

Entry Level Clinical Nutrition Part VII

Protein, amino acid imbalance,
and sarcopenia:
Part III
Diagnostic considerations

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***Quality of life issues are the
major concerns more than
ever now.***

2

- ***What appears to be the most important determinant of quality of life?***
- ***Optimal lean body mass.***

3

- ***Why is lean body mass lost?***
- ***Two reasons.***
- ***Aging***
- ***A response to environmental stressors***

4

What is the nature of this response?

- *Where does the protein go?*
- *Does it go to production of functional tissue such as muscles, gut lining, ligaments, regulatory factors, detox enzymes? (Anabolic)*
- *Or*
- *Does it go to production of inflammatory mediators such as acute phase proteins and cytokines and production of energy? (Catabolic)*

5

***Aging makes it more difficult
to respond anabolically.***

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Underlying hypotheses of Entry Level Clinical Nutrition:

- Chief complaints in chronically ill patients are not diseases but responses that have gone on too long (Allostatic load).
- The metabolic imbalances that combine to form this response have been well defined by critical care nutritionists.

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Summer of Work Exposes Medical Students to System's Ills - NYTimes.com Page 1 of 3

The New York Times

September 9, 2009

Summer of Work Exposes Medical Students to System's Ills

By Jacob R. Goffman

SEATTLE — This summer, medical students from the University of Washington took a long look under the hood of the health care system they are about to inherit, and many returned to campus last week with their eyes wide open and their idealism tempered.

Jacob R. Goffman is a senior medical student at the University of Washington School of Medicine. He is the author of "The Summer of Work Exposes Medical Students to System's Ills," which appears in the September 9, 2009 issue of The New York Times. He can be reached at jacob.goffman@u.washington.edu.

Summer of work exposes medical students to system's ills, *The New York Times*, September 9, 2009

The students learned not only to deliver babies and suture wounds, but also to order unnecessary tests as protection against lawsuits, to hector specialists into seeing Medicaid patients, to match patients with prescriptions on Wal-Mart's \$4 list. And they saw firsthand what Mr. Olgard called "a tidal wave of chronic disease" — diabetes, hypertension, obesity, depression — that left many questioning how much any one physician could really accomplish.

"I often wondered what we were actually doing to help people," Mr. Olgard said.

Not surprisingly, the students returned to campus with a new perspective on the health care system. "You have to be realistic about what you can do," Mr. Olgard said. "You have to be realistic about what you can do."

"...a tidal wave of chronic illness..."

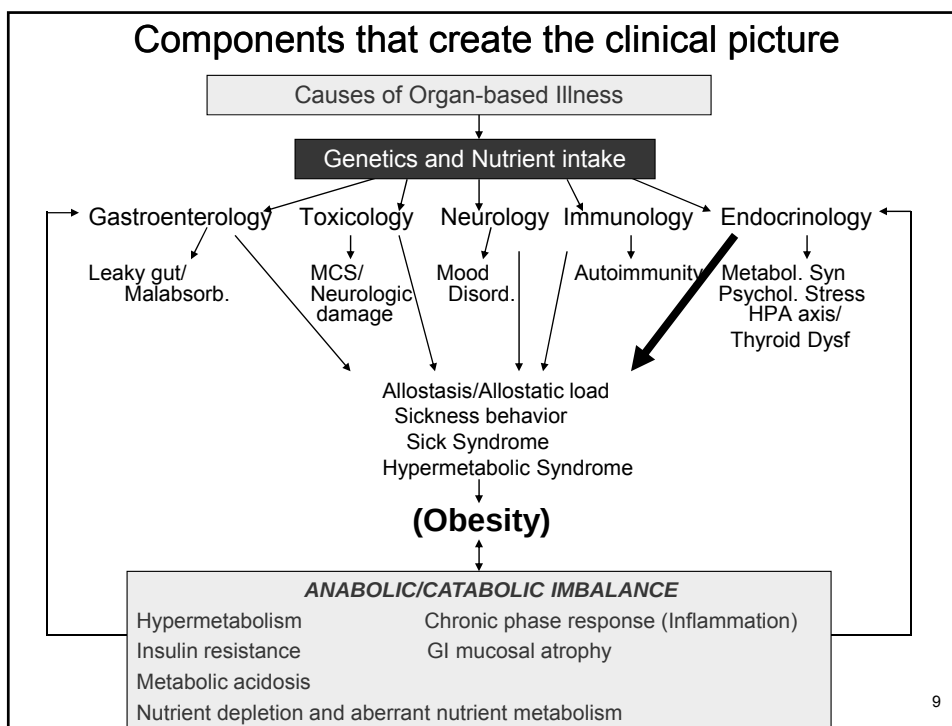
For 10 years, the University of Washington School of Medicine has dispatched its rising second-year students across the Northwest to provide primary care in rural or underserved areas. The monthlong program is elective, but a record number of students took part this year — 117 from a class of 216.

The school has a cooperative agreement to train medical students from Alaska, Idaho, Montana and Wyoming, none of which has a medical college of its own. The summer program is one of several vehicles, along with loan forgiveness arrangements, designed to lure students back to their home states to practice in areas with a shortage of primary care doctors.

This year, the students set out as negotiations were intensifying in Washington over wholesale changes to the health care system they will soon be joining. Whether there will be improvements to the system remains to be seen, but few students returned thinking there was little to fix.

http://www.nytimes.com/2009/09/09/health/policy/09medschool.html?_r=1&th=&mc=th&... 9/9/2009

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**Nestlé Nutrition Workshop Series
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Nutrition and Critical Care

**Luc Cynober
Frederick A. Moore**

Baracos VE. Overview on metabolic adaptation to stress, pp. 1-13.

“An understanding of the nature of stress is fundamental to the rational design of nutrient mixtures to feed patients whose homeostasis has been altered by one or more stressors.”

“All stresses may be presumed to be associated with characteristic modifications in the metabolism of lipids, carbohydrates, amino acids, and micronutrients.”

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Entry Level Clinical Nutrition – Part 8

Dr. Jeff Moss

Clinical Nutrition (2004) 23, 1256–1266

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REVIEW

Acute and “chronic” phase reaction—a mother of disease

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Department of Surgery and Liver Institute, UCL, London, UK

Received 23 July 2004

Clinical
Nutrition

www.elsevier.com/locate/cnu

Bengmark S. Acute and “chronic” phase reaction – a mother of disease, *Clin Nutr*, Vol. 23, pp. 1256-66, 2004

KEYWORDS

Acute phase response;
Chronic phase response;
Metabolic syndrome;
Cellular membranes;
Endothelial cells;
Abdominal obesity;
Insulin resistance;
Growth hormones;
Free fatty acids;
Alzheimer disease;
Parkinson disease;
Neurodegenerative disease;
Atherosclerosis;
Coronary-vascular disease;
Cancer;
Breast cancer;
Colorectal cancer;
Prostatic cancer;
Diabetes;
Crimson;
Fatty liver;
Gallbladder disease;
Chronic renal disease;

Summary The world is in diseases. Almost half of the mortality is due to these chronic diseases. And they are these diseases are associated consumption of calorie-conc also under consumption of a function of the innate immu changes induced in response the subsequent development chronic diseases. The endo importance, and the functio the function of the underlying cells; their ability to obtain nutrients and antioxidants and to eliminate waste products. The abdominal adipocytes seem to play a key role, as they have the ability to in stressful situations release much of proinflammatory cytokines, PA-1 and free fatty acids compared to elsewhere in the body. The load on the liver of these various substances in often of greater magnitude than the liver can handle. Some of the most common chronic diseases and their potential association with more and “chronic” phase response, and more metabolic syndrome are discussed separately. The need for studies with lifestyle modifications is especially emphasized.

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doi:10.1016/j.cnu.2004.07.016

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Considerations for the Catabolic Patient				
Signs & Symptoms	Consider	Treatment Plan	Monitor	Supplementation
Signs & Symptoms: - Feeling “lousy” - Fatigue - Cravings - Depression/anxiety - Poor quality sleep - Poor digestion/absorption/leaky gut - Chronic pain/infection	Optimize pH	Optimize fluid and electrolyte balance	Morning urinary pH -pH paper	Potassium bicarbonate -K Alkaline (Moss) Magnesium -Magnesium Glycinate (Vital Nutrients)
Clinical Findings: - High % body fat - Low bone density - High fasting insulin - Heavy metal burden - Calcium to phosphorus ratio 3:1 - High normal globulin - Cholesterol (220-280) - High LDL, low HDL - High triglycerides - Low normal serum potassium, high normal serum sodium - High normal BUN with normal creatinine - Low urinary sulfate - Genomic variations	Optimize muscle mass (reduce sarcopenia) and amino acid levels	Pay special attention to protein and amino acids	Body composition: -Bioelectric impedance scale Grip strength: -dynamometer	Amino acids -Custom Amino Base (Metabolic Maint.) Protein powders/bars -UltraLean products (Biogenesis) -Paleo products (DFH)
	Reducing inflammation	Reduce inflammation Address food allergies	Inflammatory biomarkers: -HS-CRP -Fibrinogen levels -WBC -Differential	Anti-inflammatory agents -Inflamerix (Olympian) -D-Flame (Protocols) -Pain Guard (Perque) Fish Oils -Ultra Pure Fish oil (Vital Nutrients) Food allergy blends -AllerGzymes (DFH)
	Improving insulin sensitivity	Watch carbohydrate/protein ratio	Fasting glucose Fasting insulin Cravings	Metabolic Synergy (DFH)
	Optimize dietary carbohydrate/protein ratios	Replete protein deficiencies and reduce carbohydrate intake along with improvements in dietary quality	Diet diary Optimal protein intake -1.0 – 1.2 g/kg body weight	Protein powders/bars -Paleo products (DFH) -UltraLean (Biogenesis)
	Optimize GI function	Dietary changes, supplementation of digestive aids	Patient signs and symptoms	Betaine HCl (Vital Nutrients) Digestzymes (DFH) Intestinal Repair Complex (Biogenesis)
	Optimize micronutrient deficiencies/imbalances	Supplementation of multis Possible emphasis on vitamin D, iodine, and zinc	Serum 25 OH vitamin D Fatigue/serum thyroid indicators Zinc taste test	Multi Nutrients (Vital Nutr) Vitamin D (Vital Nutr) Iosol (Moss) Zinc Supreme (DFH)

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NEURO-SIGNALS

Invited Review

Neurosignals 2009;17:144-152
DOI: 10.1159/000186862

Received: April 26, 2009
Accepted after revision: June 5, 2009
Published online: February 4, 2009

Biological Mechanism of Antidepressant Effect of Omega-3 Fatty Acids: How Does Fish Oil Act as a 'Mind-Body Interface'?

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Key Words

Major depressive disorder · Depression · Docosahexaenoic acid · Arachidonic acid · Prostaglandins · Thromboxanes · Leukotrienes · Cyclo-oxygenase 2 · Cyclo-oxygenase 1

Abstract

The unsatisfactory results of monoamine-based antidepressant therapy and the high occurrence of somatic symptoms and physical illness in patients with depression imply that the serotonin hypothesis is insufficient to approach the aetiology of depression. Depressive disorders with somatic presentation are the most common form of depression. Somatization, the bodily symptoms without organic explanation, is similar to cytokine-induced sickness behaviour. Based on recent evidence, omega-3 polyunsaturated fatty acids (n-3 PUFAs, or n-3 fatty acids) are enlightening a promising path to discover the unsolved of depression, sickness behaviour and to link the connection of mind and body. The PUFAs are classified into n-3 (or omega-3) and n-6 (or omega-6) groups. Docosahexaenoic acid and arachidonic acid, the major bioactive components of n-3 PUFAs, are not efficiently synthesized in humans and should therefore be obtained directly from the diet, particularly by consuming fish. Docosahexaenoic acid deficiency is associated with dysfunctions of neuronal membrane stability and transmission.

Introduction

Major depressive disorder (MDD) is a serious psychiatric illness with a high lifetime prevalence rate [1]. However, the current treatment for this high burden disease is not satisfactory. Less than 50% of patients achieve full remission with optimized medication treatment [2] despite that more than 40 antidepressants with mechanisms related to serotonin, noradrenaline and/or dopamine

Su KP. Biological mechanism of antidepressant effect of omega-3 fatty acids: How does fish oil act as a 'mind-body interface'? *Neurosignals*, Vol. 17, pp. 144-152, 2009

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Table 1. Overlapping of symptoms of acute sickness behaviour associated with IFN- α therapy and the somatic symptoms in MDD

Symptoms	Prevalence in IFN- α therapy ^a , %	Prevalence in MDD ^b , %
Fatigue/asthenia	39–90	73
Headache	27–67	33 ^c
Gastrointestinal symptoms	50 ^{c, 1}	34–47 ^f
Psychomotor slowing	40 ^c	59–65 ^f
Insomnia	20–39 ^d	63
Irritability	35 ^d	50
Arthralgia	9–36	31 ^e
Musculoskeletal pain	26–32	62–80 ^{g, 2}
Abdominal pain	15–20	21 ^e
Anorexia	13–19	40
Anxiety	13–18 ^d	57
Poor concentration	14 ^d	51

^a [46], unless otherwise specified; ^b [99], unless otherwise specified; ^c [100]; ^d [101]; ^e [102]; ^f [103]; ^g [104].

¹ Nausea, vomiting, bowel problems.

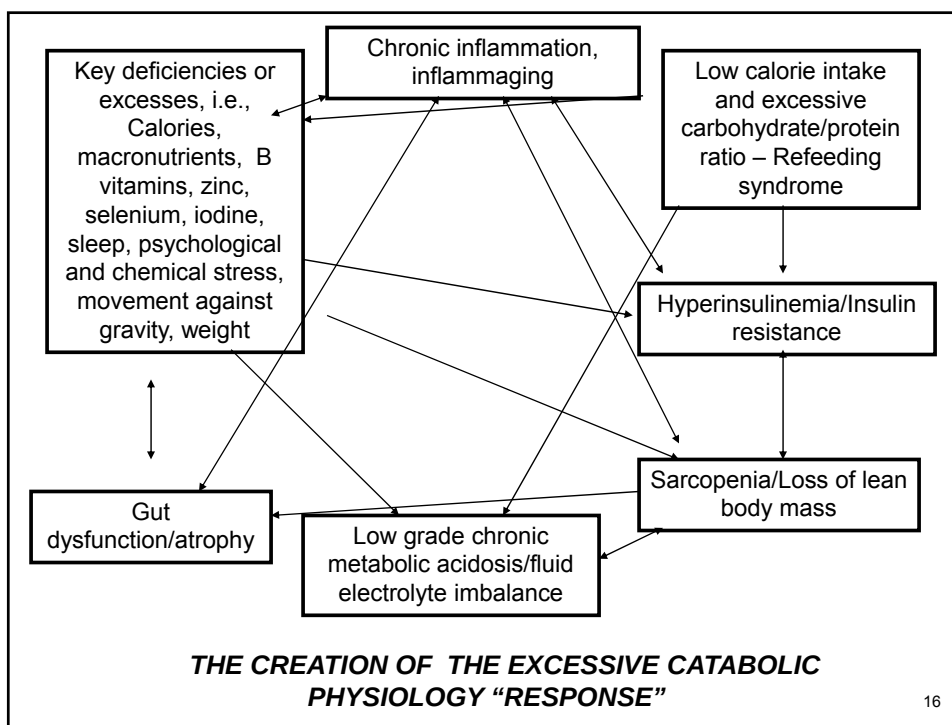
² Result from depressed inpatient population.

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Key metabolic imbalances seen with the acute phase response

- Metabolic acidosis
- Loss of lean body mass (sarcopenia)
- Insulin resistance
- Inflamm-aging (Increased innate immunity and decreased adaptive immunity)
- Suboptimal caloric intake and carbohydrate:protein ratio (Refeeding syndrome)
- Gastrointestinal dysfunction/gut atrophy
- Deficiencies of key micronutrients such as zinc, selenium, and vitamin D

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Sarcopenia: Specific clinical considerations

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Age and Ageing 2010; 39: 412–423
doi:10.1093/ageing/afq004
Published electronically 13 April 2010

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REPORT

Sarcopenia: European consensus on definition and diagnosis

Report of the European Working Group on Sarcopenia in Older People

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Cruz-Jentoft AJ et al. Sarcopenia: European consensus on definition and
diagnosis, *Age and Ageing*, Vol. 39, pp. 412-423, 2010

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⁸For the diagnosis of sarcopenia, EWGOSOP recommends using the presence of both low muscle mass + low muscle function
(strength or performance). EWGOSOP mutually applies these characteristics to further define conceptual stages as 'presarco-

penia', 'sarcopenia' and 'severe sarcopenia'. EWGOSOP reviewed a wide range of tools that can be used to measure the specific
variables of muscle mass, muscle strength and physical performance. Our paper summarizes currently available data defining
sarcopenia cut-off points by age and gender; suggests an algorithm for sarcopenia case finding in older individuals based on
measurements of gait speed, grip strength and muscle mass; and presents a list of suggested primary and secondary outcome
domains for research.

Once an operational definition of sarcopenia is adopted and included in the mainstream of comprehensive geriatric assess-
ment, the next steps are to define the natural course of sarcopenia and to develop and define effective treatment.

⁹EPSEN, the International Association of Gerontology and Geriatrics—European Region (IAGG-ER) and the International As-
sociation of Nutrition and Aging (IANA)

Abstract

The European Working Group on Sarcopenia in Older People (EWGOSOP) developed a practical clinical definition and
consensus diagnostic criteria for age-related sarcopenia. EWGOSOP included representatives from four participant organisations,
i.e. the European Geriatric Medicine Society, the European Society for Clinical Nutrition and Metabolism, the International
Association of Gerontology and Geriatrics—European Region and the International Association of Nutrition and Aging. These
organisations endorsed the findings in the final document.

The group met and addressed the following questions, using the medical literature to build evidence-based answers: (i) What
is sarcopenia? (ii) What parameters define sarcopenia? (iii) What variables reflect these parameters, and what measurement
tools and cut-off points can be used? (iv) How does sarcopenia relate to cachexia, frailty and sarcopenic obesity?

For the diagnosis of sarcopenia, EWGOSOP recommends using the presence of both low muscle mass + low muscle function
(strength or performance). EWGOSOP mutually applies these characteristics to further define conceptual stages as 'presarco-

penia', 'sarcopenia' and 'severe sarcopenia'. EWGOSOP reviewed a wide range of tools that can be used to measure the specific
variables of muscle mass, muscle strength and physical performance. Our paper summarizes currently available data defining
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Once an operational definition of sarcopenia is adopted and included in the mainstream of comprehensive geriatric assess-
ment, the next steps are to define the natural course of sarcopenia and to develop and define effective treatment.

Keywords: sarcopenia elderly muscle strength muscle mass physical performance

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- “Sarcopenia has since been defined as the loss of skeletal muscle mass and strength that occurs with advancing age.”
- “Sarcopenia has multiple contributing factors—the ageing process over the life course, early life developmental influences, less-than-optimal diet, bed rest or sedentary lifestyle, chronic diseases and certain drug treatments.”

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“Sarcopenia represents an impaired state of health with a high personal toll—mobility disorders, increased risk of falls and fractures, impaired ability to perform activities of daily living, disabilities, loss of independence and increased risk of death.”

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What is sarcopenia: Working definition

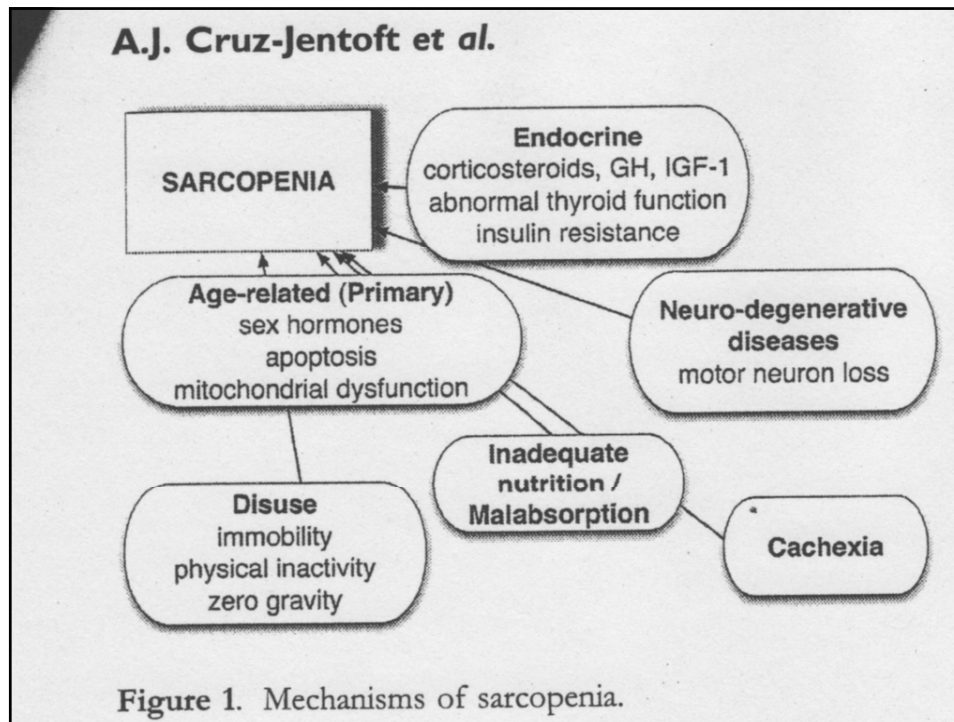
- “Sarcopenia is a syndrome characterized by progressive and generalised loss of skeletal muscle mass and strength with a risk of adverse outcomes such as physical disability, poor quality of life and death.”

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Mechanisms of sarcopenia

- “There are several mechanisms that may be involved in the onset and progression of sarcopenia.”
- “These mechanisms involve, among others, protein synthesis, proteolysis, neuromuscular integrity and muscle fat content.”

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Sarcopenia categories

- “While sarcopenia is mainly observed in older people, it can also develop in younger adults, as is likewise the case for dementia and osteoporosis.”
- “Thus, the categories of primary sarcopenia and secondary sarcopenia may be useful in clinical practice.”

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Table 2. Sarcopenia categories by cause

Primary sarcopenia	
Age-related sarcopenia	No other cause evident except ageing
Secondary sarcopenia	
Activity-related sarcopenia	Can result from bed rest, sedentary lifestyle, deconditioning or zero-gravity conditions
Disease-related sarcopenia	Associated with advanced organ failure (heart, lung, liver, kidney, brain), inflammatory disease, malignancy or endocrine disease
Nutrition-related sarcopenia	Results from inadequate dietary intake of energy and/or protein, as with malabsorption, gastrointestinal disorders or use of medications that cause anorexia

Sarcopenia stages

- “EWGSOP suggests a conceptual staging as ‘presarcopenia’, ‘sarcopenia’ and ‘severe sarcopenia’.”

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Sarcopenia stages

- “The ‘presarcopenia’ stage is characterised by low muscle mass without impact on muscle strength or physical performance.”
- “This stage can only be identified by techniques that measure muscle mass accurately and in reference to standard populations.”

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Sarcopenia stages

- “The ‘sarcopenia’ stage is characterised by low muscle mass, plus low muscle strength and low physical performance.”
- “‘Severe sarcopenia’ is the stage identified when all three criteria of the definition are met (low muscle mass, low muscle strength and low physical performance).”

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Table 3. EWGSOP conceptual stages of sarcopenia

Stage	Muscle mass	Muscle strength	Performance
Presarcopenia	↓		
Sarcopenia	↓	↓	Or ↓
Severe sarcopenia	↓	↓	↓

Cachexia versus sarcopenia

- “Cachexia has recently been defined as a complex metabolic syndrome associated with underlying illness and characterised by loss of muscle with or without loss of fat mass.”
- “Cachexia is frequently associated with inflammation, insulin resistance, anorexia and increased breakdown of muscle protein.”

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Cachexia versus sarcopenia

- “Thus, most cachectic individuals are also sarcopenic, but most sarcopenic individuals are not considered cachectic.”
- “Sarcopenia is one of the elements of the proposed definition for cachexia.”

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Sarcopenia: Methods of assessment

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Definition and diagnosis of sarcopenia		
Table 4. Measurements of muscle mass, strength, and function in research and practice ^a		
Variable	Research	Clinical practice
Muscle mass	Computed tomography (CT)	BIA
	Magnetic resonance imaging (MRI)	DXA
	Dual energy X-ray absorptiometry (DXA)	Anthropometry
	→ Bioimpedance analysis (BIA)	
	Total or partial body potassium per fat-free soft tissue	
Muscle strength	→ Handgrip strength	Handgrip strength
	Knee flexion/extension	
	Peak expiratory flow	
Physical performance	Short Physical Performance Battery (SPPB)	SPPB
	→ Usual gait speed	Usual gait speed
	Timed get-up-and-go test	Get-up-and-go test
	Stair climb power test	
^a Please refer to the text for a description and references on these measurement techniques.		

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Muscle mass: Bioelectric impedance

- “Bioimpedance analysis (BIA) estimates the volume of fat and lean body mass.”
- “The test itself is inexpensive, easy to use, readily reproducible and appropriate for ambulatory and bedridden patients.”
- “BIA measurement techniques, used under standard conditions, have been studied for >10 years, and BIA results under standard conditions have been found to correlate well with MRI predictions.”

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Muscle mass: Bioelectric impedance

- “...BIA might be a good portable alternative to dual energy X-ray absorptiometry (DXA).”

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Muscle strength: Handgrip strength

- “Isometric hand grip strength is strongly related with lower extremity muscle power, knee extension torque and calf cross-sectional muscle area.”
- “Low handgrip strength is a clinical marker of poor mobility and a better predictor of clinical outcomes than low muscle mass.”
- “In practice, there is also a linear relationship between baseline handgrip strength and incident disability for activities of daily living (ADL).”

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Physical performance: Gait speed

- “Most recently, Cesari et al. confirmed the importance of gait speed (over a 6-m course) as a predictor of adverse health events (severe mobility limitation, mortality) but showed that poor performance on other tests of lower extremity function (standing balance and time to rise from a chair five times) had comparable prognostic value.”

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Physical performance: Gait speed

- “The EWGSOP has developed a suggested algorithm based on gait speed measurement as the easiest and most reliable way to begin sarcopenia case finding or screening practice.”
- ***“A cut-off point of >0.8 m/s identifies risk for sarcopenia.”***

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Muscle mass: Percent body fat

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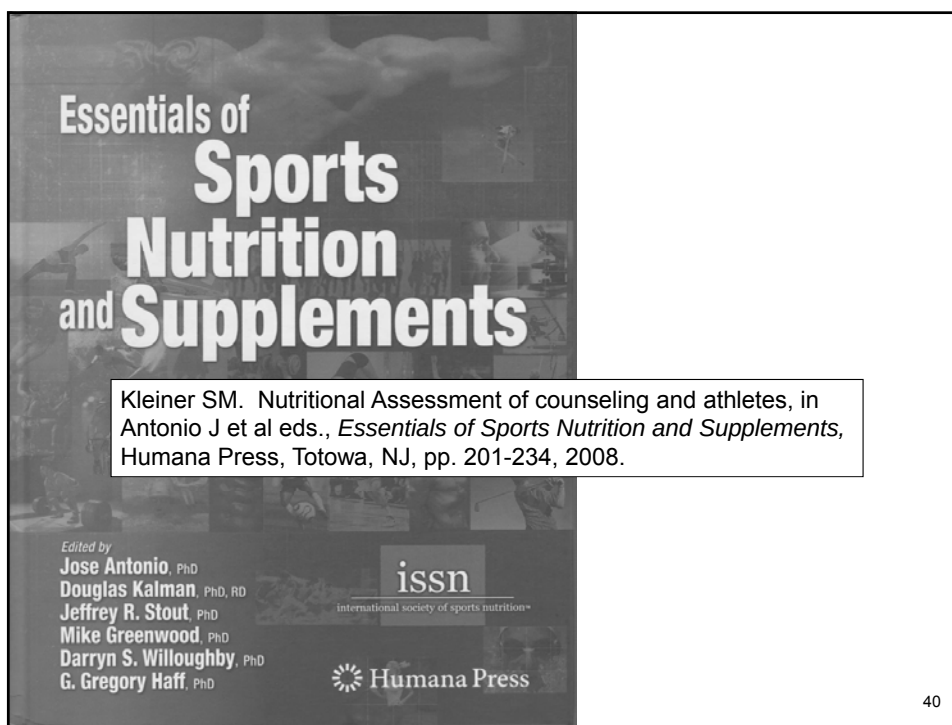


TABLE 10.4. Health standards for percent body fat.

	Recommended body fat levels				
	Not recommended	Low	Mid	Upper	Obesity
Men					
Young adult	<8	8	13	22	→
Middle adult	<10	10	18	25	→
Elderly	<10	10	16	23	→
Women					
Young adult	<20	20	28	35	→
Middle adult	<25	25	32	38	→
Elderly	<25	25	30	35	→

Source: Lohman TG, Houtkooper L, Going SB. Body fat measurement goes high-tech: not all are created equal. ACSM's Health Fit J 1997;7:30-35.

TABLE 10.5. New fat fitness standards for percent body fat in active men and women.

	Recommended body fat levels		
	Low	Mid	Upper
Men			
Young adult	5	10	15
Middle adult	7	11	18
Elderly	9	12	18
Women			
Young adult	16	23	28
Middle adult	20	27	33
Elderly	20	27	33

Source: Lohman TG, Houtkooper L, Going SB. Body fat measurement goes high-tech: not all are created equal. ACSM's Health Fit J 1997;7:30-35.

Healthy body weights: an alternative perspective^{1,2}

RP Abernathy and DR Black

ABSTRACT The primary purpose of this roundtable discussion of the American Health Foundation is to establish healthy weight standards for adults. In most large, long-term, well-designed studies, the lowest morbidity and mortality rates occurred in adults at weights that yielded BMIs (in kg/m²) between 19 and 25. Best body fat percentages averaged between 12% and 20% for men and 20% and 30% for women. However, statistical values are not applicable to everyone and their actual application may be counterproductive. Healthy weights, percentage body fat, insulin resistance, hypertension, metabolically obese, obesity, overweight, fat cell function, body mass index, full fat cell hypothesis.

KEY WORDS: Healthy weights, percentage body fat, insulin resistance, hypertension, metabolically obese, obesity, overweight, fat cell function, body mass index, full fat cell hypothesis.

INTRODUCTION

How can a person determine his or her best weight or amount of body fat for health? This is a primary question of the American Health Foundation Roundtable on Healthy Weight. A review of the literature indicates the following: (1) most recommended body mass indexes (BMIs, in kg/m²) (Table 1) based on lowest statistical health risks are between 19 and 25 (1, 2, 3, 4, 5, 6, 7); (2) a statistically "best" body fat percentage is between 12% and 20% for men, and 20% and 30% for women (10); and (3) correlations and coefficients of determination between BMI and morbidity or mortality rates are low (11-14), which diminishes the value of height-and-weight tables as predictors of best weights for individuals in genetically diverse populations.

We believe that statistical height and weight standards should be developed as guidelines for all. However, we do not wish to underemphasize the risk of overweight and obesity because health problems are statistically associated with high weight and percentage body fat (15-19). Even though obesity is greatly abhorred and billions of dollars are spent annually in

efforts to be thinner, the incidence of overweight is increasing at an alarming rate (4). The focus on thinness is clearly not working for the population as a whole and, we believe, is causing more harm than good. Many overweight or obese people who could be helped with small weight losses and exercise have abandoned weight-loss efforts because they have tried and failed to reach and maintain a statistically desirable weight (20). At the other extreme, overemphasis on thinness

Statistically desirable weights and percentages of body fat frequently are not indicative of health in individuals in genetically divergent populations. Height-and-weight tables are derived from large epidemiologic studies that show weights statistically associated with the longest average life span or lowest disease rates (1-3, 4, 5, 6, 7). These standards are invaluable for population comparisons and are useful as screening tests, but their applicability to individuals are limited for many reasons. Many persons outside the desirable weight range live long, healthy lives (23) whereas some persons with "ideal weights" develop diseases associated with obesity such as non-insulin-dependent diabetes mellitus and coronary heart disease (24-26). Further evidence of the inappropriate use of standards as guidelines for all individuals is shown by the large sample size and length of studies required to produce significant associations between weight and mortality rates. Consistent significant findings for mortality can be obtained only when > 20,000 healthy subjects, with control subjects for those who smoke, are followed for several years and data from the first few years are discarded to reduce the effects of undetected illnesses (26). Despite these problems, "statistical best weights" are routinely recommended by health practitioners as individual guidelines.

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²Reprints are available. Address correspondence to RP Abernathy, Department of Foods and Nutrition, 1264 Howe Hall, Purdue University, West Lafayette, IN 47907-1364 or DR Black, Division of Health Promotion, 1362 Lamber Building, Purdue University, West Lafayette, IN 47907-1362.

Abernathy RP and Black DR. Healthy body weights: an alternative perspective, Am J Clin Nutr, Vol. 63(suppl), pp. 448S-51S, 1996.

- “BMIs between 19 and 25 and percentages of body fat between 12% and 20% for men and 20% and 30% for women are useful as ‘screening tests’ to determine whether a person has a significantly increased weight-associated health risk.”
- “Although persons with BMIs and percentages of body fat above these values have increased likelihood of being functionally obese, not everyone will be.”

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- “Equally important, many within these recommended ranges may be functionally obese.”
- “Most weight-related health problems are associated with insulin resistance and with the damaging effects of excesses of glucose, lipids, and insulin circulating in the blood.”
- ***“Thus, we believe that the maintenance of fat cell functions that normalize blood concentrations of glucose, lipids, and insulin is more important to health than the maintenance of ‘desirable’ percentages of body fat or body weights.”***

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Muscle strength: Handgrip strength

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The American Journal of Medicine (2007) 120, 337-342

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CLINICAL RESEARCH STUDY

Grip Strength Predicts Cause-Specific Mortality in Middle-Aged and Elderly Persons

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ABSTRACT

PURPOSE: Handgrip strength is a simple measurement used to estimate overall muscle strength but might also serve as a predictor of health-related prognosis. We investigated grip strength-mortality association in a longitudinal study.

METHODS: A total of 4912 subjects of this study, aged 55-74 years, underwent a baseline examination in 1970 and June 1972. Mortality associated with grip strength were adjusted for potentially confounding factors by Cox proportional hazard analysis.

RESULTS: Multivariate-adjusted HR of all causes of death, except for external causes, for the highest quartile of grip strength in men was 0.52 (95% confidence interval [CI], 0.33-0.80) for the age group 55-54 years, 0.72 (95% CI, 0.53-0.96) for the age 55-64 years, and 0.67 (95% CI, 0.49-0.91) for the age 65-74 years. These figures were significantly lower than the HR for the reference group (the third quartile). *Significant results were observed in women. Multivariate-adjusted HR of all causes of death except cancer*

Sasaki H et al. *Am J Med*, Vol. 120, pp. 337-342, 2007

“Grip-strength measurement is useful for assessing approximate overall muscle strength of middle-aged and elderly people, and longitudinal studies revealed that it also predicts health-related prognosis.”

“Grip strength is an accurate and consistent predictor of all causes of mortality in middle-aged and elderly persons.”

Requests for reprints should be sent to Hideo Sasaki, MD, PhD, Radiation Effects Research Foundation, 1-1-1, Hiroshima, Japan. E-mail address: hideo@rerf.or.jp

0002-9343/\$ - see front matter © 2007 doi:10.1016/j.amjmed.2006.04.018

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Entry Level Clinical Nutrition – Part 8

Dr. Jeff Moss

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Serial Grip Strength Testing- Its Role In Assessment Of Wrist And Hand Disability

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Citation:
L. Andrew Ashton, Stuart Myers: Serial Grip Strength Testing- Its Role In Assessment Of Wrist And Hand Disability. *The Internet Journal of Surgery*. 2004. Volume 5 Number 2.

Keywords: assessment, dynamometer, grip strength, sincerity of effort

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Entry Level Clinical Nutrition – Part 8 Dr. Jeff Moss

Grip and Pinch Strength: Normative Data for Adults
Virgil Mathiowetz, MS, OTR, Nancy Kuschner, OTR, Gloria Volland, OTR, Mary Dowse, OTS, Sandra Rogers, OTS

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ABSTRACT. Mathiowetz V, Kuschner N, Volland G, Weber K, Dowse M, Rogers S: Grip and pinch strength: normative data for adults. *Arch Phys Med Rehabil* 66:69-72, 1985.

The primary purpose of this study was to establish clinical norms for adults aged 20 to 75+ years on four tests of hand strength. A dynamometer was used to measure grip strength and a pinch gauge to measure tip, key, and palm pinch. A sample of 310 male and 328 female adults, ages 20 to 74, from the seven-county Milwaukee area were tested using standardized positioning and instructions. Right hand and left hand data were stratified into 12 age groups for both sexes. This stratification provides a means of comparing the score of individual patients to that of normal subjects of the same age and sex. The highest grip strength scores occurred in the 21 to 39 age groups. For tip, key, and palm pinch the average scores were relatively stable from 30 to 59 years, with a gradual decline from 60 to 79 years. A high correlation was seen between grip strength and age, but a low to moderate correlation between pinch strength and age. The newer pinch gauge used in this study appears to read higher than that used in a previous normative study. Comparison of the average hand strength of right-handed and left-handed subjects showed only minimal difference.

KEY WORDS: Exercise test, Eriksen, Occupational therapy, Physical therapy

Reliable and valid evaluation of hand strength is of paramount importance in determining the effectiveness of various surgical or treatment procedures. In addition, normative data are needed to interpret evaluation data to set realistic treatment goals; and to assess a patient's ability to return to employment.

The most common norms for grip and pinch strength in therapy clinics were compiled by Kurland¹ and sampled 250 individuals in three large age groups. Analysis was performed to predict the grip (RH) or left hand (LH) strength an individual and particular age would demonstrate. Six subjects were tested, their scores were used right-handed subjects. No standardized positioning or instructions were followed. Test-retest and intratester reliability data were not reported. The Ohio pinch meter used in their study is no longer commercially available and there is some question whether data from use of the newer pinch meters can be validly compared to their norms.²

Another study³ established clinical norms for grip strength, employing the Martin Vigorimeter, which has a soft handle and has been used clinically with arthritic patients. However, the Janair dynamometer has been found^{4,5} to give the most accurate measure of grip strength.

Schmidt and Trews⁶ used the Janair dynamometer to test grip strength in a large sample, 178 males (83, 95 females) (F), of employee applicants at a manufacturing plant. Although the instrument and examination were described in detail, description was not sufficient for replication. Unfortunately, as the handles of the dynamometer were coated with a sand-ester mixture and the data were collected in the competitive situation of a pre-job placement interview, generalization from these results is questionable.

Recently, the American Society of Hand Therapists, suggesting a standardized arm positioning for hand strength tests, concluded that the position of the upper extremity (UE) might influence measurements, and recommended that the patient should be seated with his shoulder abducted and neutrally rotated, elbow flexed at 90° and the forearm and wrist in neutral position.⁷

Table 1: Characteristics of Subjects: Age, Sex, and Hand Dominance

Age	Male				Female			
	N	Age (yr)	R	L	N	Age (yr)	R	L
20-24	22	21.7	20	2	22	21.4	20	2

Age	Male				Female			
	N	Age (yr)	R	L	N	Age (yr)	R	L
25-29	22	26.9	21	1	22	26.7	21	1
30-34	22	31.9	21	1	22	31.8	21	1
35-39	22	36.9	21	1	22	36.8	21	1
40-44	22	41.9	21	1	22	41.8	21	1
45-49	22	46.9	21	1	22	46.8	21	1
50-54	22	51.9	21	1	22	51.8	21	1
55-59	22	56.9	21	1	22	56.8	21	1
60-64	22	61.9	21	1	22	61.8	21	1
65-69	22	66.9	21	1	22	66.8	21	1
70-74	22	71.9	21	1	22	71.8	21	1
75+	22	76.9	21	1	22	76.8	21	1
TOTAL	220		210	10	220		210	10

In testing the variable of wrist position, Pyzio⁸ found no significant difference in grip strength with test positions at 0° and 15° ulnar deviation, 0° and 15° dorsiflexion, or any combination of these. Kraft and Daniels⁹ found no significant difference with test positions at 0°, 15°, and 30° dorsiflexion (0° ulnar deviation) in measuring grip strength. Both studies^{8,9} found grip strength to be significantly less at 15° of volar flexion.

Mathiowetz and associates¹⁰ used standardized procedures (subject position and instructions) to assess the reliability and validity of grip strength and pain evaluations. The highest test-retest reliability for each test was achieved when the mean of three trials was utilized. The Janair dynamometer and the B&L pinch gauge¹¹ had the highest calibration accuracy of the instruments tested.¹² No normative data based on these standardized procedures have previously been reported.

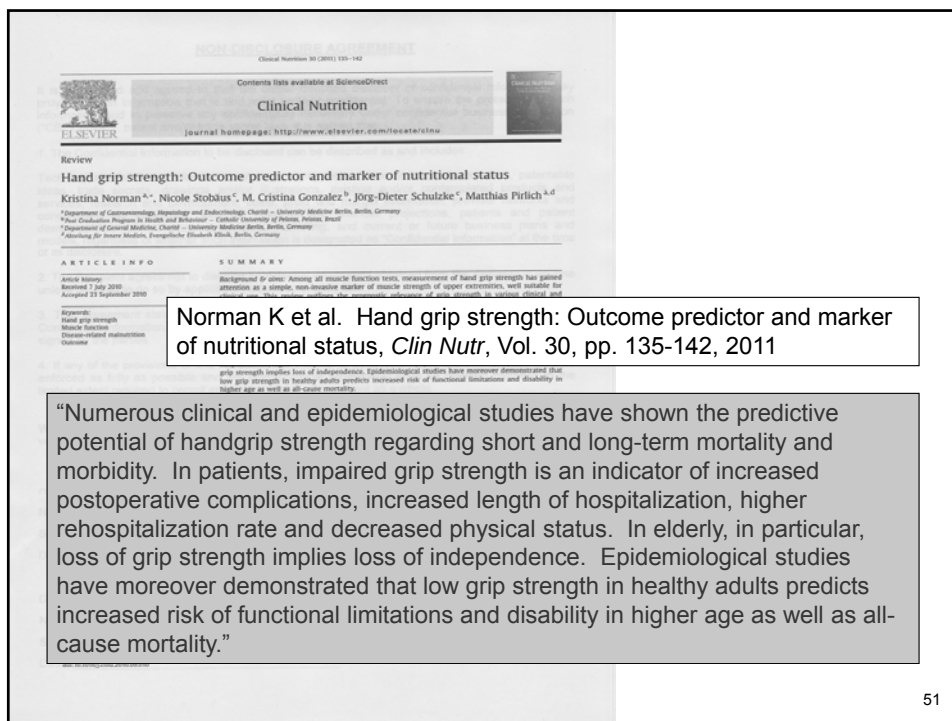
The primary purpose of this study was to establish clinical norms for grip and pinch strength in adults aged 20 to 75+ years. This study was funded in part by a grant from the American Occupational Therapy Foundation. Submitted for publication December 15, 1984; accepted March 21, 1985.

Mathiowetz V et al. Grip and pinch strength: Normative data for adults, *Arch Phys Med Rehabil*, Vol. 66, pp. 69-72, 1985

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Table 2: Performance of All Subjects on Grip Strength (pounds)

		Men					Women				
	Hand	Mean	SD	SE	Low	High	Mean	SD	SE	Low	High
20-24	R	121.0	20.6	3.8	91	187	70.4	14.5	2.8	48	95
	L	104.5	21.8	4.0	71	150	61.0	13.1	2.6	33	88
25-29	R	120.8	23.0	4.4	78	158	74.5	13.9	2.7	48	97
	L	110.5	16.2	3.1	77	139	63.5	12.2	2.4	48	97
30-34	R	121.8	22.4	4.3	70	170	78.7	19.2	3.8	46	137
	L	110.4	21.7	4.2	64	145	68.0	17.7	3.5	36	115
35-39	R	119.7	24.0	4.8	76	176	74.1	10.8	2.2	50	99
	L	112.9	21.7	4.4	73	157	66.3	11.7	2.3	49	91
40-44	R	116.8	20.7	4.1	84	165	70.4	13.5	2.4	38	103
	L	112.8	18.7	3.7	73	157	62.3	13.8	2.5	35	94
45-49	R	109.9	23.0	4.3	65	155	62.2	15.1	3.0	39	100
	L	100.8	22.8	4.3	58	160	56.0	12.7	2.5	37	83
50-54	R	113.6	18.1	3.6	79	151	65.8	11.6	2.3	38	87
	L	101.9	17.0	3.4	70	143	57.3	10.7	2.1	35	76
55-59	R	101.1	26.7	5.8	59	154	57.3	12.5	2.5	33	86
	L	83.2	23.4	5.1	43	128	47.3	11.9	2.4	31	76
60-64	R	89.7	20.4	4.2	51	137	55.1	10.1	2.0	37	77
	L	76.8	20.3	4.1	27	116	45.7	10.1	2.0	29	66
65-69	R	91.1	20.6	4.0	56	131	49.6	9.7	1.8	35	74
	L	76.8	19.8	3.8	43	117	41.0	8.2	1.5	29	63
70-74	R	75.3	21.5	4.2	32	108	49.6	11.7	2.2	33	78
	L	64.8	18.1	3.7	32	93	41.5	10.2	1.9	23	67
75+	R	65.7	21.0	4.2	40	135	42.6	11.0	2.2	25	65
	L	55.0	17.0	3.4	31	119	37.6	8.9	1.7	24	61
All	R	104.3	28.3	1.6	32	176	62.8	17.0	0.96	25	137
	L	93.1	27.6	1.6	27	160	53.9	15.7	0.88	23	115



“As muscle function reacts early to nutritional deprivation, hand grip strength has also become a popular marker of nutritional status and is increasingly being employed as outcome variable in nutritional intervention studies.”

Handgrip strength parameters: Cruz-Jentoft et al.

- Men:
- BMI ≤ 24 ≤ 29 kg
- BMI 24.1-26 ≤ 30 kg
- BMI 26.1-28 ≤ 30 kg
- BMI > 28 ≤ 32 kg
- Women:
- BMI ≤ 23 ≤ 17 kg
- BMI 23.1-26 ≤ 17.3 kg
- BMI 26.1-29 ≤ 18 kg
- BMI > 29 ≤ 21 kg

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Handgrip strength parameters: Cruz-Jentoft et al.

- Men: < 30 kg
- Women: < 20 kg

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Thank you!!

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