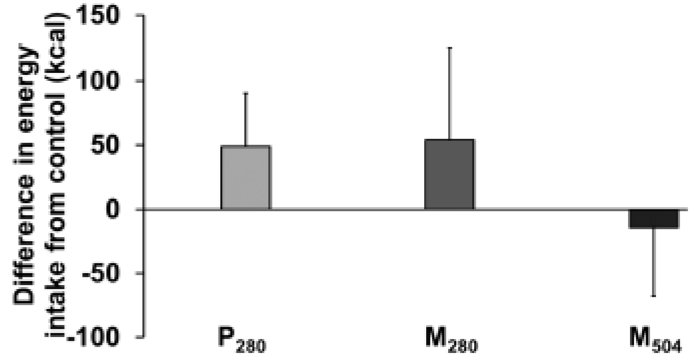
EXEMPLES DE PLATS ENRICHIS

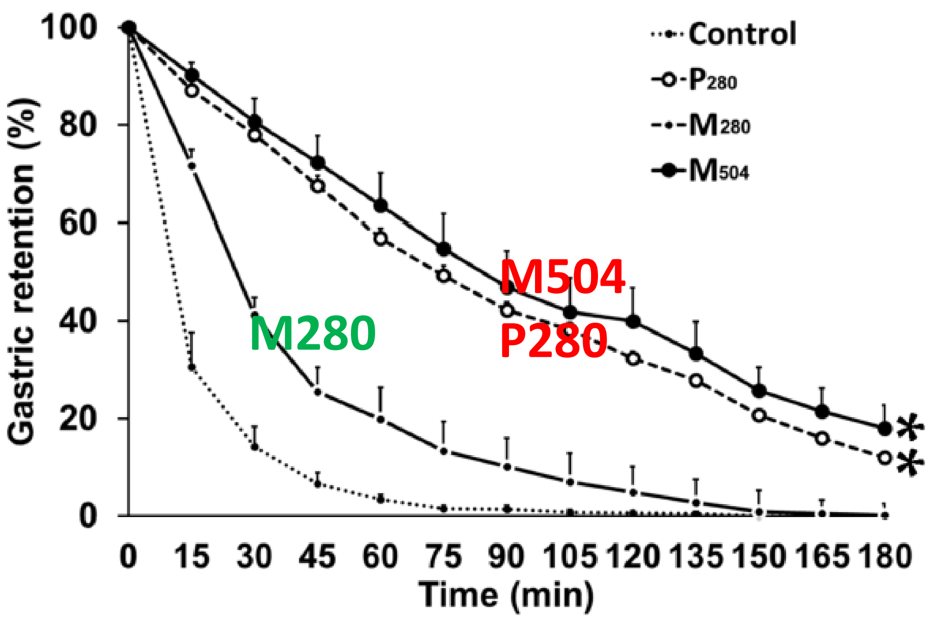
Un potage enrichi = 

Un gratin enrichi = 

Influence de l'addition de lipides et glucides sur une supplémentation en a a essentiels sur les apports et la vidange gastrique *(Giezenaar C Nutrients 2018)*







P280:70g protéines

M280:14g protéines +28g CH +12,4g lipides

M504:70g protéines+28g CH +12,4g lipides

EPA Cachexie *Pappalardo G Nutrition 2015*

Statistically and clinically positive intervention studies with EPA and/or DHA and outcomes

Author (y)	Population and study design	Intervention	Outcomes	Results
Wigmore, et al [12]	18 patients Advanced pancreatic cancer Open-label, single-arm Phase II study	Fish oil capsules (1 g EPA 18%; DHA 12%) 2 g/d fish oil, increased at weekly intervals by 2 g, to maximum dose of 16 g/d.	Weight Anthropometry: MAMC and TSF	Increase in weight of 0.3 kg/month ($P < 0.002$). No significant change in MAMC and TSF values.
Barber, et al [8]	20 patients Pancreatic cancer Single-arm study	Fish oil-enriched oral nutritional supplement 2 cans/d (2.2 g EPA + 0.96 g) Follow-up at 3 and 7 wk from baseline.	Weight Anthropometry: TSF + MUAMC BIA: LBM and FM	Increase in weight at 3 and 7 wk of median 1 kg ($P = 0.020$) and 2 kg ($P = 0.033$), respectively. Increase in LBM at 3 and 7 wk of median 1.0 ($P = 0.0064$) and 1.9 kg ($P = 0.0047$), respectively.
Wigmore, et al [14]	26 patients Pancreatic cancer Single-arm study	Gelatin capsules high-purity EPA (500 mg) 1 g/d EPA on first week, 2 g/d for the second week, 4 g/d for the third week and 6 g/d thereafter Follow-up at 4, 8 and 12 wk	Weight Anthropometry: TSF and MUAMC	Decrease in median weight loss after 4 wk of EPA vs. pre study values ($P < 0.005$), reduction remained significant at 8 and 12 wk ($P < 0.005$). No significant change in MUAMC or TSF at 4, 8 or 12 wk of EPA vs. pre study values.
Bauer, et al [16]	7 patients Pancreatic and lung cancer Open-label, single-arm study	EPA enriched oral nutritional supplement At least 1 can/d (1.1 g EPA/d) Follow-up at 8 wk	Weight LBM with staple isotope deuterium	Increase in weight and LBM (NS). Increase in LBM associated with better nutritional status ($r = 0.998$, $P = 0.04$).
Read, et al [7]	23 patients (15 patients at baseline) Advanced colorectal cancer Open-label, single-arm study	EPA enriched oral nutritional supplement 2 cans/d (1.18 g EPA + 0.92 g DHA/day) Follow-up at 3 and 9 wk 4 cycles of chemotherapy regimen with FOLFIRI, commenced at end of week 3 and repeated every 2 wk.	Weight BIA: LBM (single frequency, tetrapolar device BIM-4, SEAC Pty Ltd)	Increase in weight at end of week 3 (mean increase of 2.5 kg from baseline, $P = 0.03$) and maintenance during chemotherapy. No significant change in LBM before and during chemotherapy.
Ryan, et al [18]	53 patients Oesophageal cancer Double-blind, randomized, controlled trial	EPA enriched enteral feed (2.2 g EPA/d) during 5 d preoperatively, 2–10 d postoperatively and 11–21 d concomitantly with oral diet. Controls: Feeding regimen with an iso-caloric, iso-nitrogenous enteral feed.	Weight BIA: LBM and FM	EPA enriched feed regimen group: No significant difference in weight and FFM from preoperatively to day 21 postoperatively. Control group: Weight loss of 1.8 kg ($P = 0.03$) and LBM loss of 1.9 kg ($P = 0.03$).
Weed, et al [19]	31 patients Head-neck cancer scheduled for surgery with curative intent Open-label, single-arm study	Fish-oil enriched oral nutritional supplement 2 cans/d (2.2 g EPA+0.92 g) Supplement consumed from no later than 2 wk before surgery until discharge Mean ± SD time between trial entry and hospital admission: 23 ± 2.5 d Mean ± SD time between hospital admission and discharge: 11 ± 0.85 d	Weight BIA: LBM and FM	Increase/maintenance in weight in 57% patients until hospital discharge. Increase in LBM increase from trial entry to hospital discharge (+3.2 kg, $P < 0.001$).
van der Meij, et al. [3]	40 patients Lung cancer Double-blind, randomized, controlled trial	Fish-oil enriched oral nutritional supplement (energy + protein-dense) 2 cans/d (2 g EPA+0.92 g DHA) Control group: Isocaloric oral nutritional supplement without EPA + DHA. Follow-up at 3 and 5 wk	Weight BIA: FFM MUAC	EPA group: Weight maintenance (weight difference between intervention group and control group: 1.3 kg, $P = 0.02$ at 3 wk and 1.7 kg, $P = 0.04$ at 5 wk), less decrease in FFM (FFM difference between intervention (1.5 kg at 3 wk and 1.9 kg at 5 wk) and increased MUAMC, whereas the MUAMC in the control group decrease (difference between groups not significant at 3 and 5 wk).
Murphy RA, et al [20]	31 patients (24 controls vs. 16 intervention) Lung cancer Open-label, single arm study, contemporaneous control group	2 types of supplementation: 4 × 1 g gelatin capsules fish oil/d (2.2 g EPA) or 7.5 mL of liquid fish oil/d (2.2 g EPA). Control group: No intervention Follow-up after 2 cycles of chemotherapy (at least 6 wk)	Weight CT images: Skeletal muscle, adipose tissue, muscle attenuation	Fish oil group: 69% patients maintained or gained weight (mean weight change: 0.5 ± 1.0 kg) and muscle (MM at baseline: 25.4 ± 1.4 kg vs. MM at end of treatment: 25.4 ± 1.5 kg, NS). Control group: 29% patients maintained or gained weight (mean weight change: 2.3 ± 0.9 kg) and muscle (MM at baseline: 24.4 ± 1.0 kg vs. MM at end of treatment: 23.5 ± 1.0 kg, $P < 0.002$.

BIA, bioelectric impedance analysis; DHA, docosahexaenoic acid; EPA, eicosapentaenoic acid; FM, fat mass; FFM, free fat mass; LBM, lean body mass; MM, muscle mass; MUAMC, midupper arm muscle circumference; MUAC, midupper arm circumference; NS, not significant; TSF, triceps skinfold thickness

Conclusions

Place des lipides dans le vieillissement

Et dans la prévention et la prise en charge des grands syndromes gériatriques

- Troubles cognitifs
- Inflammation
- Dénutrition
- Cachexie
- Sarcopénie