LA MALNUTRIZIONE E I SUOI INDICATORI BIOCHIMICI

Webinar FAD ENPAB

17 Dicembre 2020 ore 11-13

Mauro Mario Amato

Nutrizione Inadeguata

Malnutrizione per Difetto

Alimentazione inadeguata, alterato assorbimento o aumentata perdita di nutrienti

↓

Ridotti livelli plasmatici e cellulari del/dei nutrienti

↓

Ridotta attività enzimatica o alterata funzione del nutriente

↓

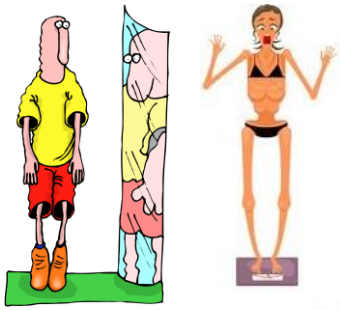
Alterata funzione cellulare e del sistema fisiologico

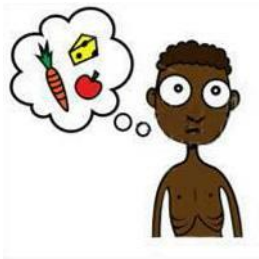
↓

Soggetto clinicamente sottonutrito

↓

Manifestazione clinica della malattia da carenza





Malnutrizione per Eccesso

Eccessiva assunzione di certi nutrienti

↓

Aumentati depositi tissutali e livelli plasmatici

↓

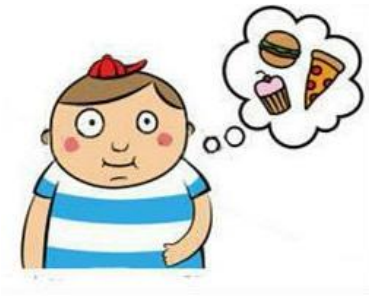
Alterata funzione cellulare, di organo e di apparato

↓

Soggetto clinicamente intossicato

↓

Mortalità



Morbilità
Insufficienza d'organo

↓

Malnutrizione irreversibile

Enpab webinar

Tratto da "Pharmacology of nutrients and nutritional disease" in Principles of Pharmacology - PL Munson. New York

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MALNUTRIZIONE

"Squilibrio tra l'apporto cellulare di nutrienti e di energia e la loro richiesta da parte del corpo per garantire la crescita, il mantenimento e lo svolgimento delle funzioni specifiche".
WHO

ABCD della Valutazione Nutrizionale Diretta

- ANTROPOMETRY
- BIOCHEMICAL ANALYSIS
- CLINICAL EXAMINATION (Functional Status)
- DIETARY HABITS

Supporto Diagnosi Nutrizionale e Monitoraggio/Valutazione Intervento Nutrizionale

Per DIFETTO

laboratorio

SEGNI CLINICI più importanti

- Alterazioni ematologiche e cardiache
- Alterazioni struttura capelli,bocca,occhi, unghie, pelle, ossa e articolazioni
- Insufficienza renale incapacità escrezione Na e H_2O
- Disfunzioni tiroidee
- Malattie polmonari Ipossia
- Integrità e immunità intestinale
- Rallentata guarigione delle ferite
- Perdita di massa e forza muscolare
- Ipotermia
- Aumentato rischio di infezioni
- Depressione e apatia
- Fibrosi e necrosi

Per ECCESSO

laboratorio

SEGNI CLINICI più importanti

- Diabete
  Dislipidemia
- Resistenza Insulinica
  Sindrome metabolica
- Malattie polmonari e coronariche
- Alterazioni cerebrali
- Ipoadiponectinemia
- NAFLD
- Anormalità ginecologiche
- Infertilità
- Neoplasie
- Osteoartrite

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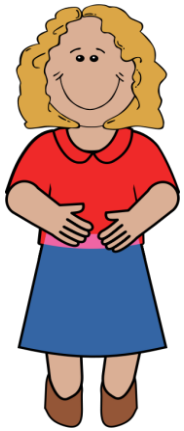
MALNUTRIZIONE - Classificazione e Cause

MALNUTRIZIONE	PER DIFETTO	PER ECCESSO
SELETTIVA	Assunzione deficitaria Vitamine, di Sali Minerali, altri Nutrienti	Assunzione eccessiva Vitamine, Sali Minerali, altri Nutrienti
GLOBALE	• Apporto nutrizionale ridotto • Dispendio energetico aumentato • Perdite di nutrienti	Apporto nutrizionale aumentato

CAUSE Malnutrizione per difetto

- Aumentate richieste energetiche
- Inadeguata assunzione di cibo
- Difetto del metabolismo di specifici nutrienti
- Malassorbimento
- Combinazioni di cause precedenti



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MALNUTRIZIONE Meccanismi

per difetto

Malnutrizione proteico-energetica (MPE)

Spesso esemplificata dai **bambini** di **paesi in via di sviluppo**, si può verificare in persone di ogni età e paese.

- **Marasmus**: **Forma asciutta di MPE**
  - Grave danno tissutale
  - Eccessiva perdita di massa magra e depositi lipidici
  - Disidratazione
  - Perdita di peso
- **Kwashiorkor**: **Forma umida di MPE**
  - Edema
  - Bassi livelli di Albumina plasmatica
  - Modifica della pigmentazione di pelle e capelli
  - Crescita ritardata
- **Marasmisc Kwashiokor**:
  - combinazione dei due precedenti

Danni metabolici: AIDS, Neoplasie, Malattie epatiche e renali, Corticosteroidi, Alterazioni metaboliche congenite.

Perdita eccessiva di nutrienti: Diarrea (Zn, Mg, K, Na), Diabete (glicosuria), Malattie infiammatorie intestinali, Sanguinamento gastrointestinale occulto (ferro).

Aumento del fabbisogno: Ustioni, Infezioni croniche, Infiammazioni croniche, Malattie polmonari croniche, ipertiroidismo, Interventi chirurgici severi, Sepsi, Traumi.

per eccesso

Obesità

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StatPearls [Internet].

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Marasmus

Owuraku A. Titi-Lartey; Vikas Gupta.

Author Information

Last Update: October 5, 2020.

https://www.ncbi.nlm.nih.gov/books/NBK559224/

Introduction

Go to:

To maintain the physiological requirements of the body, it is essential to take a sufficient amount of micro and macronutrients; however, the overconsumption of micronutrients and macronutrients can also be harmful. As defined by the World Health Organization (WHO), malnutrition is an 'inadequate or excess intake of protein, energy, and micronutrients such as vitamins, and the frequent infections and disorders that result'.[1] The excess intake would be known as overnutrition, whereas an insufficient intake would be known as undernutrition.

Undernutrition can be further classified according to the cause and presentation. The term 'protein-energy malnutrition' refers to acute malnutrition as a result of an insufficient intake of protein and calories.[2] This includes the conditions of kwashiorkor and marasmus.

Acute malnutrition is an inadequate weight relative to vertical height. Severe acute malnutrition is further divided into two main categories: marasmus and kwashiorkor. Chronic malnutrition, otherwise known as growth stunting, is characterized by linear growth (length/height) below the average for age.

A micronutrient deficiency refers to a deficiency of the essential vitamins and minerals which are needed for

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Kwashiorkor

Onecia Benjamin; Sarah L. Lappin.

Author Information

Last Update: July 19, 2020.

https://www.ncbi.nlm.nih.gov/books/NBK507876/

Introduction

Go to:

Kwashiorkor is a disease marked by severe protein malnutrition and bilateral extremity swelling. It usually affects infants and children, most often around the age of weaning through age 5. The disease is seen in very severe cases of starvation and poverty-stricken regions worldwide. In the 1950s, it was recognized as a public health crisis by the World Health Organization. However, there was a delay in its recognition, because most cases of childhood death were reported as being from diseases of the digestive system or infectious etiology. Since then, various relief efforts were aimed at eradicating it.[1][2][3][4]

As scientists continued to investigate the natural history of the disease in children, they discovered something very striking. Children who were dying from "digestive system diseases" and presenting with diarrhea, cough, coryza, and shortness of breath also were having symptoms of kwashiorkor during this time (pitting edema, anorexia, skin changes, etc.). This finding led to the medical conundrum of whether kwashiorkor was the primary or the secondary cause of death. It was concluded to be the secondary cause of death because many cases of the disease would not have developed without the precipitating stress of diarrhea, dehydration and other infectious diseases such as HIV and measles.[5]

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MALASSORBIMENTO

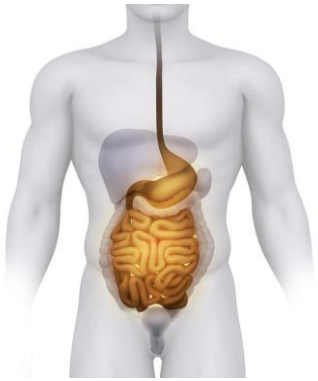
Assimilazione inadeguata delle sostanze nutritive per:

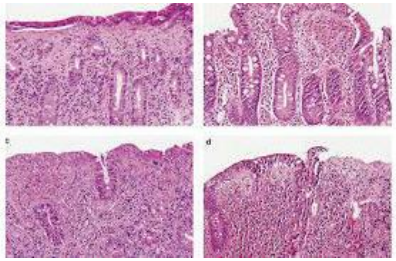
- **Difetti di digestione**
- **Alterato assorbimento**
- **Difetti del trasporto**

Può interessare i **macronutrienti** così come i **micronutrienti** o entrambi:

- Eccessiva escrezione fecale
- Carenze nutrizionali
- Sintomatologia gastro-intestinale

Può essere **Globale** o **Parziale** a seconda che il diminuito assorbimento interessi quasi tutti o solo specifici nutrienti.





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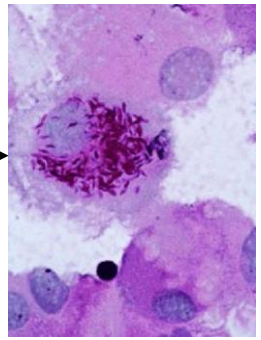
cause

- **Inadeguata miscelazione gastrica, rapido svuotamento o entrambi**
- **Agenti digestivi insufficienti**
- **Alterazione dell'ambiente intestinale**:
  - Motilità anormale secondaria a diabete, sclerodermia, iper o ipotiroidismo
  - SIBO
  - Basso pH duodenale
- **Alterazione epiteliale acuta**
  - Infezioni intestinali acute
  - Alcolismo
- **Alterazione epiteliale cronica**
  - Celiachia e MICI (IBD)
  - Ischemia e Amiloidosi
  - Sprue tropicale
  - Malattia di Whipple
- **Resezioni intestinali**
- **Alterazione del trasporto**
  - Abetalipoproteinemia
  - Morbo di Addison
  - Insufficiente Fattore Intrinseco
  - Linfangiectasia



Tropheryma whipplei

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Advanced Journal list

Journal List › Nutrients › v.12(8); 2020 Aug › PMC7469063

nutrients MDPI

Nutrients. 2020 Aug; 12(8): 2413.
Published online 2020 Aug 12. doi: 10.3390/nu12082413

PMCID: PMC7469063
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Acute Malnutrition in Children: Pathophysiology, Clinical Effects and Treatment

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Malnutrizione Acuta Infantile

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https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7469063/

Abstract

Go to:

Acute malnutrition is a nutritional deficiency resulting from either inadequate energy or protein intake. Children with primary acute malnutrition are common in developing countries as a result of inadequate food supply caused by social, economic, and environmental factors. Secondary acute malnutrition is

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VALUTAZIONE NUTRIZIONALE

INDAGINI BIOCHIMICHE DI LABORATORIO

Elementi di supporto alla diagnosi nutrizionale

Elementi utili al monitoraggio e valutazione della risposta del paziente all'Intervento Nutrizionale messo in atto

Enpab webinar

Campioni biologici normalmente utilizzati

- Siero e Plasma
- Sangue in toto
- Urine
- Feci

PANNELLI DI BIOCHIMICA CLINICA

Emocromocitometrico completo
Pannello Metabolico di Base
Pannello Metabolico Globale
Stato di Idratazione
Esame delle Urine

Emocromo completo
Glicemia
Creatininemia (azotemia)
eGFR (velocita di filtrazione glomerulare)
Elettroliti:
- Na+, K+, Cl-, CO2 totale
Transaminasi ALT e AST

- Emocromocitometrico
- Glicemia e HbA1c
- Creatininemia, Azotemia e VFG (GFR)
- Elettroliti:
  - Na+, K+, Cl-, CO2 totale
- Minerali:
  - Fosforo, Calcio, Ferro, Magnesio, Zinco, Iodio, Manganese, Rame
- TSH riflesso
- Assetto Lipidico e Stato del Ferro
- Funzionalità epatica
- Protidemia totale e sua elettroforesi
- Albuminemia e pre-Albumina (Transtiretina)
- RBG (Proteina legante il Retinolo) e
- PCR (Proteina C-reattiva)
- Vitamine:
  - A, B1,B2,B3,B6,B9(folati),B12, C, D (25OHD), E

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Sintomi da Malassorbimento

Nutriente	Sintomi
Ferro	Anemia microcitica ipocromica con anisocitosi
Vit. B_{12} - Folato	Anemia macrocitica normocromica
Vit. K, Vit. C	Sanguinamento, lividi, petecchie
Calcio, Magnesio	Spasmo carpo-pedale (contr. simul.arti sup/inf)
Proteine	Edema
Vit. B_2, B_{12}, Niacina, Folato, Ferro	Glossite
Vit. A	Cecità notturna
K, Mg, Ca, vit. D	Dolori arti, ossa, fratture patologiche
Vit. B_1, B_6, B_{12}	Neuropatica periferica

Diagnosi

- Dettaglita anamnesi
- **Indagini Biochimiche**
- **Test dei grassi fecali**
- Endoscopia/Radiografia con contrasto
- Altre indagini dove necessarie

Steatorrea

Determinazione **grasso fecale su raccolta feci di 3gg** durante il quale il paziente consuma ≥ 100 g di grasso/die. Un **dosaggio > 7 g/die è anormale**.
Il test non è in grado di determinare la causa specifica di malassorbimento. La presenza di **grasso fecale ≥ 40 g/die suggerisce insufficienza pancreatica** o **alterazione mucosa del tenue**

Colorazione qualitativa con Sudan III

Specifica per i **trigliceridi di origine alimentare e per i metaboliti lipolitici**
Un campione di feci viene esaminato microscopicamente, dopo essere stato riscaldato in acido acetico con colorante Sudan III; la presenza di diversi globuli rosso-arancioni indica **steatorrea**.

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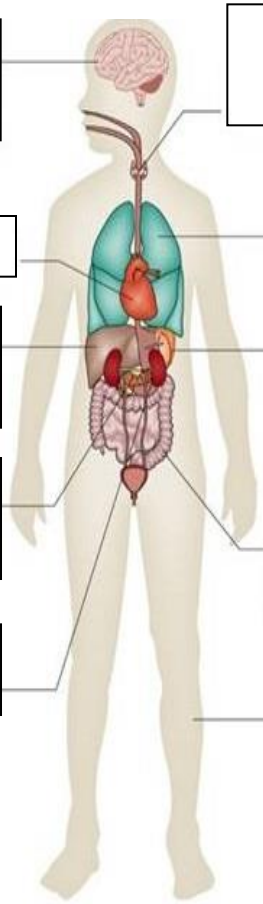
Riduzione peso corporeo
Atrofia muscolare/diminuzione forza
Riduzione capacità respiratoria e cardiaca
Riduzione del Tasso Metabolico
Immunodeficienza
Pelle sottile
Ipotermia
Apatia
Edema



Letargia e irritabilità
Probabili effetti a lungo termine
Diminuzione appetito

Disfunzioni cardiache

Alterazione delle funzioni di sintesi epatica ed epatobiliare

Riduzione funzione ß cell
Alterazioni pancreas esocrino

Alterazione funzionalità renale

Disfunzioni tiroidee
Alterata risposta al GH/Cortisolo

Infezioni vie respiratorie

Disfunzioni sistema immunitario

- Alterato assorbimento macronutrienti
- Cambiamento microbiota
Infezioni intestinali
Probabili MICI

Perdita integrità della pelle

BAMBINO

MALNUTRIZIONE PER DIFETTO
conseguenze

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Segni clinici di Malnutrizione

Site	Signs
Face	Moon face (kwashiorkor), simian facies (marasmus)
Eye	Dry eyes, pale conjunctiva, Bitot's spots (vitamin A), periorbital edema
Mouth	Angular stomatitis, cheilitis, glossitis, spongy bleeding gums (vitamin C), parotid enlargement
Teeth	Enamel mottling, delayed eruption
Hair	Dull, sparse, brittle hair, hypopigmentation, flag sign (alternating bands of light and normal color), broomstick eyelashes, alopecia.
Skin	Loose and wrinkled (marasmus), shiny and edematous (kwashiorkor), dry, follicular hyperkeratosis, patchy hyper- and hypopigmentation (crazy paving or flaky paint dermatoses), erosions, poor wound healing
Nail	Koilonychia, thin and soft nail plates, fissures or ridges
Musculature	Muscle wasting particularly buttocks and thighs. Chvostek or Trousseau signs (hypocalcemia)
Skeletal	Deformities usually a result of calcium, vitamin D or vitamin C deficiencies
Abdomen	Distended—hepatomegaly with fatty liver; ascites may be present
Cardiovascular	Bradycardia, hypotension, reduced cardiac output, small vessel vasculopathy
Neurologic	Global developmental delay, loss of knee and ankle reflexes, impaired memory
Hematological	Pallor, petechiae, bleeding diathesis
Behavior	Lethargic, apathetic, irritable on handling

researchgate.net

MALASSORBIMENTO
INSUFFICIENZA PANCREATICA

α-AMILASI totale
enzimatico-colorimetrica

1. EPS + H_2O $\xrightarrow{\alpha\text{-amylase}}$ 4,6-Ethylidene-G x + 4-Nitrophenyl-G (7-x)
2. 4-Nitrophenyl -G (7-x) + (7-x) H_2O $\xrightarrow{\alpha\text{-glucosidase}}$ (7-x) Glucose + 4-Nitrophenoxide

prodotto di reazione colorato

Siero	Amilasuria 24h
fino a 90 mU/ml	fino a 450 mU/ml

AMILASI pancreatica (isoenzima)
enzimatico-colorimetrica

Anticorpi monoclonali anti-amilasi salivare

Siero	Amilasuria 24h
fino a 50 mU/ml	fino a 400 mU/ml

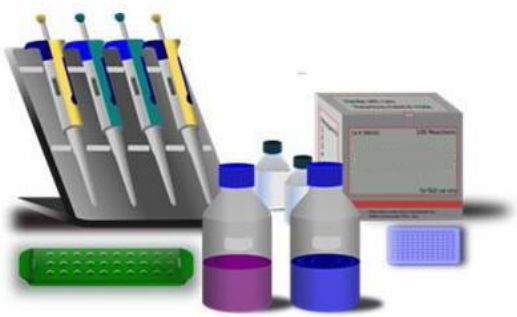
LIPASI pancreatica
enzimatico-colorimetrica

DLGGM $\xrightarrow[\text{pancreatica}]{\text{Lipasi}}$ complesso metil-resorufina

prodotto di reazione colorato

Siero/Plasma

fino a 60 mU/ml



ELASTASI fecale (Pancreatic Elastase-1)
Immunochimica ELISA
(anticorpo monoclonale di cattura)

Insuffic. pancreatica moderata ⟶ 100 - 200 μ/g
Insuffic. pancreatica severa ⟶ < 100 μ/g

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INSUFFICIENZA PANCREATICA – Interpretazione dati Laboratorio

α-Amilasi totale

Valore più alto rispetto al riferimento:
approfondire per escludere eccessiva produzione della salivare (**isoenzimi Amilasi**)

Amilasuria

Valore più alto rispetto al riferimento:
Elevata **probabilità insufficienza pancreatica** anche con amilasi sierica normale (amilasi urinaria si degrada in ritardo di alcune ore rispetto alla ematica)

Amilasi pancreatica

Valore più alto rispetto al riferimento:
Elevata **probabilità di insufficienza pancreatica**

Lipasi pancreatica

Valore più alto del riferimento:
Conferma di **pancreatite**
(La lipasi si altera a distanza di tempo rispetto all'amilasi)
Utilizzata per monitorare l'evoluzione della patologia.

Elastasi fecale (ritenuto **test gold standard**)

Valori bassi indicano insufficienza pancreatica

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EMOCROMOCITOMETRICO – Emoglobina

Limiti di Emoglobina per Anemia

CDC (Centers for Desease Control and Prevention)

Uomini (anni)	Emoglobina g/dl
12 - 14	12.5
15 - 17	13.3
> 17	13.0

Donne (anni)	Emoglobina g/dl
12 - 14	11.8
15 - 17	12.0
> 17	12.0

Donne (gravidanza)	Emoglobina g/dl
1^ trimestre	11.0
2^ trimestre	10.5
3^ trimestre	11.0

Bambini (anni)	Emoglobina g/dl
1 - 2	11.0
2 - 5	11.1
5 - 8	11.5
8 - 11	11.9

In funzione della Hgb viene considerata:

- **Anemia Lieve** con valori fino a **11.0 g/dl**
- **Anemia Moderata** **11.0-8.0 g/dl**
- **Anemia Severa** con valori **< 8.0 g/dl**

  cut off per eventuale **emotrasfusione**

Enpab webinar

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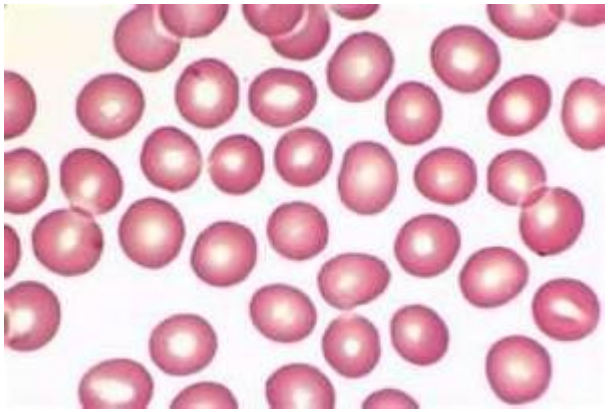
Parametri Globulari – Morfologia Eritrociti



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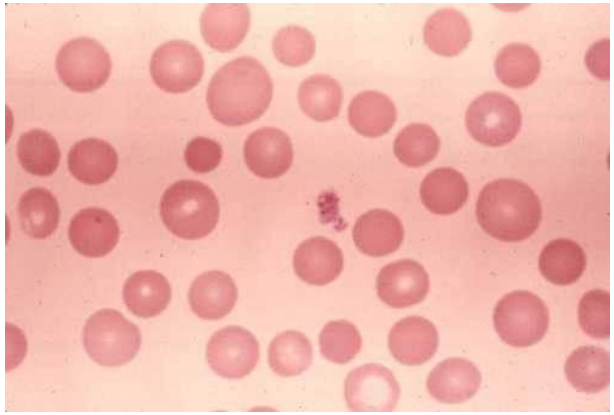
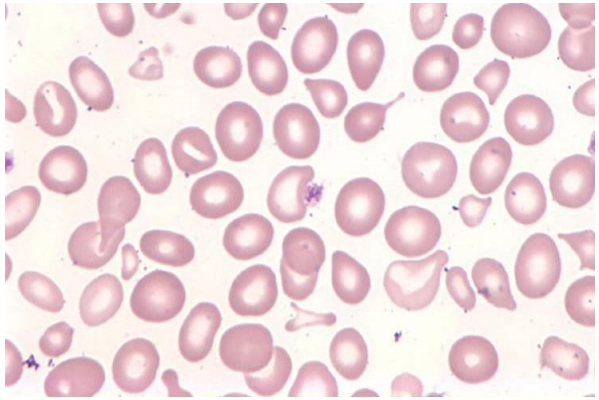


Anisocitosi
Variazione delle dimensioni delle RBC segnalate con 1+, 2+, 3+ secondo l'entità.
Diminuzione: **Microciti**
Aumento: **Macrociti**



Poichilocitosi
Variazioni della forma del contorno dei globuli rossi (RBC) segnalate con 1+, 2+, 3+ secondo l'entità.

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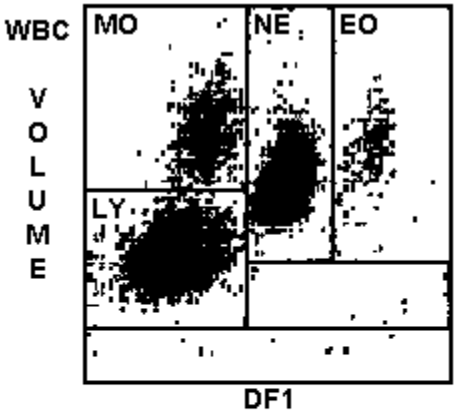
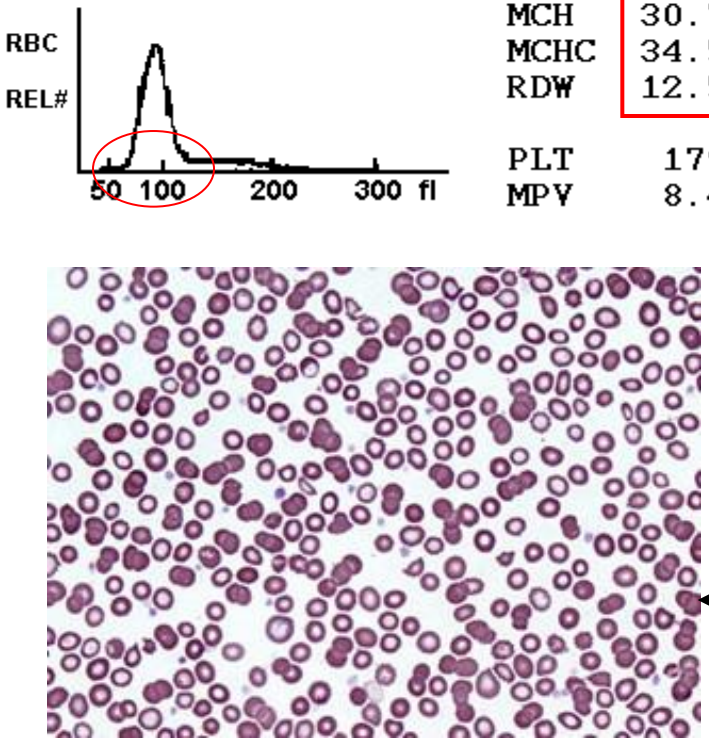
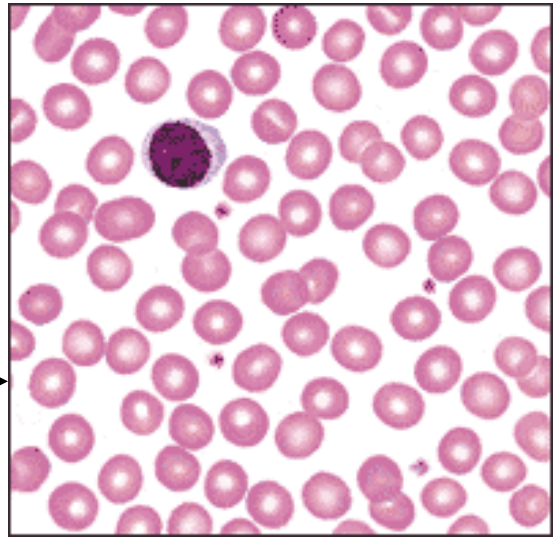


WBC	6.8	
	%	#
NE	52.6	3.6
LY	36.7	2.5
MO	7.8	0.5
EO	2.5	0.2
BA	0.4	0.0
RBC	5.29	
HGB	16.2	
HCT	47.0	
MCV	88.8	
MCH	30.7	
MCHC	34.5	
RDW	12.5	
PLT	179	
MPV	8.4	



Normale



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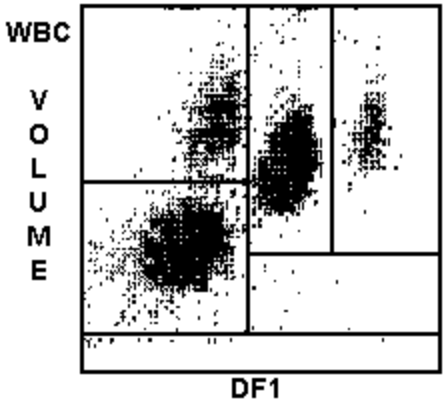
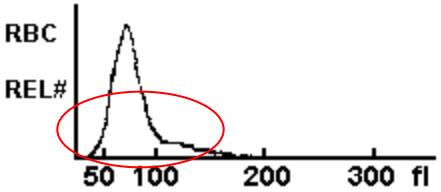
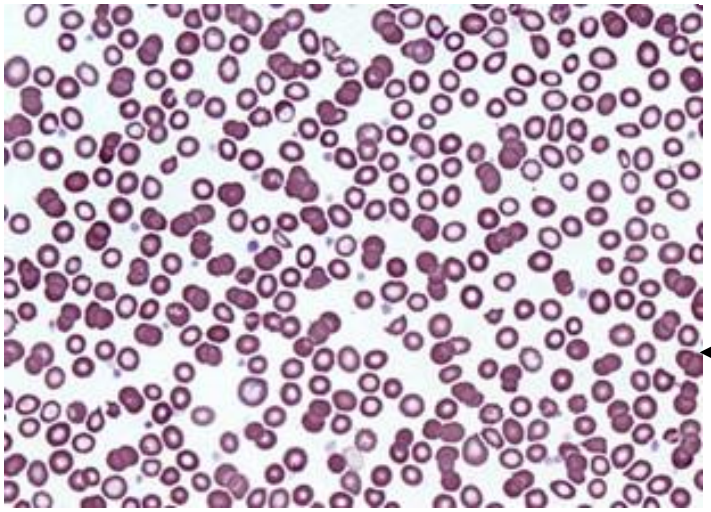
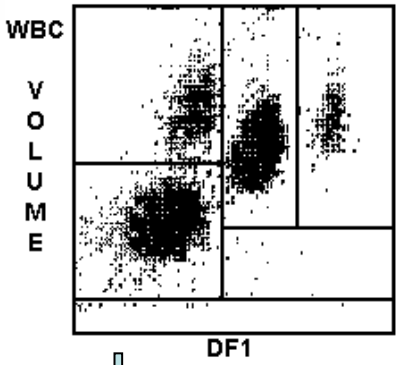


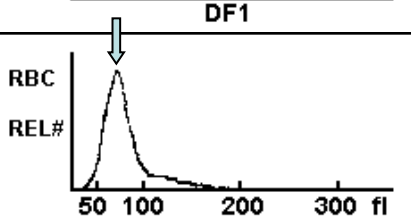


WBC	5.5		
	%		#
NE	54.7		3.0
LY	34.1		1.9
MO	7.5		0.4
EO	3.0		0.2
BA	0.7		0.0
RBC	4.28	L	
HGB	9.7	L	
HCT	29.9	L	
MCV	69.7	L	
MCH	22.6	L	
MCHC	32.4	L	
RDW	18.4	H	
PLT	331		
MPV	8.8		

Anemia sideropenica

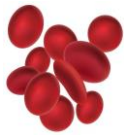






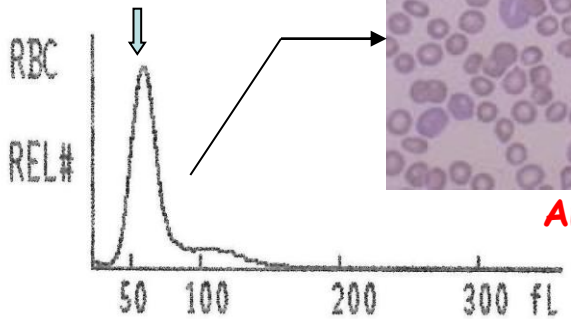
WBC	5.5		
	%		#
NE	54.7		3.0
LY	34.1		1.9
MO	7.5		0.4
EO	3.0		0.2
BA	0.7		0.0
RBC	4.28	L	
HGB	9.7	L	
HCT	29.9	L	
MCV	69.7	L	
MCH	22.6	L	
MCHC	32.4	L	
RDW	18.4	H	
PLT	331		
MPV	8.8		

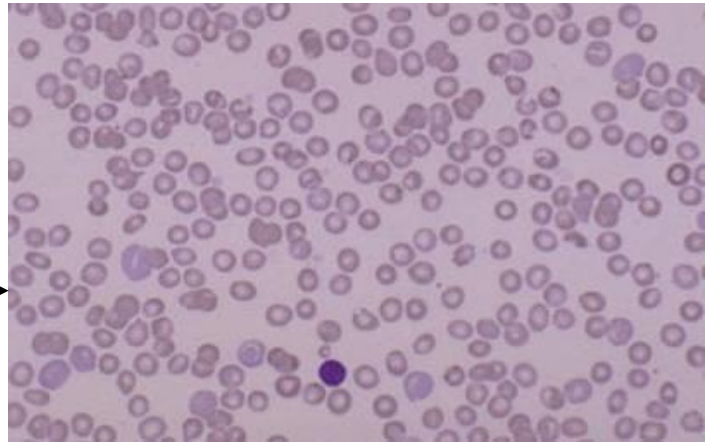
Anemia microcitica ipocromica
(da sideropenia)



Pop RBC anormale

RBC	5.30		10^6/uL
Hgb	10.1	L	g/dL
Hct	33.2	L	%
MCV	62.6	L	fL
MCH	19.1	L	pg
MCHC	30.6	L	g/dL
RDW	14.3		%





Anemia microcitica ipocromica

Soggetto **portatore di anemia mediterranea**
(tratto ßtalassemico)

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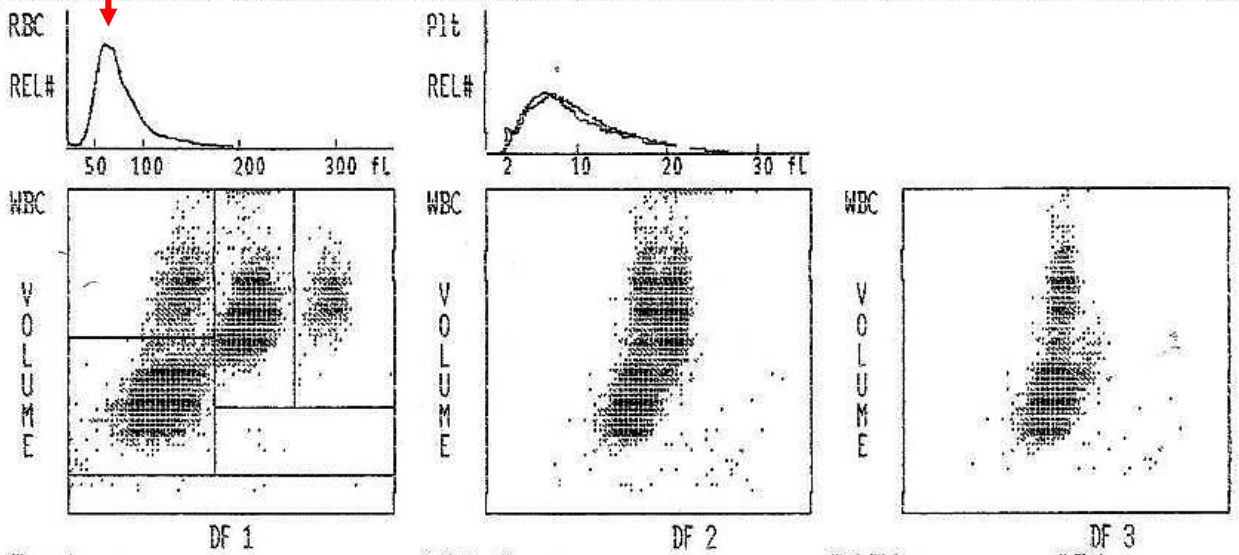
VIA TATTOLT 6/0
Dir. dr. MAURO AMATO MOLFETTA (BA)



Rack : 000802 CBC+Diff ID# 1 DATA: 11/12/18 ORA: 11:02:21

Nome : [redacted] Sequenza :000007 [redacted]

Reparto
Medico
Data nascita Sex
Commenti

Donna 35 anni gravidanza 3° mese

Pop WBC normale			Pop RBC anormale				Pop PLT normale		
WBC	6.3	10^3/uL	RBC	5.00		10^6/uL	Plt	392	10^3/uL
Ne%	45.9	%	Hgb	10.7	L	g/dL	MPV	10.0	fl
Li%	40.8	%	Hct	34.9	L	%	Pct	0.390	H %
Mo%	7.3	%	MCV	69.8	L	fL	PDW	17.3	H (ratio)
Eo%	4.3	%	MCH	21.5	L	pg			
Ba%	1.7	%	MCHC	30.7	L	g/dL			
Ne#	2.8	10^3/uL	RDW	24.6	H	%			
Li#	2.6	10^3/uL					RET%		%
Mo#	0.5	10^3/uL					RET#		10^6/ul
Eo#	0.3	10^3/uL							
Ba#	0.1	10^3/uL							

ALLARMI DT SOSPETTO:

Anemia Microcitica Ipocromica con anisocitosi
(Sideropenia)

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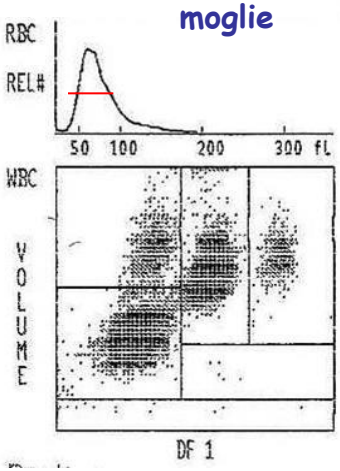
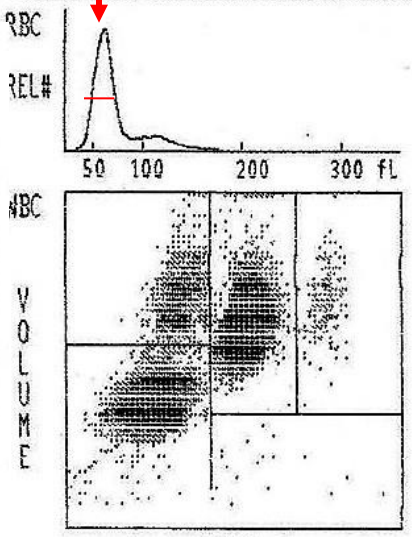
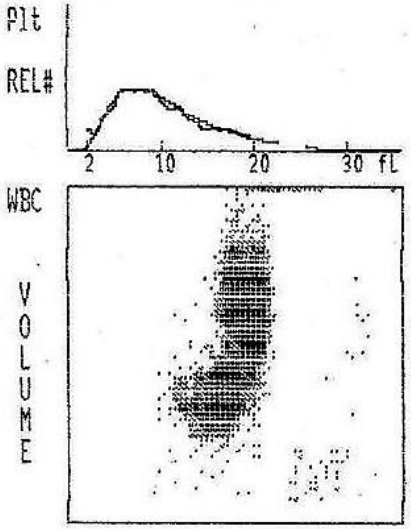
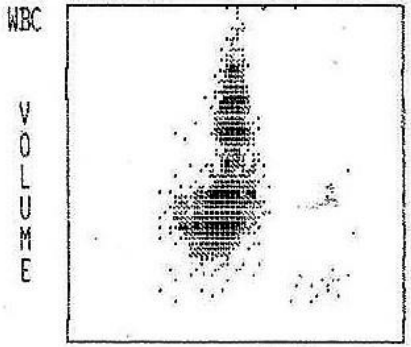
moglie



CENTRO ANALISI CLINICHE AMATO SAS
Dir. dr. MAURO AMATO VIA TATTOLI 6/0 MOLFETTA (BA)







Anemia Microcitica Ipocromica
(tratto ß-talassemico)

Rack : 000701 CBC+Diff
ID# 1
DATA: 16/11/18 ORA: 10:54:33

Nome : [redacted]
Sequenza :000003 [redacted]

Marito 39 anni

Reparto
Medico
Data nascita
Sex
Commenti

Pop WBC normale			Pop RBC anormale			Pop PLT normale		
WBC	6.8	10^3/uL	RBC	5.83	H 10^6/uL	Plt	172	10^3/uL
Ne%	56.6	%	Hgb	11.6	g/dL	MPV	10.7	H fL
Li%	31.2	%	Hct	37.6	%	Pct	0.183	%
Mo%	9.0	%	MCV	64.5	L fL	PDW	17.1	H (ratio)
Eo%	2.1	%	MCH	19.9	L pg			
Ba%	1.1	%	MCHC	30.8	L g/dL			
Ne#	3.9	10^3/uL	RDW	14.4	%			
Li#	2.1	10^3/uL				RET%		%
Mo#	0.6	10^3/uL				RET#		10^6/uL
Eo#	0.1	10^3/uL						
Ba#	0.1	10^3/uL						

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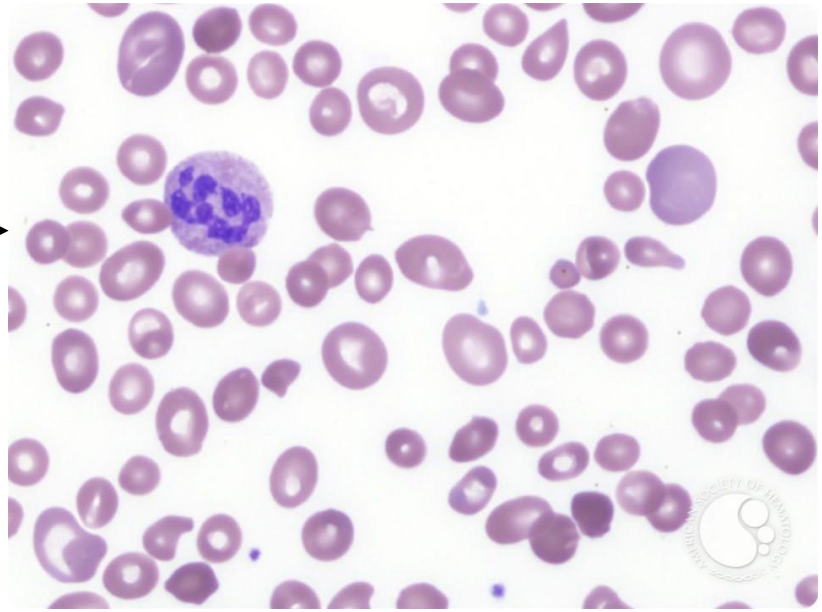
Anemia macrocitica normocromica con anisopoichilocitosi

(megaloblastica da deficit di vit. B12 e Folati)

GR/Ematocrito	↓
Emoglobina	↓
MCV/Anisocitosi	↑↑
MCH	Normale
MCHC	Normale



Anemia perniciosa

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INDICE CREATININA/ALTEZZA (ICA - CHI)

Valuta la **deplezione proteica** e fornisce **indicazioni sull'assetto muscolare**.
Rappresenta inoltre una **stima** della **massa magra**.

$$\frac{\text{Creatininuria 24h}}{\text{Creatininuria 24h ideale}} \times 100$$

Valutata in funzione di altezza e sesso

Creatininuria 24h ideale		
Altezza cm	**Uomo**	**Donna**
150	1191,4	851,4
155	1271,9	909,0
160	1354,7	968,4
165	1439,8	1029,6
170	1529,5	1092,6
175	1619,2	1175,4
180	1713,5	1224,0
185	1810,1	1294,2
190	1909,0	1364,4
195	2012,5	1438,2
200	2116,0	1512,0
Funzione di conversione	23 mg x kg peso ideale	18 mg x kg di peso ideale
Peso ideale	(altezza in m)^2 x 23 ± 4	(altezza in m)^2 x 21 ± 3

Normale	> 90%
Malnutrizione lieve	80-89%
Malnutrizione media	60-79%
Malnutrizione grave	< 60%

→ Parametro affidabile con una **corretta raccolta delle urine 24h**

Enpab webinar

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Yusuf

h 150 cm

Campione urine 24h
(Diuresi 1500 ml)

creatininuria → **49.1 mg/dl**

creatininuria 24h

$$\textbf{ICA} = \frac{\textbf{736.5 mg/24h}}{\textbf{1191.4 mg/24h}} = \textbf{61.8\%}$$

creatininuria 24h ideale

Normale	> 90%
Malnutrizione lieve	80-89%
Malnutrizione media	60-79%
Malnutrizione grave	< 60%

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Journal of Public Health and Epidemiology

Full Length Research Paper

Creatinine height index as a predictor of nutritional status among patients with liver cirrhosis

Medhat, A. Saleh[1]*, Ahmed, A. Obeidalla[2], Ahmed F. Thabet[2] and Amal, M. Abdel Aal[3]

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[2]Internal Medicine Department, Faculty of Medicine, Assiut University, Egypt.
[3]Department of Clinical Pathology, Faculty of Medicine, Assiut University, Egypt.

Received 15 July, 2016; Accepted 19 August, 2016

Assessment of nutritional status in cirrhotic patients is very difficult, and there is no gold-standard method used for nutritional evaluation of these patients. The study aims to assess the role of creatinine height index in evaluation of nutritional status of patients with liver cirrhosis, and to compare its results with different ordinary methods used for nutritional assessment. The study was cross sectional observational study, carried out at El-Rajhi Liver Hospital and internal medicine department in Assiut University on 103 patients with liver cirrhosis after obtaining their informed consent form May to September 2015. 24 h urine collection was obtained from all patients, then measurement of their urine creatinine was done, after that, creatinine height index (CHI) was calculated for every patient, furthermore, All patients did the followings investigations: Serum albumin, Anthropometric measurements, Subjective Global Assessment. Then its results were compared with their CHI. According to CHI, malnutrition was present in 89.2% of patients: 11 patients (11.8%) were mildly malnourished, 38 (40.8%) were moderately malnourished and 35 (36.6%) were severely malnourished, Subjective Global Assessment detects malnutrition in 92.2% of patients. Furthermore, 87.4% of the patients were malnourished according to Mid Arm Muscle Circumference while 86.4% of them were malnourished according to Triceps Skin Fold Thickness. Mean value of CHI was decreased markedly from 86.1, 64.5 to 39.1% in Child score A, B and C respectively (P value= 0.000). CHI is a good predictor of muscle mass in patients with liver cirrhosis.

ICA quale indicatore di stato nutrizionale in cirrosi epatica

Mauro Amato **https://www.mendeley.com/catalogue/013534f4-0f4f-37d9-80cb-b69850b4dc00/**

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J Intensive Care Med. 2018 Feb;33(2):104-110. doi: 10.1177/0885066616648133. Epub 2016 May 13.

Can Creatinine Height Index Predict Weaning and Survival Outcomes in Patients on Prolonged Mechanical Ventilation After Critical Illness?

Datta D[1], Foley R[1], Wu R[2], Grady J[2], Scalise P[3].

Author information

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3 3 Division of Pulmonary & Critical Care Medicine, Hospital for Special Care, New Britain, CT, USA.

ICA quale indicatore di successo per svezzamento e sopravvivenza pazienti in ventilazione meccanica prolungata (covid19)

Abstract

OBJECTIVE: Malnutrition is common in chronic critically ill patients on prolonged mechanical ventilation (PMV) and may affect weaning. The creatinine height index (CHI), which reflects lean muscle mass, is regarded as the most accurate indicator of malnutrition. The objective of this study was to determine the impact of CHI in comparison with other traditional nutritional indices on successful weaning and survival in patients on PMV after critical illness.

METHODS: Records of 167 patients on PMV following critical illness, admitted for weaning, were reviewed. Parameters studied included age, gender, body mass index (BMI), percentage ideal body weight (%IBW), total protein, albumin, prealbumin, hemoglobin (Hb), and cause of respiratory failure. Number successfully weaned and number discharged alive and time to wean and time to discharge alive were determined from records. The CHI was calculated from 24-hour urine creatinine using a standard formula. Unpaired 2-sample t test was performed to determine the association between the studied nutritional parameters and outcomes. Predictive value of studied parameters for successful weaning and survival was determined by multivariate logistic regression analysis to model dichotomous outcome of successful weaning and survival.

RESULTS: Mean age was 68 ± 14 years, 49% were males, 64% were successfully weaned, and 65.8% survived. Total protein, Hb, and CHI had a significant impact on successful weaning. Weight, %IBW, BMI, and CHI had a significant effect on survival. Of all parameters, CHI was most strongly predictive of successful weaning and survival.

CONCLUSIONS: The CHI is a strong predictor of successful weaning and survival in patients on PMV.

Clinical Nutrition 36 (2017) 49–64

Contents lists available at ScienceDirect

Clinical Nutrition

journal homepage: http://www.elsevier.com/locate/clnu

ESPEN Guideline

ESPEN guidelines on definitions and terminology of clinical nutrition

T. Cederholm [a,*], R. Barazzoni [b], P. Austin [c,y], P. Ballmer [d], G. Biolo [e], S.C. Bischoff [f], C. Compher [g,1], I. Correia [h,1], T. Higashiguchi [i,1], M. Holst [j], G.L. Jensen [k,1], A. Malone [l,1], M. Muscaritoli [m], I. Nyulasi [n,1], M. Pirlich [o], E. Rothenberg [p], K. Schindler [q], S.M. Schneider [r], M.A.E. de van der Schueren [s,z], C. Sieber [t], L. Valentini [u], J.C. Yu [v,1], A. Van Gossum [w], P. Singer [x]

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Linee guida ESPEN
Terminologia e definizioni in Nutrizione Clinica

Materiale didattico
n. 01

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Valori degli Indicatori Laboratoristici di Disidratazione

Esame	Disidratazione incombente	Disidratazione in atto
Rapporto Azoto ureico/Creatininemia	20/1 - 24/1	= o > 25/1
Osmolarità plasmatica (concentraz.soluz.)	290-300 mOsm/Kg	> 300 mOsm/Kg
Osmolarità urinaria		> 1050 mOsm/Kg
Sodio sierico		> 150 mEq/l
Peso specifico urinario	1020 - 1029	> 1029
Quantità urine/24h		< 800 ml/24h
Colore delle urine	Giallo scuro	Verde marrone

Am J Nurs 2006, 106: 40-49

La disidratazione può essere
- **Ipertonica** **Sodiemia ↑**
- **Ipotonica** **Sodiemia ↓**
- **Isotonica** **Sodiemia normale**

Disidratazione
- **Lieve** 3-5% perdita peso abituale
- **Moderata** 10%
- **Grave** > 15%

Giovanni

Azotemia= 60
Creatinina= 1.03
Azoto ureico= 28.0

BUN/Cre= 27.2

Azoto ureico (BUN) **mg/dl= Urea** (azotemia) **mg/dl x 0.466**

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OSMOMETRO

OSMOLARITA' MISURATA

2[Na+] + Glucosio/18 + BUN/2.8

Na+	mEq/l
Glucosio	mg/dl
BUN	mg/dl

OSMOLARITA' plasmatica CALCOLATA

valori piuttosto normali

https://www.siditalia.it/clinica/formule-e-calcolatori/osmolarita-plasmatica

2*[NA+] + [K+] + BUN/2.8 + Glucosio/18

valori urine

OSMOLARITA' urinaria CALCOLATA

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Enpab webinar

PREALBUMINA (TRANSTIRETINA)

- Sintetizzata dal fegato chiamata **pre-Albumina** in quanto più veloce dell'albumina in migrazione elettroforetica.
- Si preferisce chiamarla **Transtiretina** per la sua **funzione di trasporto della Tiroxina** insieme alla TBG.
- Il suo **dosaggio** viene raccomandato quale **marcatore di malnutrizione** in quanto con una **emivita di 2-4 gg** consente di avere **informazioni** sullo **stato nutrizionale** della settimana precedente l'osservazione medica.

Dosaggio Immunochimico Immunoturbidimetrico → **10 – 40 mg/dl**

PROTEINA LEGANTE IL RETINOLO (RBP)

- Sintetizzata dal fegato presenta specificità per il **trasporto del Retinolo**.
- E' una delle prime **proteine a non essere più prodotte in condizioni di deficit energetico-proteico**. Con una **emivita di 10-12h** rappresenta un **marcatore precoce di malnutrizione**
- Permette di avere informazioni sulla **VAD** (**Vitamin A Deficiency**).
- Viene filtrata a livello glomerulare e riassorbita a livello tubulare e può così fornire indicazioni su **nefropatie con danni tubulari**.

Dosaggio Immunochimico Immunoturbidimetrico → **3.0 – 6.0 mg/dl**

Tabella 1
Intervalli di riferimento della concentrazione sierica di transtiretina (g/L) per età e sesso

	Neonati	1-2 anni	10-20 anni	21-35 anni	36-60 anni	> 60 anni
Maschi	0,07-0,17	0,11-0,26	0,16-0,40	0,22-0,44	0,22-0,45	0,16-0,40
Femmine	0,08-0,17	0,12-0,25	0,15-0,32	0,16-0,35	0,18-0,38	0,14-0,37

Modificata da Ritchie et al (30)

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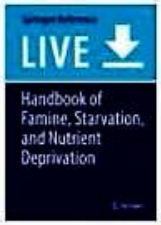

Handbook of Famine, Starvation, and Nutrient Deprivation pp 1-21 | Cite as

Prealbumin and Retinol Binding Protein as Screening Tools for Malnutrition

Authors Authors and affiliations

Sylvie Siminkovitch, Borislav Vladimirov

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Transtiretina e Proteina Legante il Retinolo come biomarcatori per lo screening della Malnutrizione

Abstract

Prealbumin (transthyretin) and retinol-binding protein are mainly secreted from the liver for what they are also called as hepatic proteins. Different hepatic or visceral proteins are increasingly used for the screening of malnutrition, according to many national and international guidelines from 1995 up to now. On the other hand, the screening is a clinical process and cannot be based only on a single marker. The clinical and economic impact of the application of different biochemical markers for malnutrition assessment in a variety of clinical settings has been extensively studied. Several previously published nutrition screening tools have been validated in a variety of clinical conditions and patient populations. The current approach to malnutrition screening encompasses a combination of screening tools with laboratory investigations.

Mauro Amato

https://link.springer.com/referenceworkentry/10.1007%2F978-3-319-40007-5_54-1

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J Surg Res. 2018 Jul;227:145-150. doi: 10.1016/j.jss.2018.02.035. Epub 2018 Mar 15.

Serum transthyretin level is associated with prognosis of patients with gastric cancer

Tatsuo Shimura [1], Masahiko Shibata [2], Kenji Gonda [2], Hirokazu Okayama [2], Motonobu Saito [2], Tomoyuki Momma [2], Shinji Ohki [2], Koji Kono [2]

Affiliations + expand

PMID: 29804846 DOI: 10.1016/j.jss.2018.02.035

Transtiretina come biomarcatore di prognosi nel cancro gastrico

Abstract

Background: The goal of the present study was to determine whether serum transthyretin level can be used as a novel prognostic biomarker for patients with gastric cancer.

https://pubmed.ncbi.nlm.nih.gov/29804846/

Mauro Amato

PROGNOSTIC NUTRITIONAL INDEX (PNI)

Indice di prognosi basato sull'Albumina sierica e sul numero dei linfociti presenti in circolo

Trova buona applicazione in campo oncologico e malattie croniche

$$PNI = [\,10 \times \text{Albumina (gr/dl)} + (\,0.005 \times \text{numero linfociti}/\mu l\,)]$$

Prognostic Nutritional Index

PNI

Albumin (in grams per liter)

Lymphocyte Count (per microliter)

PNI value

0.00

Normale	≥ 50
Malnutrizione	
blanda	< 50
moderata/servera	< 45
grave	< 40

http://radiologyreviewarticles.com/radiology-calculators/prognostic-nutritional-index/

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Yusuf

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Prognostic Nutritional Index

Prognostic Nutritional Index

PNI

Albumin (in grams per liter)

40

Lymphocyte Count (per microliter)

1500

PNI value

47.50

Malnutrizione

blanda	< 50
moderata/servera	< 45
grave	< 40

MALNUTRIZIONE PAZIENTE ONCOLOGICO
Indici Biochimici

Mauro Mario Amato

Prognostic Nutritional Index

12/8/20 20h:38min

MediCalc® | Equations | Nutrition | Nutritional Assessment | PNI

Quick Help

back | forward

Inputs

Albumin (S)		g/dL
Triceps Skinfold		mm
Transferrin (S)		g/L
DHI	◉ anergy ○ reactive	

Outputs

■ normal ■ abnormal

PNI Prognostic Nutritional Index		%

Print Format | Reset | Calculate

MediCalc® 9

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Equation

PNI = 158% – (1.66*albumin) – (0.78*TSF) – (2.0*transferrin) – (5.8*DHI)

PNI = Prognostic Nutritional Index (%)
Alb = Albumin (S, g/dL)
TSF = Triceps Skinfold (cm)
Transferrin (S, g/L)
DHI = Delayed Hypersensitivity Index (anergy)
*anergy = 1, reactive = 2.

B= blood. S= serum. P= plasma. U= urine.

Personalize: Print | Save (optional)

Provider Name

Patient Name

Printing ◉ color ○ black

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Paziente in condizioni critiche (Prognostic Nutritional Risk Index)

About

Parameters & Abbreviations | References

PNI is used in the assessment of severity of disease and nutritional status of the critically ill Patient.

Risk:
Low = < 40%
Moderate = 40% – 49%
High = > 50%

Buona applicazione in campo oncologico e malattie croniche

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http://www.scymed.com/en/smnxpn/pnnhb328.htm

Prognostic Nutritional Index

MediCalc® | Equations | Nutrition | Nutritional Assessment | PNI

Quick Help

Inputs

Albumin (S)	3.5	g/dL
Triceps Skinfold	15.5	mm
Transferrin (S)	200	mg/dL
DHI	○ anergy ◉ reactive	

Outputs ■normal ■abnormal

PNI Prognostic Nutritional Index	72.2	%

Print Format | Reset | Calculate

MediCalc® 9

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Equation

$$PNI = 158\% - (1.66*albumin) - (0.78*TSF) - (2.0*transferrin) - (5.8*DHI)$$

PNI = Prognostic Nutritional Index (%)
Alb = Albumin (S, g/dL)
TSF = Triceps Skinfold (cm)
Transferrin (S, g/L)
DHI = Delayed Hypersensitivity Index (anergy)
*anergy = 1, reactive = 2.

B= blood. S= serum. P= plasma. U= urine.

Personalize: Print | Save (optional)

Provider Name

Patient Name

Printing ◉ color ○ black

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Prognostic Nutritional Risk Index

Patient Name:

Dr.

Prognostic Nutritional Index - Report Date: 12/13/20

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Time: 16h:39min

MediCalc® 9 Medical Calculator System™

Inputs (Parameters) (Sp)	Abbrev	Values[1]	C Units[2]	CF[3]	Values SI Units[4]	normal values[5]	other[6]
Albumin (S)	Alb	3.5	g/dL	10	35 g/L	3.5-5.5	
Triceps Skinfold	TSF	15.5	mm	0.1	1.6 cm	5.0-30.0	
Transferrin (S)		2	g/L	100	200 mg/dL	2.2-4	
Delayed Hypersensitivity Index	DHI	reactive					

Outputs (Parameters) (Sp)	Abbrev	Values[1]	C Units[2]	CF[3]	Values SI Units[4]	normal values[5]	Equation[7]
Prognostic Nutritional Index	PNI	72.2	%	0.01	0.72 fraction	0-40	158%-(1.66*alb)-(0.78*TSF)-(2*transfe)-(5.8DHI)

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Rischio elevato di prognosi non buona

frontiers in Oncology | Radiation Oncology

ORIGINAL RESEARCH ARTICLE
Front. Oncol., 30 January 2020 | https://doi.org/10.3389/fonc.2019.01562

Valenza del PNI/Cancro Seno

The Value of Prognostic Nutritional Index (PNI) in Predicting Survival and Guiding Radiotherapy of Patients With T1-2N1 Breast Cancer

Xin Hua[1,2†], Zhi-Qing Long[1,2†], Xin Huang[1†], Jia-Peng Deng[1,2], Zhen-Yu He[1,2], Ling Guo[1,3], Wen-Wen Zhang[1,2*†] and Huan-Xin Lin[1,2*†]

[1]Sun Yat-sen University Cancer Center, State Key Laboratory of Oncology in South China, Collaborative Innovation Center for Cancer Medicine, Guangzhou, China
[2]Department of Radiotherapy, Sun Yat-sen University Cancer Center, Guangzhou, China
[3]Department of Nasopharyngeal Carcinoma, Sun Yat-sen University Cancer Center, Guangzhou, China

Background: To investigate the significance of the prognostic nutrition index (PNI) as a predictor of survival and guide for treating T1-2N1 breast cancer.

Methods: Patients with T1-2N1 breast cancer ($N = 380$) who underwent a mastectomy at our center were studied. PNI was calculated as 10 × serum albumin (g/dl) + 0.005 × total lymphocyte count (per mm^3). The cutoff for the PNI was calculated using the time-dependent receiver operating characteristic (ROC) curve analysis by overall survival (OS) prediction. The associations between the PNI and the clinicopathologic characteristics were analyzed using Pearson's χ^2 test. Survival curves were calculated using the Kaplan–Meier method. Univariate and multivariate analyses were performed using the Cox proportional hazards model.

https://www.frontiersin.org/articles/10.3389/fonc.2019.01562/full

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Valenza del PNI/Carcinoma orale

Oral Dis. 2020 Jul;26(5):903-911. doi: 10.1111/odi.13318. Epub 2020 Mar 19.

Predictive value of prognostic nutritional index in patients with oral squamous cell carcinoma

Xiang Wu [1], Yue Jiang [1], Han Ge [1], Pengfei Diao [1], Dongmiao Wang [1], Yanling Wang [1], Jie Cheng [1 2]

Affiliations + expand

PMID: 32125746 DOI: 10.1111/odi.13318

Abstract

https://pubmed.ncbi.nlm.nih.gov/32125746/

Objectives: To determine the prognostic significance of preoperative prognostic nutritional index (PNI) in patients with primary oral squamous cell carcinoma (OSCC) after ablative surgery.

Materials and methods: A total of 333 patients from two tertiary referral centers were enrolled as training and validation cohorts. The PNI was calculated as 10× serum albumin (g/dL) + 0.005 × total lymphocyte number (per mm^3), and its optimal cutoff value for patient stratification was identified by X-tile software. Cox's proportional regression analyses and receiver operating characteristic (ROC) curves were employed to identify prognostic factors and their predictive performance.

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Applicazione clinica PNI
Carcinoma esofageo

Nutr Cancer. 2020 Oct 12;1-8. doi: 10.1080/01635581.2020.1817511. Online ahead of print.

Clinical Application Value of the Prognostic Nutritional Index for Predicting Survival in Patients with Esophageal Squamous Cell Carcinoma Undergoing Chemoradiotherapy or Radiotherapy

Ling Xiao [1 2], Jiahua Lyu [1 2], Xiao Liu [3], Ke Li [3], Yuan Wang [1], Rongke Zhang [3], Taiyu Chen [4], Tao Li [1 2]

Affiliations + expand

PMID: 33044092 DOI: 10.1080/01635581.2020.1817511

https://pubmed.ncbi.nlm.nih.gov/33044092/

Abstract

Background: The prognostic nutrition index (PNI) has been shown to have prognostic value for several common cancers. The study aim was to explore the clinical application value of the PNI for prognosis of patients with esophageal squamous cell carcinoma (ESCC) treated with radical

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scientific reports

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nature › scientific reports › articles › article

Article | Open Access | Published: 15 October 2020

The role of prognostic nutritional index for clinical outcomes of gastric cancer after total gastrectomy

Zhu Xishan, Zhao Ye, Ma Feiyan, Xuan Liang & Wu Shikai

Scientific Reports **10**, Article number: 17373 (2020) | Cite this article

205 Accesses | Metrics

Ruolo PNI/Carcinoma gastrico

https://www.nature.com/articles/s41598-020-74525-8

Abstract

The purpose of this article is to evaluate the relationship between the nutrition-based microenvironment and clinicopathological information for gastric cancer patients and to investigate the prognostic value of nutrition index for gastric cancer patients undergoing total gastrectomy. We retrospectively collected clinical information of 245 gastric cancer patients who underwent total gastrectomy in our hospital between January 1st 2005 and December 30th 2015. According to the prognostic nutritional index (PNI) level, they were divided into low PNI (< 43) group and high PNI (≥ 43) group. The relationship between PNI and the disease-free survival (DFS) and overall survival (OS) were analyzed by statistical analysis. Univariate analyses demonstrated that TNM stage ($p = 0.025$), patients age ($p = 0.042$), lymph node metastasis ($p = 0.028$), tumor differentiation ($p = 0.037$) and a low PNI ($p = 0.033$) were closely

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PMC Advanced Journal list

Journal List › J Clin Lab Anal › v.34(10); 2020 Oct › PMC7595894

JCLA Journal of Clinical Laboratory Analysis Open Access

J Clin Lab Anal. 2020 Oct; 34(10): e23566.
Published online 2020 Sep 11. doi: 10.1002/jcla.23566

PMCID: PMC7595894
PMID: 32914892

The Prognostic Nutritional Index is associated with mortality of COVID-19 patients in Wuhan, China

Ruoran Wang,[1] Min He,[1,2] Wanhong Yin,[1] Xuelian Liao,[1] Bo Wang,[1] Xiaodong Jin,[1] Yao Ma,[2,3] Jirong Yue,[2,3] Lang Bai,[2,4] Dan Liu,[2,5] Ting Zhu,[6] Zhixin Huang,[7] and Yan Kang[1,2]

Author information · Article notes · Copyright and License information Disclaimer

PANDEMIA COVID19
Associazione PNI/Mortalità

This article has been cited by other articles in PMC.

Abstract

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7595894/

Go to:

Background

Declared as pandemic by WHO, the coronavirus disease 2019 (COVID-19) pneumonia has brought great damage to human health. The uncontrollable spread and poor progression of COVID-19 have attracted much attention from all over the world. We designed this study to develop a prognostic nomogram incorporating Prognostic nutritional index (PNI) in COVID-19 patients.

J Clin Lab Anal

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CONUT score (COntrolling NUtritional status)

Indicatore nutrizionale che funge da fattore prognostico per molti tumori maligni.
E' basato su tre parametri di Laboratorio:
Albumina, **conta Linfociti e Colesterolo**
L'evidenza clinica del CONUT score è aumentata in **oncologia gastroenterologica**
Sono allo studio **modificazioni CONUT score con HDL e LDL** in sostituzione del colesterolo

CONUT score= punteggio **Albumina** + punteggio **Linfociti** + punteggio **Colesterolo**

Laboratory parameters	None	Light	Moderate	Severe
Serum albumin (g/dL)	≥ 3.50	3.00-3.49	2.50-2.99	<2.50
Score	0	2	4	6
Total lymphocyte count (/mm3)	≥ 1600	1200-1599	800-1199	<800
Score	0	1	2	3
Total cholesterol (mg/dL)	≥ 180	140-179	100-139	<100
Score	0	1	2	3

CONUT score= Serum albumin score + total lymphocyte count score + total cholesterol score

CONUT score

0-1 normale
2-4 alto blando
5-8 alto
9-12 molto alto

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Meta-Analysis > Int J Surg. 2020 Jun;78:91-96. doi: 10.1016/j.ijsu.2020.04.046. Epub 2020 Apr 23.

Prognostic significance of the controlling nutritional status (CONUT) score in patients with colorectal cancer: A systematic review and meta-analysis

Kosei Takagi [1], Stefan Buettner [2], Jan N M Ijzermans [2]

Affiliations + expand

PMID: 32335238 DOI: 10.1016/j.ijsu.2020.04.046

CONUT score/Cancro Colon-retto

Abstract

Background: The clinical evidence of the controlling nutritional status (CONUT) score for outcomes has increased in gastroenterological surgical oncology. The aim of this study was to investigate the impact of the CONUT score on outcomes in patients with colorectal cancer (CRC).

Methods: A literature review was systematically conducted to evaluate the significance of the CONUT score in CRC patients. Meta-analyses of survival were performed to investigate the effects of the CONUT score in CRC patients.

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https://pubmed.ncbi.nlm.nih.gov/32335238/

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Diagnosis (Berl). 2020 Aug 31;/j/dx.ahead-of-print/dx-2020-0073/dx-2020-0073.xml.
doi: 10.1515/dx-2020-0073. Online ahead of print.

CONUT: a tool to assess nutritional status. First application in a primary care population

Maria Salinas [1 2], Emilio Flores [1 3], Alvaro Blasco [1], Maite López-Garrigós [1], Carmen Puche [1], Alberto Asencio [4], Carlos Leiva-Salinas [5]

Affiliations + expand

PMID: 32866115 DOI: 10.1515/dx-2020-0073

CONUT score
strumento di valutazione delle cure primarie

Abstract

https://pubmed.ncbi.nlm.nih.gov/32866115/

Objectives Malnutrition is an unfavorable prognostic factor associated with an increase in mortality, hospital stays, readmissions and resources consumption. The aim was to screen primary care patients for risk of malnutrition by using the control nutritional (CONUT) score, calculated through total lymphocytes count, serum albumin and total cholesterol, when the three markers were requested, and to compare results between primary care centers (PCC). Methods The clinical laboratory located in a 370-bed suburban University Community Hospital serves the Health Department inhabitants (2,34,551), attended in nine PCC. The laboratory information system (LIS) automatically calculated the CONUT score in every primary care patient over 18 years old, when all three laboratory markers were ordered by the General Practitioner. For all primary care patients, we collected demographic data, CONUT index and PCC. We classified results by PCC, and compared them. Results The clinical laboratory received 74,743 requests from primary care. The CONUT score was calculated in 7,155 (12.28%) patients. Nine hundred seventy-six (13.6%) were at risk of malnutrition according to the

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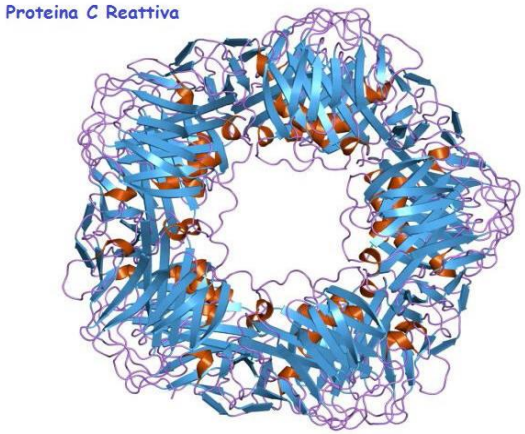
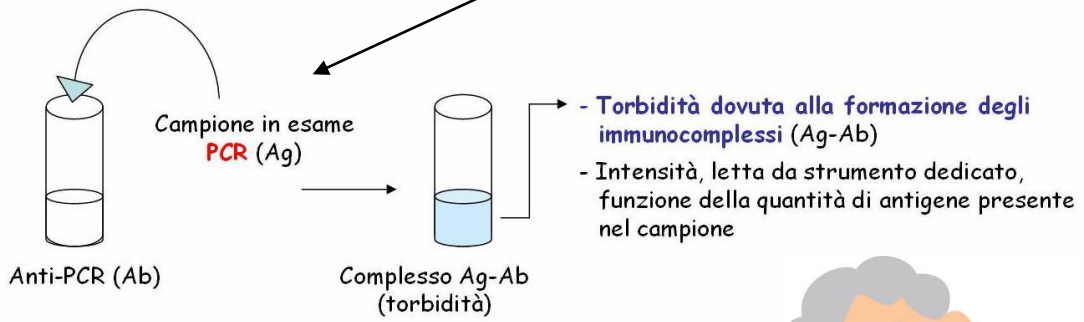
hs PCR – PROTEINA C REATTIVA (alta sensibilità)

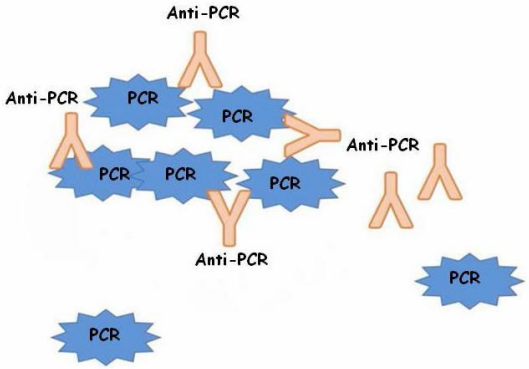


- **Alfaglobulina** sintetizzata da **fegato** in risposta a **IL6**, **TNFα** e **IL1β** con netto incremento in **fase acuta reattiva**.
  Può essere prodotta anche dagli **adipociti**
- **Test aspecifico** (non fornisce informazioni sull'origine del processo)
- **Marcatore di flogosi sensibile**

I test di nuova generazione sono **hs-PCR** (PCR quantitativa ad alta sensibilità) in **immunoturbidimetria**



Valori riferimento di hs-PCR
3-4.5 mg/l



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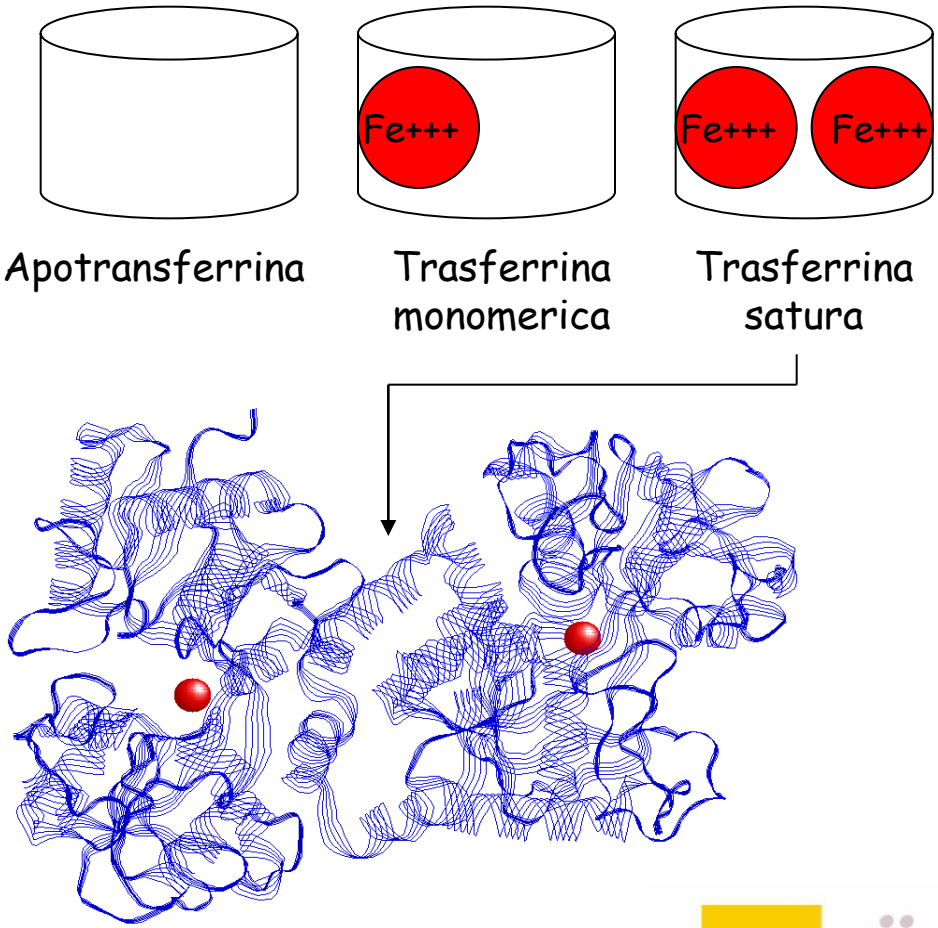
LA TRANSFERRINA



- **Proteina plasmatica** sintetizzata soprattutto a livello epatico normalmente **saturata con Fe(3+)** per circa il **30%.**
- I **livelli sierici** sono **regolati dalla biodisponibilità di ferro**: **bassi livelli di ferro determinano suo incremento**
- La sideremia riflette i livelli di ferro nella transferrina

- **Livelli elevati**:
  - Anemia sideropenica
  - Gravidanza/uso di estrogeni
  - Sindrome nefrosica

- **Proteina di fase acuta negativa**: diminuisce durante processi infiammatori

- **Livelli diminuiti**:
  - Emocromatosi
  - Infiammazioni acute
  - Patologie croniche
  - Malnutrizione e Infezioni
  - Uso di Testosterone
  - Neoplasie

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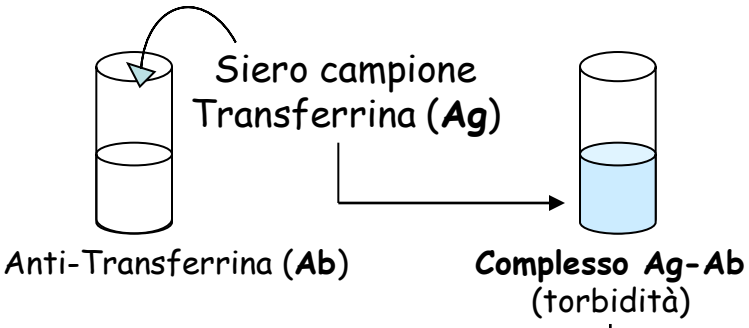
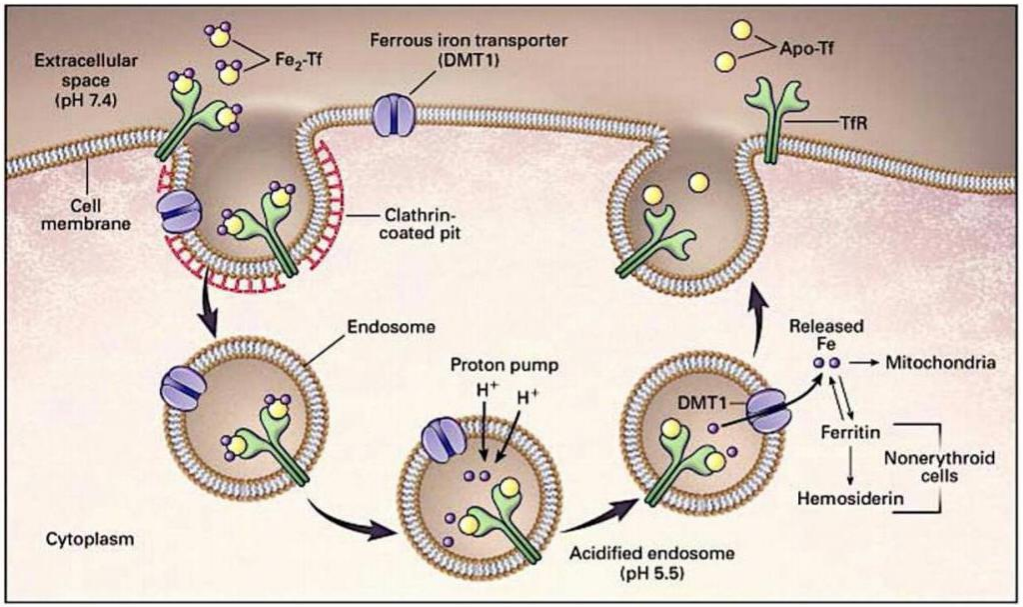
TRANSFERRINA

Dosaggio (immunoturbidimetrico)



L'aggiunta di siero campione contenente transferrina in una soluzione in cui è presente l'anti-transferrina, in un preciso rapporto, provoca una **torbidità dovuta alla formazione degli immunocomplessi** (Ag-Ab) la cui intesità, letta da uno strumento opportuno, è funzione della quantità di transferrina presente nel siero campione.



Valori di riferimento **180 – 330 mg/dl**

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International Journal of Sport Nutrition and Exercise Metabolism, 2018, 28, 139-158
https://doi.org/10.1123/ijsnem.2017-0338
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Human Kinetics
SCHOLARLY REVIEW

Assessment of Nutrient Status in Athletes and the Need for Supplementation

D. Enette Larson-Meyer
University of Wyoming

Kathleen Woolf
NYU Steinhardt

Louise Burke
Australian Institute of Sport

Materiale didattico
n. 02

Valutazione dello Stato nutrizionale degli atleti e l'esigenza della supplementazione

Nutrition assessment is a necessary first step in advising athletes on dietary strategies that include dietary supplementation, and in evaluating the effectiveness of supplementation regimens. Although dietary assessment is the cornerstone component of the nutrition assessment process, it should be performed within the context of a complete assessment that includes collection/evaluation of anthropometric, biochemical, clinical, and environmental data. Collection of dietary intake data can be challenging, with the potential for significant error of validity and reliability, which include inherent errors of the collection methodology, coding of data by dietitians, estimation of nutrient composition using nutrient food tables and/or dietary software programs, and expression of data relative to reference standards including eating guidance systems, macronutrient guidelines for athletes, and recommended dietary allowances. Limitations in methodologies used to complete anthropometric assessment and biochemical analysis also exist, as reference norms for the athlete are not well established and practical and reliable

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Advanced Journal list

Journal List › Biochim Open › v.4; 2017 Jun › PMC5802101

ELSEVIER
Biochimie Open

Biochim Open. 2017 Jun; 4: 1–7.
Published online 2016 Nov 23. doi: 10.1016/j.biopen.2016.10.001

PMCID: PMC5802101
PMID: 29450135

Development of a specific index to detect malnutrition in athletes: Validity in weight class or intermittent fasted athletes

François D. Desgorces,[a,b] Christophe Moinard,[c,d] Mounir Chennaoui,[e,f] Jean-François Toussaint,[a,b,g] Cyril Petibois,[h] and Philippe Noirez[a,b,*]

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This article has been cited by other articles in PMC.

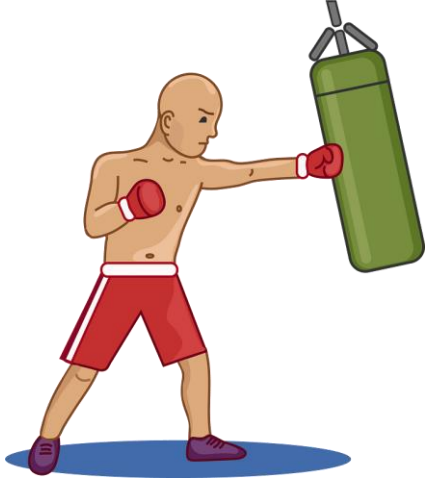
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5802101/

Abstract

Go to:

Fasted or weight-category athletes manage their training under strict diet conditions that could impair the stress-recovery balance and result in acute or chronic fatigue. However, to date, no validated biomarker are available to quantify this phenomena. The aim of this study was to assess the validity of a specific index combining plasma albumin and weight change to detect nutrition-related risks of fatigue increase and under-performance in athletes experiencing particular nutritional conditions.

An athlete's nutrition risk index (ANRI) equation, based on data from lightweight and heavyweight rowers, was developed using relationship between plasma albumin concentrations combined to weight changes



ANRI (Athlete's Nutrition Risk Index)

Atleti di alcuni sport (boxe, lotta) sono legati al mantenimento di ben precisi limiti di peso e talvolta si sottopongono a regimi dietetici che se non ben controllati possono portare a denutrizione.

Insieme ai classici parametri biochimici si sta cercando di mettere a punto strumenti di valutazione dello stato nutrizionale e uno di questi è l'**ANRI** basato sull'**Albumina** e lo **Stato del peso**.

Journal List › Biochim Open › v.4; 2017 Jun › PMC5802101

ELSEVIER
Biochimie Open

Biochim Open. 2017 Jun; 4: 1–7.
Published online 2016 Nov 23. doi: 10.1016/j.biopen.2016.10.001

PMCID: PMC5802101
PMID: 29450135

Development of a specific index to detect malnutrition in athletes: Validity in weight class or intermittent fasted athletes

François D. Desgorces,[a,b] Christophe Moinard,[c,d] Mounir Chennaoui,[e,f] Jean-François Toussaint,[a,b,g] Cyril Petibois,[h] and Philippe Noirez[a,b,*]

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This article has been cited by other articles in PMC.

Abstract **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5802101/** Go to:

Fasted or weight-category athletes manage their training under strict diet conditions that could impair the stress-recovery balance and result in acute or chronic fatigue. However, to date, no validated biomarker are available to quantify this phenomena. The aim of this study was to assess the validity of a specific index combining plasma albumin and weight change to detect nutrition-related risks of fatigue increase and under-performance in athletes experiencing particular nutritional conditions.

An athlete's nutrition risk index (ANRI) equation, based on data from lightweight and heavyweight rowers, was developed using relationship between plasma albumin concentrations combined to weight changes

Enpab webinar

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INSTANT NUTRITIONAL ASSESSMENT (INA)

Screening rapido, basato sulla determinazione di **Albumina** e **Linfociti**, per la **valutazione iniziale** dello stato nutrizionale

INA normale	**albumina ≥ 3.5 g/dl**	**-**	**linfociti ≥ 1500**
INA rischio	**albumina < 3.5 g/dl**	**-**	**linfociti < 1500**

Web Application → http://www.medicalalgorithms.com/instant-nutritional-assessment

NUTRITIONAL RISK INDEX (NRI)

Screening rapido, funzione del dosaggio **Albumina** e del **rapporto tra peso attuale e abituale**

NRI normale	**> 100**
NRI medio	**97.5-100**
NRI moderato	**83.5-97.4**
NRI severo	**< 83.5**

NRI= 1,52 x Albumina (g/l) + 41,7 x (peso attuale/peso abituale)

- Il **peso abituale** viene definito quale **peso stabile da 6 mesi** prima della determinazione.
- Il **peso attuale** determinato con **bilancia professionale calibrata**

Web Application → https://www.mdcalc.com/nutritional-risk-index-nri

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- Hgb= 11.7 g/dl
- Linfociti= 1500 µl
- Albumina= 4.0 g/dl
- peso attuale= 38 kg
- h= 150 cm
- peso abituale= ?
- peso ideale= h^2 (m) x 22 = 49.5 Kg

Yusuf

NUTRITIONAL RISK INDEX (NRI)

NRI= 1,52 x Albumina (g/l) + 41,7 x (peso attuale/peso ideale)

NRI= 1,52 x 40 + 41,7 x (38/49.5) = 92.8

NRI normale	> 100
NRI medio	97.5-100
NRI moderato	83.5-97.4
NRI severo	< 83.5

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Instant Nutritional Assessment

Purpose: To quickly screen a patient for nutritional status at initial presentation using the Instant Nutritional Assessment.

Specialty: Nutrition

Objective: severity, prognosis, stage

ICD-10: E40-E46, E50-E64

Evaluation

Serum albumin	3.8	g/L ◉ g/dL
Percent lymphocytes in peripheral blood differential (enter from 0 to 100)	42	percent
White blood cell count	2300	*10^9/L ◉ per µL

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Results | Interpretation and Description | References

https://www.medicalalgorithms.com/instant-nutritional-assessment

Results

Absolute lymphocyte count	966	per µL
Instant Nutritional Assessment	albumin normal but lymphocyte count low	
The percentage of patients with complications in the original study was	7.5% ⇦	

Nutritional Risk Index (NRI)

Quantifies malnutrition, validated in many populations.

INSTRUCTIONS

Note: although weight and nutritional status are not always correlated (e.g. obese patients may have malnutrition), for the purposes of this calculator, patients with increased weight from baseline (present weight > usual weight) are unlikely to have malnutrition. Always use clinical judgment.

When to Use

Serum albumin	3.4	g/dL
Present weight	66	kg
Usual weight Defined as stable body weight for last 6 months	64	kg

94.6 points

NRI Score

Moderate risk

Risk of malnutrition

Copy Results

Next Steps

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https://www.mdcalc.com/nutritional-risk-index-nri

Indicatori Biochimici di Malnutrizione				
Indagine	**Stato Nutrizionale**			
	Normale	**Malnutrizione lieve**	**Malnutrizione**	**Malnutrizione grave**
Albumina	3.5 - 5.0 gr/dl	3.0 - 3.5 gr/dl	**2.5 - 2.9 gr/dl**	**< 2.5 gr/dl**
Transtiretina (Prealbumina)	10 - 40 mg/dl	18 - 22 mg/dl	**10 - 17 mg/dl**	**< 10 mg/dl**
Transferrina	200 - 350 mg/dl	150 - 199 mg/dl	**100 - 149 mg/dl**	**< 100 mg/dl**
RBP (proteina trasporto retinolo)	3 - 6 mg/dl	2.5 - 2.9 mg/dl	**2.4 - 2.1 mg/dl**	**< 2.1 mg/dl**
Indice creatinina/altezza	> 90%	80 - 89%	**60 - 79 %**	**< 60 %**
Linfociti	≥ 2000 mm3	1200 - 1500 mm3	**800 - 1499 mm3**	**< 800 mm3**
Nutritional Risk Index (NRI)	> 100	100 – 97.5	**97.4 – 8.35**	**< 83.5**
PCR (proteina C reattiva)	3.0 – 4.5 mg/l	normale - ↑	↑ - ↑↑	↑↑↑
PNI (Prognostic Nutritional Index)	≥ 50%	< 50%	**< 45%**	**< 40%**

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E' importante notare che **può aversi linfopenia** anche in caso di:
- Malattie infettive acute debilitanti
- Cortisone prolungato
- Linfomi e Radioterapia
- Immunosoppressivi LES e Neoplasie.

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Marcatori antropometrici di malnutrizione		
BMI (Indice Massa Corporea)	< **20** Uomini	< **19** Donne
WHR (Rapporto vita/fianchi)	< **0,80** Uomini	< **0,60** Donne
Grasso corporeo	< **10 %** Uomini	< **18 %** Donne
Circonferenza braccio	< **23 cm** Uomini	< **19 cm** Donne
Perdita peso	> **10 %** in 6 mesi	> **10 %** in 6 mesi

$$\text{Perdita di peso \%} = \frac{\text{Peso abituale} - \text{Peso attuale}}{\text{Peso abituale}} \times 100$$

valori significativi

= > **5%** in 1 mese
= > **7.5%** in 3 mesi

$$\text{Perdita di peso abituale \%} = \frac{\text{Peso attuale}}{\text{Peso abituale}} \times 100$$

= > **95%** Normale
94 -85% Malnutrizione lieve
84 -75% Malnutrizione media
< **75%** Malnutrizione severa

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- Il **peso abituale** viene definito quale **peso stabile da 6 mesi** prima della determinazione.
- Il **peso attuale** determinato con **bilancia professionale calibrata**

Mini Nutritional Assessment

MNA®

Nestlé Nutrition Institute

MALNUTRIZIONE GERIATRICA

L'**MNA®** è uno strumento convalidato di **valutazione e stima della nutrizione per l'identificazione dei pazienti geriatrici** (età superiore ai 65) che sono malnutriti o a rischio di malnutrizione.

Cognome: _____ Nome: _____

Sesso: _____ Età: _____ Peso, kg: _____ Altezza, cm: _____ Data: _____

Completa lo schema riempiendo le caselle con gli appropriati numeri. Somma i punti per ottenere l'esito finale della valutazione.

Screening

A Presenta una perdita dell' appetito? Ha mangiato meno negli ultimi 3 mesi? (perdita d'appetito, problemi digestivi, difficoltà di masticazione o deglutizione)
0 = Grave riduzione dell'assunzione di cibo
1 = Moderata riduzione dell'assunzione di cibo
2 = Nessuna riduzione dell'assunzione di cibo

digitare valore → ☐

B Perdita di peso recente (<3 mesi)
0 = perdita di peso > 3 kg
1 = non sa
2 = perdita di peso tra 1 e 3 kg
3 = nessuna perdita di peso ☐

C Motricità
0 = dal letto alla poltrona
1 = autonomo a domicilio
2 = esce di casa ☐

D Nell' arco degli ultimi 3 mesi: malattie acute o stress psicologici?
0 = sì 2 = no ☐

E Problemi neuropsicologici
0 = demenza o depressione grave
1 = demenza moderata
2 = nessun problema psicologico ☐

F1 Indice di massa corporea (IMC) = peso in kg / (altezza in m)^2 ☐
0 = IMC <19
1 = 19 ≤ IMC < 21
2 = 21 ≤ IMC < 23
3 = IMC ≥ 23 ☐

SE L' IMC NON E DISPONIBILE, SOSTITUIRE LA DOMANDA F1 CON LA DOMANDA F2.
NON RISPONDERE ALLA DOMANDA F2 SE LA DOMANDA F1 E GIA' STATA COMPLETATA.

F2 Circonferenza del polpaccio (CP in cm)
0 = CP inferiore a 31
3 = CP 31 o superiore ☐

Valutazione di screening ☐☐
(max.14 punti)

12-14 punti: ☐ stato nutrizionale normale
8-11 punti: ☐ a rischio di malnutrizione
0-7 punti: ☐ malnutrito

Salvare
Stampare
Resettare

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Materiale didattico n. 03

foglio pdf editabile

Foglio 1

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MALNUTRIZIONE GERIATRICA

Mini Nutritional Assessment

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Cognome:	Rossi			Nome:	Mario		
Sesso:	M	Età:	72	Peso, kg:	66.0	Altezza, cm:	165	Data:	17.12.2020

Completa lo schema riempiendo le caselle con gli appropriati numeri. Somma i punti per ottenere l'esito finale della valutazione.

Screening

A Presenta una perdita dell' appetito? Ha mangiato meno negli ultimi 3 mesi? (perdita d'appetito, problemi digestivi, difficoltà di masticazione o deglutizione)
0 = Grave riduzione dell'assunzione di cibo
1 = Moderata riduzione dell'assunzione di cibo
2 = Nessuna riduzione dell'assunzione di cibo
[1]

B Perdita di peso recente (<3 mesi)
0 = perdita di peso > 3 kg
1 = non sa
2 = perdita di peso tra 1 e 3 kg
3 = nessuna perdita di peso
[2]

C Motricità
0 = dal letto alla poltrona
1 = autonomo a domicilio
2 = esce di casa
[1]

D Nell' arco degli ultimi 3 mesi: malattie acute o stress psicologici?
0 = sì 2 = no
[0]

E Problemi neuropsicologici
0 = demenza o depressione grave
1 = demenza moderata
2 = nessun problema psicologico
[2]

F1 Indice di massa corporea (IMC) = peso in kg / (altezza in m)^2 [24]
0 = IMC <19
1 = 19 ≤ IMC < 21
2 = 21 ≤ IMC < 23
3 = IMC ≥ 23
[3]

SE L' IMC NON E DISPONIBILE, SOSTITUIRE LA DOMANDA F1 CON LA DOMANDA F2.
NON RISPONDERE ALLA DOMANDA F2 SE LA DOMANDA F1 E GIA' STATA COMPLETATA.

F2 Circonferenza del polpaccio (CP in cm)
0 = CP inferiore a 31
3 = CP 31 o superiore
[ ]

Valutazione di screening
(max.14 punti)
[ ] [9]

12-14 punti:	[ ]	stato nutrizionale normale
8-11 punti:	[x]	a rischio di malnutrizione
0-7 punti:	[ ]	malnutrito

Salvare
Stampare
Resettare

Passare al Foglio 2

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MALNUTRIZIONE GERIATRICA

Se con il **form 1** il soggetto supera i 12 punti non è necessario continuare il test (**rischio nutrizionale molto basso**).

Se il punteggio è inferiore o uguale a 11 punti è necessario continuare con le domande presenti nel **form 2** individuare il **Rischio Nutrizionale**.

Mini Nutritional Assessment MNA®

Nestlé NutritionInstitute

Cognome: Nome:

Sesso: Età: Peso, kg: Altezza, cm: Data:

Risponda alla prima parte del questionario indicando, per ogni domanda, il punteggio appropriato. Sommi il punteggio della valutazione di screening e, se il risultato è uguale o inferiore a 11, completi il questionario per ottenere una valutazione dello stato nutrizionale.

Screening

A Presenta una perdita dell' appetito? Ha mangiato meno negli ultimi 3 mesi? (perdita d'appetito, problemi digestivi, difficoltà di masticazione o deglutizione)
0 = grave riduzione dell'assunzione di cibo
1 = moderata riduzione dell'assunzione di cibo
2 = nessuna riduzione dell'assunzione di cibo ☐

B Perdita di peso recente (<3 mesi)
0 = perdita di peso > 3 kg
1 = non sa
2 = perdita di peso tra 1 e 3 kg
3 = nessuna perdita di peso ☐

C Motricità
0 = dal letto alla poltrona
1 = autonomo a domicilio
2 = esce di casa ☐

D Nell' arco degli ultimi 3 mesi: malattie acuteo stress psicologici?
0 = sì 2 = no ☐

E Problemi neuropsicologici
0 = demenza o depressione grave
1 = demenza moderata
2 = nessun problema psicologico ☐

F Indice di massa corporea IMC = peso in kg / (altezza in m)^2
0 = IMC <19
1 = 19 ≤ IMC < 21
2 = 21 ≤ IMC < 23
3 = IMC ≥ 23 ☐

Valutazione di screening ☐☐
(totale parziale max.14 punti)

12-14 punti: stato nutrizionale normale
8-11 punti: a rischio di malnutrizione
0-7 punti: malnutrito

Per una valutazione più approfondita, continuare con le domande G-R

Valutazione globale

G Il paziente vive autonomamente a domicilio?
1 = sì 0 = no ☐

H Prende più di 3 medicinali al giorno?
0 = sì 1 = no ☐

I Presenza di decubiti, ulcere cutanee?
0 = sì 1 = no ☐

J Quanti pasti completi prende al giorno?
0 = 1 pasto
1 = 2 pasti
2 = 3 pasti ☐

K Consuma?
- Almeno una volta al giorno dei prodotti lattiero-caseari? sì ☐ no ☐
- Una o due volte la settimana uova o legumi? sì ☐ no ☐
- Ogni giorno della carne, del pesce o del pollame? sì ☐ no ☐

0.0 = se 0 o 1 sì
0.5 = se 2 sì
1.0 = se 3 sì ☐.☐

L Consuma almeno due volte al giorno frutta o verdura?
0 = no 1 = sì ☐

M Quanti bicchieri beve al giorno? (acqua, succhi, caffé, té, latte...)
0.0 = meno di 3 bicchieri
0.5 = da 3 a 5 bicchieri
1.0 = più di 5 bicchieri ☐.☐

N Come si nutre?
0 = necessita di assistenza
1 = autonomamente con difficoltà
2 = autonomamente senza difficoltà ☐

O Il paziente si considera ben nutrito? (ha dei problemi nutrizionali)
0 = malnutrizione grave
1 = malnutrizione moderata o non sa
2 = nessun problema nutrizionale ☐

P Il paziente considera il suo stato di salute miglioreo peggiore di altre persone della sua età?
0.0 = meno buono
0.5 = non sa
1.0 = uguale
2.0 = migliore ☐.☐

Q Circonferenza brachiale (CB, cm)
0.0 = CB < 21
0.5 = CB ≤ 21 CB ≤ 22
1.0 = CB > 22 ☐.☐

R Circonferenza del polpaccio (CP in cm)
0 = CP < 31
1 = CP ≥ 31 ☐

Valutazione globale (max. 16 punti) ☐☐.☐
Screening ☐☐.☐
Valutazione totale (max. 30 punti) ☐☐.☐

Valutazione dello stato nutrizionale

24-30 da 24 a 30 punti ☐ stato nutrizionale normale
17-23.5 da 17 a 23,5 punti ☐ rischio di malnutrizione
meno 17 punti ☐ cattivo stato nutrizionale

Ref. Vellas B, Villars H, Abellan G, et al. Overview of MNA® - Its History and Challenges. J Nut Health Aging 2006; 10: 456-465.
Rubenstein LZ, Harker JO, Salva A, Guigoz Y, Vellas B. Screening for Undernutrition in Geriatric Practice: Developing the Short-Form Mini Nutritional Assessment (MNA-SF). J. Geront 2001; 56A: M366-377.
Guigoz Y. The Mini-Nutritional Assessment (MNA®) Review of the Literature – What does it tell us? J Nutr Health Aging 2006; 10: 466-487.
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Materiale didattico n. 04

Foglio 2

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Mini Nutritional Assessment

MNA®

Foglio 2

Nestlé NutritionInstitute

Cognome: Nome:

Sesso: Età: Peso, kg: Altezza, cm: Data:

Risponda alla prima parte del questionario indicando, per ogni domanda, il punteggio appropriato. Sommi il punteggio della valutazione di screening e, se il risultato è uguale o inferiore a 11, completi il questionario per ottenere una valutazione dello stato nutrizionale.

Screening

A Presenta una perdita dell' appetito? Ha mangiato meno negli ultimi 3 mesi? (perdita d'appetito, problemi digestivi, difficoltà di masticazione o deglutizione)
0 = grave riduzione dell'assunzione di cibo
1 = moderata riduzione dell'assunzione di cibo
2 = nessuna riduzione dell'assunzione di cibo ☐

B Perdita di peso recente (<3 mesi)
0 = perdita di peso > 3 kg
1 = non sa
2 = perdita di peso tra 1 e 3 kg
3 = nessuna perdita di peso ☐

C Motricità
0 = dal letto alla poltrona
1 = autonomo a domicilio
2 = esce di casa ☐

D Nell' arco degli ultimi 3 mesi: malattie acuteo stress psicologici?
0 = sì 2 = no ☐

E Problemi neuropsicologici
0 = demenza o depressione grave
1 = demenza moderata
2 = nessun problema psicologico ☐

J Quanti pasti completi prende al giorno?
0 = 1 pasto
1 = 2 pasti
2 = 3 pasti ☐

K Consuma?
- Almeno una volta al giorno dei prodotti lattiero-caseari? sì ☐ no ☐
- Una o due volte la settimana uova o legumi? sì ☐ no ☐
- Oni giorne della carne, del pesce o del pollame? sì ☐ no ☐

0.0 = se 0 o 1 sì
0.5 = se 2 sì
1.0 = se 3 sì ☐.☐

L Consuma almeno due volte al giorno frutta o verdura?
0 = no 1 = sì ☐

M Quanti bicchieri beve al giorno? (acqua, succhi, caffé, té, latte...)
0.0 = meno di 3 bicchieri
0.5 = da 3 a 5 bicchieri
1.0 = più di 5 bicchieri ☐.☐

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Foglio 2

F Indice di massa corporea IMC = peso in kg / (altezza in m)^2
0 = IMC <19
1 = 19 ≤ IMC < 21
2 = 21 ≤ IMC < 23
3 = IMC ≥ 23 ☐

Valutazione di screening ☐☐
(totale parziale max.14 punti)

12-14 punti:	stato nutrizionale normale
8-11 punti:	a rischio di malnutrizione
0-7 punti:	malnutrito

Per una valutazione più approfondita, continuare con le domande G-R

Valutazione globale

G Il paziente vive autonomamente a domicilio?
1 = sì 0 = no ☐

H Prende più di 3 medicinali al giorno?
0 = sì 1 = no ☐

I Presenza di decubiti, ulcere cutanee?
0 = sì 1 = no ☐

N Come si nutre?
0 = necessita di assistenza
1 = autonomamente con difficoltà
2 = autonomamente senza difficoltà ☐

O Il paziente si considera ben nutrito? (ha dei problemi nutrizionali)
0 = malnutrizione grave
1 = malnutrizione moderata o non sa
2 = nessun problema nutrizionale ☐

P Il paziente considera il suo stato di salute miglioreo peggiore di altre persone della sua età?
0.0 = meno buono
0.5 = non sa
1.0 = uguale
2.0 = migliore ☐.☐

Q Circonferenza brachiale (CB, cm)
0.0 = CB < 21
0.5 = CB ≤ 21 CB ≤ 22
1.0 = CB > 22 ☐.☐

R Circonferenza del polpaccio (CP in cm)
0 = CP < 31
1 = CP ≥ 31 ☐

Valutazione globale (max. 16 punti) ☐☐.☐

Screening ☐☐.☐

Valutazione totale (max. 30 punti) ☐☐.☐

Valutazione dello stato nutrizionale

24-30 da 24 a 30 punti	☐	stato nutrizionale normale
17-23.5 da 17 a 23,5 punti	☐	rischio di malnutrizione
meno 17 punti	☐	cattivo stato nutrizionale

Ref. Vellas B, Villars H, Abellan G, et al. *Overview of MNA® - Its History and Challenges.* J Nut Health Aging 2006; 10: 456-465.
Rubenstein LZ, Harker JO, Salva A, Guigoz Y, Vellas B. Screening for Undernutrition in Geriatric Practice: *Developing the Short-Form Mini Nutritional Assessment (MNA-SF).* J. Geront 2001; 56A: M366-377.
Guigoz Y. The Mini-Nutritional Assessment (MNA®) *Review of the Literature – What does it tell us?* J Nutr Health Aging 2006; 10: 466-487.

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Guida alla compilazione del
Mini Nutritional Assessment MNA®

Nestlé Nutrition INSTITUTE

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Materiale didattico n. 05

Mauro Amato

Geriatric Nutritional Risk Index (GNRI)

$$GNRI = 1.487 \times \text{Albumina (g/L)} + 41.7 \times \text{Peso attuale/Peso ideale (kg)}$$

GNRI normale	> 100
GNRI medio	97.5-100
GNRI moderato	83.5-97.4
GNRI severo	< 83.5

Prognostic Inflammatory and Nutrional Index (PINI)

$$PINI = [\text{PCR (mg/L)} \times \text{a1-Glicoprot.acida (g/L)}] \,/\, [\text{Albumina (g/L)} \times \text{Prealbumina (g/L)}]$$

↓

cut-off 25

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2.2.1. *Questionnaire-based nutritional indicators*

Ten statements describing personal and behavioral factors related to inadequate or poor quality food and nutrient intake among older persons are found in the DETERMINE Your Nutritional Health checklist. The DETERMINE check-list is developed jointly for the Nutrition Screening Initiative by the American Dietetic Association, the American Academy of Family Physicians, and the National Council on Aging in the United States to aid health professionals and providers of nutritional support services in identifying older adults at-risk for malnutrition. The checklist includes 10 yes/no statements: Not enough money to buy needed food, Eat alone most of the time, Physically unable to shop, cook and/or feed myself, Tooth or mouth problem causes difficulty eating, Fewer than 2 meals eaten per day, Few milk products (less than once a day), Few fruits or vegetables (less than 2 portions per day), Unintended loss of 10 lbs/4 kg or more in last 6 months, Illness/condition that changes kind/amount of food eaten, Take 3 or more different drugs a day, Alcohol: 3 or more drinks almost every day.

2.2.2. *Blood nutritional indicators*

Serum albumin, hemoglobin, total cholesterol and lymphocyte count were measured using standard clinical laboratory methods in an accredited hospital laboratory (National University Hospital National Reference Laboratory). Low values of the blood nutritional markers were based on documented cutoffs associated with increased mortality risk: hemoglobin or anemia [21–24] (Hb <12 g/L in female, <13 g/L in male according to WHO criteria for anemia), low lymphocyte counts [25] (<1200/mm^3), low total cholesterol, (26–28) (<4.14 mmol/L), and low albumin [26–28] (<40 g/L). We used a higher cutoff for low albumin in accordance with a prior study that documented its association with increased mortality among Japanese older persons [26].

ENIGMA

Elderly Nutritional Indicators for Geriatric Malnutrition Assessment

Questionario con checklist di 10 domande si/no
(simili MNA)

- **Emoglobina**
- **Linfociti**
- **Albumina**
- **Colesterolo totale**

(valori di cut-off già visti)

Sommatoria punteggi= score totale (0-10)

Enpab webinar

Mauro Amato

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journal homepage: http://www.clinicalnutritionespen.com

Original article

Elderly Nutritional Indicators for Geriatric Malnutrition Assessment (ENIGMA): Development and validation of a nutritional prognostic index

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SUMMARY

Background: Few nutritional measurement tools have been validated that predict long-term mortality risks in community-living older persons.
Objective: To develop and validate a new nutritional prognostic index (ENIGMA) for use in geriatric outpatient or primary care.
Design: We developed the ENIGMA (four questions: unable to shop, cook or feed one's self, difficulty eating due to oral problem, eat few fruits or vegetables, 3 or more drugs a day, and four blood indicators: low albumin, hemoglobin, total cholesterol and lymphocyte count), and evaluated its predictive validity for 10 years mortality outcome in a development cohort (N = 1550) of community-living older persons, in comparison with the Geriatric Nutritional Risk Index (GNRI), Mini Nutritional Assessment (MNA) and ESPEN Malnutrition (ESPEN-M), and calibrated it externally in a validation cohort (N = 924).
Results: In the development cohort, ENIGMA component indicators and summary risk score (0–10) were independently associated with significantly increased mortality hazard ratio (HR), adjusted for age, sex, chronic diseases, comorbidity and inflammatory status. Increasing risk categories predicted increasing adjusted HRs (95% CI): low (0–1): reference, moderate (2–3): 1.48 (1.10–2.00), high (4–5): 2.32 (1.52–3.55), very high (6+): 4.97 (2.52–9.77). ENIGMA showed better discriminatory accuracy (C = 0.67, 95% CI = 0.63–0.71) than MNA (C = 0.59, 95% CI = 0.55–0.63), GNRI (C = 0.57, 95% CI = 0.52–0.61), and ESPEN-M (C = 0.52, 95% CI = 0.48–0.56). The predictive accuracy and utility of ENIGMA was supported in the validation cohort (C = 0.68, 95% CI = 0.62–0.74); calibration-at-large, a = 0.00007, p = 0.187; calibration slope = 0.997, 95% CI, 0.997–0.998).
Conclusion: The ENIGMA is a validated nutritional prognostic tool that strongly predicts long-term mortality risks and is recommended for use in geriatric outpatient and primary care settings.

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Materiale didattico n. 06

Mauro Amato

VCMC
Victorian Cancer Malnutrition Collaborative

Malnutrition Screening Tool[1] (MST)

ENGLISH

This is a Malnutrition Screening Tool which helps us to know more about your weight and the food you eat. Malnutrition can cause you to lose muscle and take longer to recover.

Your answers to the questions in the tool will tell us how we can help you to reduce your risk of malnutrition. Please choose the answers that apply to you.

Question 1. Within the last 6 months, have you lost weight without trying?	**No**	0	☐
	Not sure	2	☐
	Yes: *If yes, how much weight have you lost?*		
	1 to 5kgs	1	☐
	6 to 10kgs	2	☐
	11 to 15kgs	3	☐
	More than 15kgs	4	☐
	I have lost weight but not sure how much	2	☐
Question 2. Have you been eating less food than usual because you have not been hungry?	**No**	0	☐
	Yes	1	☐
Add your score from question 1 and question 2	**TOTAL MST score=**		

MST score 0-1

Your score shows you are at low risk of malnutrition.

If you do start to lose weight or eat less than usual you might become at risk of malnutrition. If this happens make sure you tell your doctor or nurse

MST score 2

Your score shows you might be at risk of malnutrition.

You need to talk to your doctor or nurse about your weight and eating as you might need to see a nutrition specialist, called a dietitian.

MST score 3-5

Your score shows you are at risk of malnutrition.

You need to see a nutrition specialist, called a dietitian. You can ask your doctor or nurse to refer you to a dietitian.

Peter Mac
wcmics
VICTORIA State Government

Enpab webinar

Strumento di **screening rapido a due domande** con punteggio su 5

Destinato all'uso da parte di personale che si prende cura di **persone anziane**

Materiale didattico n. 07
Manuale

Mauro Amato

SERVIZIO SANITARIO REGIONALE
EMILIA-ROMAGNA
Azienda Unità Sanitaria Locale di Piacenza

Malnutrition Universal Screening Tool (MUST)

Cognome	Nome	dn	data	reparto

STEP 1			STEP 2			STEP 3	
BMI Kg/m²		+	Decremento ponderale ultimi 3 mesi (P.abituale-P. attuale)/P.abituale x100		+	**Effetti malattia acuta***	
	Punti		%	Punti		Se il pz è affetto da malattia acuta e si è verificato o si prevede per almeno 5 gg un introito nutrizionale insufficiente	Punti
> 20	0		< 5%	0			2
18,5-20	1		5-10%	1			
< 18,5	2		>10%	2			

STEP 4 (STEP 1+ STEP 2+ STEP 3)	Valutazione globale del rischio di malnutrizione	Rischio di malnutrizione	Punti
		Basso	0
		Medio	1
		Alto	≥ 2

STEP 5	PUNTI 0	PUNTI 1	PUNTI ≥ 2
	Basso rischio di malnutrizione	Medio rischio di malnutrizione	Alto rischio di malnutrizione
	ASSISTENZA DI ROUTINE ripetere lo screening se le condizioni del paziente cambiano e: – in ospedale settimanalmente - nelle strutture: mensilmente - in comunità: annualmente per pz di età > 75 anni	**OSSERVAZIONE** • Documentare assunzione dietetica per 3 gg. • Se assunzione dietetica è adeguata o incrementata non si adottano misure cliniche • Se l'assunzione non è incrementata si applicano le procedure previste per lo score ≥ 2 • Ripetere lo screening settimanalmente, mensilmente in struttura, ogni 2-3 mesi in comunità	**TRATTAMENTO** • Documentare assunzione dietetica per 3 gg • Migliorare/incrementare l'intake nutrizionale ** • Monitorare e rivedere il piano di cura (1volta /settimana ospedale, 1volta /mese struttura e comunità) • Eventuale consulenza dietista/TN

*Per malattia acuta si intende un quadro clinico infiammatorio e non per il quale si prevede un aumentato fabbisogno nutrizionale
* *il piano nutrizionale va rivalutato 1 volta alla settimana

Malnutrition Universal Screening Tool (MUST)

↓

strumento di screening in cinque fasi per identificare gli adulti a rischio di malnutrizione

Enpab webinar

http://www.ausl.pc.it/dedicato/nutrizione_artificiale/doc/All%208.1%20Malnutrition%20Universal%20Screening%20Tool%20MUST%202013.pdf

Mauro Amato

BAPEN

www.bapen.org.uk

Enpab webinar

LIBRETTO INFORMATIVO DEL 'MUST'

Guida al 'Malnutrition Universal Screening Tool' ('MUST': 'Strumento di screening universale della malnutrizione') per adulti

MAG

Malnutrition Action Group
A Standing Committee of BAPEN

Materiale didattico n. 08

Manuale

Mauro Amato

Clinical Nutrition xxx (2018) 1–38

Contents lists available at ScienceDirect

Clinical Nutrition

journal homepage: http://www.elsevier.com/locate/clnu

ESPEN Guideline

ESPEN guideline on clinical nutrition and hydration in geriatrics

Dorothee Volkert [a,*], Anne Marie Beck [b], Tommy Cederholm [c], Alfonso Cruz-Jentoft [d], Sabine Goisser [e], Lee Hooper [f], Eva Kiesswetter [a], Marcello Maggio [g,h], Agathe Raynaud-Simon [i], Cornel C. Sieber [a,j], Lubos Sobotka [k], Dieneke van Asselt [l], Rainer Wirth [m], Stephan C. Bischoff [n]

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Linee guida ESPEN
Nutrizione Clinica e Idratazione geriatrica

Materiale didattico
n. 10

Mauro Amato

Journal of
Clinical Medicine

MDPI

Review

Management of Malnutrition in Older Patients—Current Approaches, Evidence and Open Questions

Dorothee Volkert [1,*], Anne Marie Beck [2,3], Tommy Cederholm [4,5], Emanuele Cereda [6], Alfonso Cruz-Jentoft [7], Sabine Goisser [8], Lisette de Groot [9], Franz Großhauser [1], Eva Kiesswetter [1], Kristina Norman [10,11,12], Maryam Pourhassan [13], Ilse Reinders [14], Helen C. Roberts [15], Yves Rolland [16], Stéphane M. Schneider [17], Cornel C. Sieber [1,18], Ulrich Thiem [19], Marjolein Visser [14], Hanneke A.H. Wijnhoven [14] and Rainer Wirth [13]

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check for updates

Gestione della Malnutrizione nell'anziano

Materiale didattico n. 11

Mauro Amato

MAG
Malnutrition Action Group
A Standing Committee of BAPEN

Guida pratica all'uso del MUST in pandemia da COVID-19

BAPEN

Practical guidance for using 'MUST' to identify malnutrition during the COVID-19 pandemic
Malnutrition Action Group (MAG) update

The detection and management of malnutrition in patients with Covid-19 is of fundamental importance. Malnutrition is likely to be a common problem due to a wide range of reasons. These include: the physiological effects of the SARS-CoV-2 infection on the body; the effects of management strategies required (e.g. ventilation, NIV/CPAP), which vary depending on the severity of the illness; the many challenges that arise from such a pandemic, which can restrict physical access to patients by HCPs and carers due to infection control impacting the ability to identify and treat nutritional issues, and an impact on free living individuals ability to purchase food, exercise and socialise.

The consequences of disease-related malnutrition, although not yet documented in this specific patient group, are well known and include: impaired immune function, reduced respiratory and skeletal muscle strength, effects on psychological function, and impaired recovery with poorer clinical outcomes (higher mortality) and longer stays in hospital/greater health care use and costs.

Effective nutritional support, as required to manage patients at risk of malnutrition, is known to improve nutritional intake, status, functional and clinical outcomes, from the intensive care setting through to those living in their own homes in a wide variety of patient groups (although data in patients with Covid-19 is awaited).

Materiale didattico n. 09

Contents lists available at ScienceDirect

Clinical Nutrition

journal homepage: http://www.elsevier.com/locate/clnu

Original article

Malnutrition and nutritional therapy in patients with SARS-CoV-2 disease

Loris Pironi [a, b, *], Anna Simona Sasdelli [a, b], Federico Ravaioli [a, b], Bianca Baracco [a, b], Claudia Battaiola [a, b], Giulia Bocedi [a, b], Lucia Brodosi [a, b], Laura Leoni [a, b], Giulia Aurora Mari [a, b], Alessandra Musio [a, b]

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Covid19/Malnutrizione e Terapia Nutrizionale

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COVID-19
Malnutrition
Nutritional therapy
NRS-2002
GLIM

SUMMARY

Rationale: The prevalence of malnutrition and the provided nutritional therapy were evaluated in all the patients with SARS-CoV-2 infection (COVID-19) hospitalized in a 3rd level hospital in Italy.

Methods: A one-day audit was carried out recording: age, measured or estimated body weight (BW) and height, body mass index (BMI, kg/m^2), 30-day weight loss (WL), comorbidities, serum albumin and C-reactive protein (CRP: nv < 0.5 mg/dL), hospital diet (HD) intake, oral nutritional supplements (ONS), enteral (EN) and parenteral nutrition (PN). Modified NRS-2002 tool and GLIM criteria were used for nutritional risk screening and for the diagnosis of malnutrition, respectively.

Results: A total of 268 patients was evaluated; intermediate care units (IMCUs, 61%), sub-intensive care units (SICUs, 8%), intensive care units (ICUs, 17%) and rehabilitation units (RUs, 14%): BMI: <18.5, 9% (higher in RUs, $p = 0.008$) and ≥30, 13% (higher in ICUs, $p = 0.012$); WL ≥ 5%, 52% (higher in ICUs and RUs, $p = 0.001$); CRP >0.5: 78% (higher in ICUs and lower in RUs, $p < 0.001$); Nutritional risk and malnutrition were present in 77% (higher in ICUs and RUs, $p < 0.001$) and 50% (higher in ICUs, $p = 0.0792$) of the patients, respectively. HD intake ≤50%, 39% (higher in IMCUs and ICUs, $p < 0.001$); ONS, EN and PN were prescribed to 6%, 13% and 5%, respectively. Median energy and protein intake/kg BW were 25 kcal and 1.1 g (both lower in ICUs, $p < 0.05$) respectively.

Conclusions: Most of the patients were at nutritional risk, and one-half of them was malnourished. The frequency of nutritional risk, malnutrition, disease/inflammation burden and decrease intake of HD differed among the intensity of care settings, where the patients were managed according to the severity of the disease. The patient energy and protein intake were at the lowest limit or below the recommended amounts, indicating the need for actions to improve the nutritional care practice.

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Materiale didattico n. 12

Mauro Amato

International Journal of
Molecular Sciences

MDPI

Ruolo gestione nutrizionale/Miglioramenti risultati in covid19

Hypothesis

Functional Role of Dietary Intervention to Improve the Outcome of COVID-19: A Hypothesis of Work

Giovanni Messina [1,*], Rita Polito [1], Vincenzo Monda [2], Luigi Cipolloni [1], Nunzio Di Nunno [3], Giulio Di Mizio [4], Paolo Murabito [5], Marco Carotenuto [6], Antonietta Messina [2], Daniela Pisanelli [1], Anna Valenzano [1], Giuseppe Cibelli [1], Alessia Scarinci [7], Marcellino Monda [2,*] and Francesco Sessa [1]

Lavoro interuniversitario

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Materiale didattico n. 13

https://www.eatrightpro.org/practice/practice-resources/clinical-malnutrition

Topics

- Continuing Professional Education +
- Quality Management +
- Dietetics Resources -
  - Chronic Disease and Wellness
  - Clinical Malnutrition
  - Diversity and Inclusivity
  - Food Security and Sustainability
  - Foodservice
  - Global Food and Nutrition Resource Hub

Clinical Malnutrition

Registered dietitian nutritionists have the opportunity and responsibility to be at the forefront of the prevention and treatment of malnutrition. The evidence-based tools and resources below, enable RDNs and NDTRs to screen and assess, diagnose and treat malnutrition across the healthcare continuum.

Malnutrition Quality Improvement Initiative

The Malnutrition Quality Improvement Initiative is a project of the Academy of Nutrition and Dietetics, Avalere Health, and other stakeholders who provided guidance and expertise through a collaborative partnership. The Academy of Nutrition and Dietetics and Abbott provides support for the MQii. The Academy collaborates with MQii partners and engages stakeholders to discuss malnutrition quality improvement and care transitions documented in Dialogue Proceedings. The MQii Toolkit provides practical, interdisciplinary tools and resources to help hospitals implement malnutrition best practices and adopt eCQMs to measure their success in meeting the standards of care.

Electronic Clinical Quality Measures
The Academy is a measure steward of four malnutrition electronic clinical quality measures. These four measures aim to promote appropriate screening, assessment, diagnosis and intervention with development of a care plan for malnourished adults in order to improve patient outcomes. Find out the what, who, when, why and how on eCQMs by reviewing the FAQs.

Malnutrition Quality Measures included in QCDRs
The Centers for Medicare & Medicaid Services has approved inclusion of new Malnutrition Quality

Mauro Amato

Table 1. Anthropometric parameters and biomarkers in various nutritional assessment and screening tools (adapted from [3] with an update, in chronological order of publication.

Nutritional Assessment and Screening Tool	Anthropometric Parameters and History	Biomarkers
Prognostic Nutritional Index [6]	Triceps skin fold	Albumin, transferrin, skin sensitivity
Prognostic Inflammatory and Nutritional Index [7]	None	Albumin, prealbumin, C-reactive protein, α1-acid glycoprotein
Subjective Global Assessment (SGA) [8]	Weight history, diet history, primary diagnosis, stress level, physical symptoms (s.c. fat, muscle wasting, edema), functional capacity, gastrointestinal symptoms	None
Birmingham Nutrition Risk Score [9]	Weight loss, BMI, appetite, ability to eat, stress factor, (severity of diagnosis)	None
Nutrition Risk Classification [10]	Weight loss, percentage ideal body weight, dietary intake, gastrointestinal function	None
Mini Nutritional Assessment (MNA; [11]	Weight data, height, mid-arm circumference, calf circumference, diet history, appetite, feeding mode	Albumin, prealbumin, cholesterol, lymphocyte count
Malnutrition Screening Tool [12]	Appetite, unintentional weight loss	None
Simple Screening Tool [13]	Body mass index (BMI), percentage weight loss	Albumin
Full nutritional assessment [14]	BMI, information on unintended weight loss, triceps skinfold thickness, mid-arm muscle circumference	Serum albumin, prealbumin, and total lymphocyte count
Malnutrition Universal Screening Tool (MUST) [15]	BMI, change in weight, presence of acute disease	None
Nutritional Risk Screening (NRS) 2002 [1]	Weight loss, BMI, food intake, diagnosis (severity)	None
Short Nutrition Assessment Questionnaire [16]	Recent weight history, appetite, use of oral supplement or tube feeding	None
Controlling nutritional status (CONUT) [17]	None	Serum albumin, total cholesterol and total lymphocyte count
Maastricht Index [18]	Percentage ideal body weight	Albumin, prealbumin, lymphocyte count
Nutritional Risk Index [19]	Present and usual body weight	Albumin
Elderly Nutritional Indicators for Geriatric Malnutrition Assessment (ENIGMA) [20]	Nutritional history	Albumin, hemoglobin, total cholesterol and lymphocyte count

Mauro Amato

J. Clin. Med. ***2019***, *8*, *775*; *doi:10.3390/jcm8060775*

Minerali Macroelementi	Funzioni più importanti	Test	Valori riferimento	Livelli aumentati	Livelli diminuiti
Calcio totale	99% depositato in **ossa, unghie e denti** di cui ne **consente stabilità.**	**Colorimetr.**	Adulti **8.5-10.4** mg/dl Bambini **9.5-11.5** mg/dl	**Disidratazione**, iperparatiroid., **ipervitaminosi D**, Addison, neoplas.	**Malnutrizione**, **malassobirmento**, **deficit vitD**, insuffic. renale, ipoparatiroid.
Calcio Ionizzato (frazione libera)	Frazione attiva per: **coagulazione, eccitabilità** neuro muscolare, **cofattore** reazioni enzimatiche, **sistema endocrino**	**ISE**	**4.5-5.4** mg/dl	**Iperparatiroidis.**, sindr. milk-alkali, **ipercalcemia**	**Malnutrizione**, **malassobirmento calcio**, **deficit di vit. D**, deficit di magnesio, pancreatite, insufficienza renale
Fosforo (fosfato inorganico)	**Acidi nucleici**, fosfolipidi **integrità membrane cell.**, ossa, **regolatore acidità**, esalta **attiv. antiossidanti**	**Colorimetr.**	Adulti **2.4-4.9** mg/dl Bambini **4.0-6.8** mg/dl **CaxP** Adulti **35-40** Bambini **40-55**	Ipervitaminosi D, **disidratazione**, **iperparatiroid.** acromegalia, morbo di Addison	**Malnutrizione**, **malassorbimento**, **deficit vit. D**, insufficienza renale, ipoparatiroidismo
Potassio	Catione intracellulare, **eccitabilità neuro muscolare**, **ritmicità** del **cuore**, **sintesi proteica**, **equilibrio acido-base**, **scambi gassosi Glob. rossi**	**ISE**	Sierico **3.5-5.0** mEq/l Urinario **25-125** mEq/24h	**Iposurrenalismo**, **disidratazione**, **nefriti**, esercizio fisico anaerobico	Ipersurrenalismo, **occlusioni**, **malattie intestinali**, **acidosi**, mixedema, sudoraz. diuretici, **ipercatabolismo prot.**
Sodio	Catione extracellulare, controllo dei liquidi **osmosi**, variazioni della **pressione arteriosa** legata alla **sua concentrazione** controllata da Aldosterone.	**ISE**	Sierico **135-152** mEq/l Urinario **45-220** mEq/24h	**Dieta**, nefriti, **disidratazione**, aldosteronismo, **edema**	**Disordini endocrini**, **occlusioni intestinali**, mixedema, diuretici
Cloro	Anione extracellulare per **equilibrio idro-elettrolitico normale osmolarità** e **volemia**, succhi gastrici	**Colorimetr.**	Sierico **97-108** mEq/l Urinar. **150-250** mEq/24h	**Disidratazione** e diarea, insuffic. renale e **sindr. nefrosica**	**Vomito prolungato**, **ustioni**, **stati allergici**, **Alcalosi metabolica**, **acidosi respiratoria**
Magnesio	Catione intracellulare imp. per oltre **300 processi**, **utilizzo dell'energia**, trasmissione **impulso nerv.**, **attività muscolare**, import. **equilibrio con il calcio**	**Colorimetr.**	Adulti **2.4-4.9** mg/dl Bambini **4.0-6.8** mg/dl Urinar. **350-1250** mg/24h	**Iperparatiroid.**, **insufficien.renal** ipotiroidismo, morbo Addison	**Malnutrizione e malassorbimento**, diabete scompensato, diuretici, ipoparatiroi. **Sintomi: debolezza**, **irritabilità**, alter. ECG

Minerali Microelementi	Funzioni più importanti	Test	Valori riferimento	Livelli aumentati	Livelli diminuiti
Iodio	**Sintesi T3 T4**, prevenzione tireopatie, monitoraggio Amiodarone	**Spettrometria di massa**	**40 – 92** ng/ml	Rari per **escrezione urinaria eccesso**	**Malnutrizione**, **malassorbimento**, **gozzo ipotiroideo**, **obesità**, malattie congenite, **perdita elasticità arterie**
Rame	Veicolato da ceruloplasmina è importante per **crescita** ed **eritropoiesi**, **indice aspecifico di flogosi**, diagnosi **Morbo Wilson**	**Spettrometria di massa Colorimetrico**	**65 – 145** ug/dl	**Infarto** miocardico, **cirrosi** epatica, ittero ostruttivo, **Leucemia**, **Morbo di Hodgkin**	**Deficit nutrizionali**, **celiachia**, ustioni, **morbo di Wilson**, sindrome nefrosica
Zinco	**Cofattore** importante per **anidrasi carbonica**, **DNA e RNA polimerasi**, **fosfatasi alcalina** e altre proteine, **guarigione ferite**	**Spettrometria di massa Colorimetrico**	**65 – 120** ug/dl	**Assunzione eccessiva** (integrazione): reazioni tossiche, nausea, diarrea	**Malnutrizione**, **malassorbimento** (**MICI**), ustioni, **eccesso fitati** dieta, neoplasie, cirrosi ep.
Manganese	**Antiossidante** (superossido dismutasi), metabolismo **Colina**, **Biotina**, **Tiamina**, **vit. C**, catalizzatore **sintesi acidi grassi**, **colesterolo**, **mucopolissaccaridi**. Importante sintesi **ormoni sessuali**, **protrombina**, **vit. K** e funz. **sistema immunitario**	**Spettrometria di massa**	**< 2.4** ng/ml	**Inalazioni** da produzioni industriali, **eccessiva integrazione**	**Malnutrizione**, **malassorbimento**. **Conseguenze**: **Intolleranza glucosio**, **atassia** e paralisi, **convulsioni**, epilessia, **sindrome nefrosica**

Mauro Mario Amato
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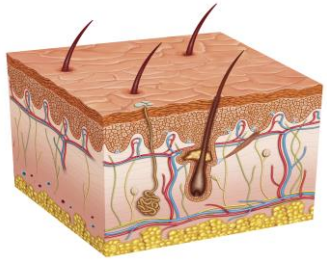
VITAMINA D

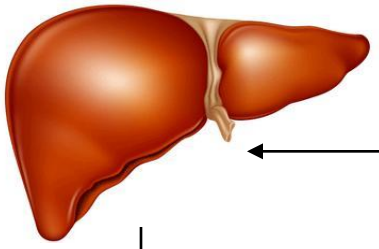
metabolismo

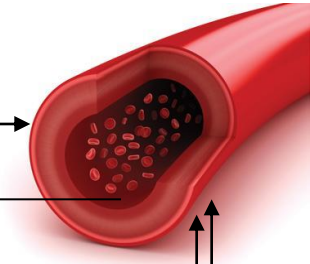
Melanina
Protezione solare
Latitudine
Inverno

UVB



7-deidrocolesterolo (pro-D3) → **pre-D3** —calore→ **Vitamina D3 (85%)**





DPB
Lipoproteine
Albumina

D2/D3

25(OH)D3

25(OH)D

feed-back

1,25(OH)2D3
calcitriolo
biologicamente attivo

PTH
Calcio
Fosforo

indicatore dello status della vit.D

serie di altre attività

Dosaggio Immunochimico

(15%) **Vitamina D2**
ergocalciferolo

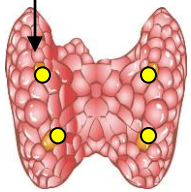
Vitamina D3
colecalciferolo

Assorbimento
Ca e **P**
facilitato **Mg**

PTH

Deficit fino a **18 ng/ml**
Ipovitaminosi fino **29 ng/ml**
Desiderabili **30-80 ng/ml**

Secrezione
PTH



Modulazione
metabolismo
osseo

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Tabella 1. Cut-off proposti a livello internazionale negli ultimi 10 anni per la definizione dello stato vitaminico D in base ai livelli circolanti di 25(OH)D.

	25(OH)D			
	Deficit grave	**Deficit**	**Insufficienza**	**Sufficienza**
Canadian Pediatric Society (2007)	-	< 10 ng/ml	10-29 ng/ml	≥ 30 ng/ml
Lawson Wilkins Pediatric Endocrine Society (Misra 2008)	< 5 ng/ml	5-14 ng/ml	15-19 ng/ml	≥ 20 ng/ml
Institute of Medicine (2011)	-	< 20 ng/ml	-	≥ 20 ng/ml
Endocrine Society (Holick 2011)	-	< 20 ng/ml	20-29 ng/ml	≥ 30 ng/ml
SIOMMMS (Adami 2011)	-	< 20 ng/ml	20-29 ng/ml	≥ 30 ng/ml
British Paediatric and Adolescent Bone Group (Arundel 2012)	-	< 10 ng/ml	10-19 ng/ml	≥ 20 ng/ml
Francia (Vidailhet 2012)	-	< 20 ng/ml	-	≥ 20 ng/ml
Spagna (Martínez Suárez 2012)	-	< 20 ng/ml	-	≥ 20 ng/ml
Svizzera (2012)	< 10 ng/ml	< 20 ng/ml	-	≥ 20 ng/ml
ESPHGAN 2013 (Braegger 2013)	< 10 ng/ml	< 20 ng/ml	-	≥ 20 ng/ml
Europa Centrale (Płudowski 2013)	-	< 20 ng/ml	20-29 ng/ml	≥ 30 ng/ml
Society for Adolescent Health and Medicine (2013)	-	< 20 ng/ml	20-29 ng/ml	≥ 30 ng/ml
Australia/Nuova Zelanda (Paxton 2013)	< 5 ng/ml	5-11 ng/ml	12-19 ng/ml	≥ 20 ng/ml
AAP (AAP 2012, Golden 2014)	-	< 20 ng/ml	-	≥ 20 ng/ml

SIPPS – Consensus Vit. D 2015

Mauro Amato

Carenza di VITAMINA D

Melanina
Protezione solare
Latitudine
Inverno

Cause

Farmaci e Integratori
- Anticonvulsivanti
- Rifampicina
- Glicocorticoidi
- Antiretrovirali

Malassorbimento
- Morbo di Chron
- Fibrosi Cistica
- Celiachia
- Morbo di Whipple
- Malattie Epatiche

Malnutrizione

Sindrome Nefrosica

Insufficienza Renale

Insufficienza Epatica

Obesità

Conseguenze

Depressione
Disordini psicotici

Infezioni
- Vie aeree superiori
- Tubercolosi

Diminuzione pervietà grandi vie aeree
Asma
Broncopneumopatia

Diabete mellito 2
Preeclampsia
Taglio cesareo
Dolori muscolari
Debolezza muscolare
Osteoartrite
Osteoporosi
Dolore osseo
Rachitismo
Cancro
Infertilità

Malattie Autoimmuni
- Diabete mellito 1
- Morbo di Chron
- Sclerosi multipla
- Artrite reumatoide
- Psoriasi

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ACIDO FOLICO e FOLATI (VITAMINA B9)

I due termini vanno distinti anche se spesso sono usati come sinonimi:

- **Folato** è riferito alla vitamina nella **forma naturale presente negli alimenti**.
- **Acido Folico** indica la **forma ossidata** della vitamina e **identifica la molecola di sintesi presente nei formulati vitaminici** e in aggiunta agli alimenti fortificati.

Fondamentale, **insieme alla B12**, per la **sintesi del DNA** e dell'**emoglobina** è anche importante per la **differenziazione dei tessuti embrionali**.

Acido folico essenziale nella **prevenzione** di alcune **malformazioni congenite del tubo neurale** e forse anche nella prevenzione di altri difetti congeniti come la labio-palatoschisi e alcuni danni cardiaci.

A dosaggi ottimali, insieme alla vit. B12, tende a mantenere nei livelli di guardia l'**omocisteina** il cui aumento è associato al rischio per diverse patologie.

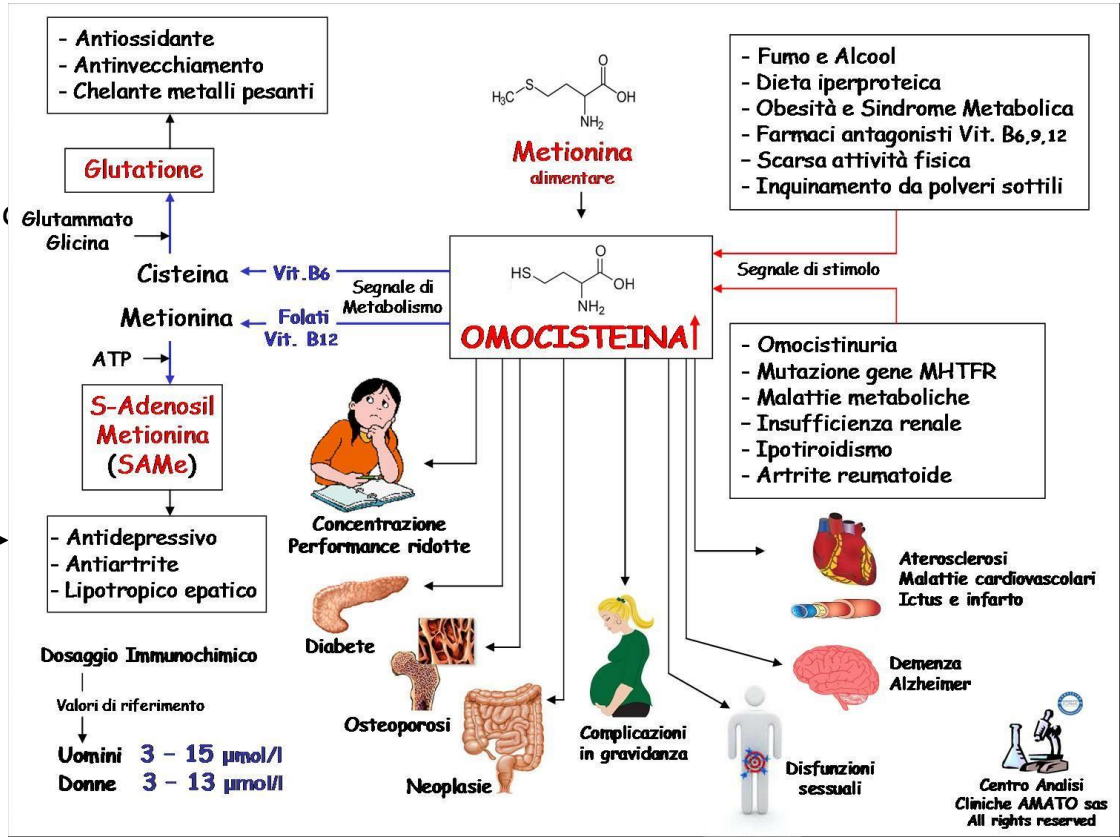
Livelli aumentati:
- Assunzione eccessiva (integratori)

Livelli diminuiti:
- Dieta insufficiente
- Malassorbimento
- Gravidanza e alcolismo
- Uso di estroprogestinici
- Chemioterapia
- Epatopatie acute e croniche

Dosaggio Immunochimico

valori di riferimento

3.0 - 17.0 ng/ml



VITAMINA B12 (Cobalamina)

Gruppo di sostanze contenenti **cobalto** essenziali soprattutto per:
- **Emopoiesi**
- **Sintesi del DNA**
- **Sintesi della Mielina**

Diverse sono inoltre le funzioni che la Vit. B12 condivide con l'Acido Folico, tanto che i loro dosaggi sono spesso richiesti insieme.
Le fonti sono:
- Essenzialmente con l'Alimentazione
- Parte metabolismo batterico intestinale

Livelli aumentati:
- Leucocitosi
- Patologie Mieloproliferative
- Epatopatie virali/tossiche

Livelli diminuiti:
Insufficiente apporto alimentare
Malassorbimento:
- Ipo o acloridria gastrica
- Deficit di fattore intrinseco (**anemia perniciosa**)
- Morbo di Chron/Celiachia
- Resezioni gastrointestinali
- Acido Amminosalicilico

Uso prolungato di **Metformina**
Alcolismo e **Gravidanza**
Parassitosi intestinale

Anemia megaloblastica (**Macrocitosi**)
Disturbi cognitivi e nervosi

Dosaggio Immunochimico

valori di riferimento

200 - 780 pg/ml

Metabolismo

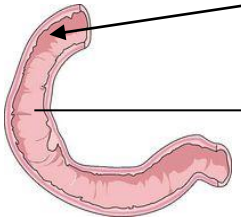
Alimenti-vit.B12

Aptocorrina (Proteina R)

Centro Analisi Cliniche AMATO sas

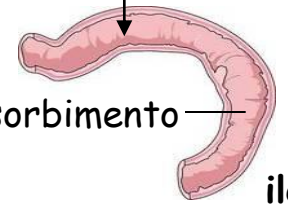
Fattore intrinseco (IF)

Complesso B12-Aptocorrina



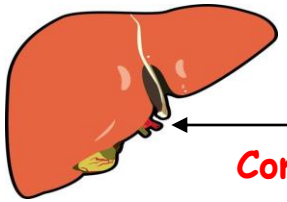
duodeno

Complesso Cbl-IF



ileo

assorbimento



assorbimento

ComplessoTCII-B12 (HoloTC)

Transcobalamina I (TCI) → **in circolo**

Vitamina B12 totale e Vitamina B12 attiva

HoloHC
(Oloaptocorrina)

rappresenta il **70-90% della vitamina B12 circolante** ma **biologicamente inerte**

HoloTC
(Olotranscobalamina)

10-30% della vitamina B12 circolante **biologicamente attiva** (essendo captabile dalle cellule)

Vit. B12 attiva

Dosaggio Immunochimico

valori di riferimento

21 - 123 pmoli/l

Con vitamina B12 totale inferiore a 300/350 è bene **dosare la forma attivata**

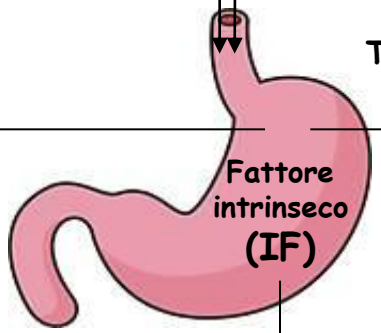
Dosaggio Immunochimico

valori di riferimento

200-780 pg/ml

Alimenti-vit.B12

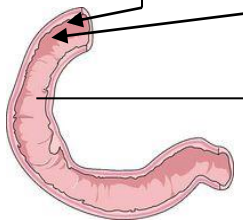
Aptocorrina (HC)



TCI (Transcobalamina I)

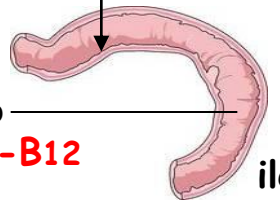
Fattore intrinseco (IF)

Complesso B12-HC (TCI-B12) (HoloHC)



duodeno

Complesso B12-IF

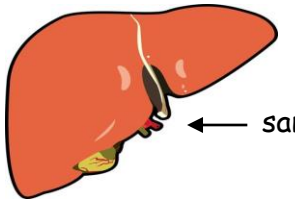


ileo

assorbimento

ComplessoTCII-B12 (HoloTC)

sangue portale



TCII (Transcobalamina II)

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BIOHIT HealthCare

Innovating for Health

BIOHIT ACTIVE B12

(HOLOTRANSCOBALAMIN)

Mauro Amato

Materiale didattico
n. 14

	Funzione	Carenza	Richiesta die	Test	Valori riferimento	Patologie associate
Vitamina B1 (Tiamina)	cofattore deidrogenasi	produzione energetica ridotta	1-1.5 mg	HPLC	70-180 nmol/l	Beri-Beri
Vitamina B2 (Riboflavina)	reazioni redox	produzione energetica ridotta	1.0-1.5 mg	HPLC	5-50 nmol/l	Arresto crescita lesioni mucose
Vitamina B3 (Niacina, PP)	cofattore deidrogenasi	produzione energetica ridotta	13-19 mg	HPLC	0.5-8.45 µg/ml	Pellagra - dermatite fotosensibiliz.
Vitamina B5 (Ac.Pantotenico)	CoA - reaz. di trasferimento	produzione energetica ridotta	6-16 mg	HPLC	37-147 µg/l	Effetti non chiari per grande diffus. Vitamina
Vitamina B6 (Piridossal-5-P)	reaz.transaminaz. glicogenolisi	produzione energetica ridotta	1,4-2,2 mg	HPLC	20-125nmol/l	Apatia, debolezza, anemia
Biotina (Vitamina H,B7)	sintesi glucosio e acidi grassi	produzione energetica ridotta	15-100 ug	HPLC	221-3000 pg/ml	Desquamazioni cutanee
Vitamina A (Retinolo)	Reg.espress.genica Pigmenti visivi, risp.immunitaria, ag. Antitumorale	Alterazioni rodopsina	0.6-0.7 mg	HPLC	32.5-78.0 µg/dl	Alterazione funzione visiva, malformaz.fetali
Vitamina E (tocoferolo)	Antiossidante, integrità cellulare	Alterazioni metabolismo	7-9 mg	HPLC	5.5-17.0 mg/l	Difetti dello sviluppo, disturbi sistema nervoso
Vitamina K	Cofattore coagulazione	Alterazione coagulazione	50-70 ug	HPLC	0.10-2.2 ng/ml	Emorragie

Grazie per la vostra attenzione

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See you soon