VII CONGRESSO NAZIONALE B&M 2018

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BRAIN AND MALNUTRITION
Chronic Diseases Association ONLUS

VII CONGRESSO NAZIONALE B&M 2018

I SESSIONE

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Medico chirurgo Specialista in Scienza dell'Alimentazione,
Ricercatore universitario confermato
Docente nel corso di Laurea Harvey in Medicina e Chirurgia,
Corso di Laurea in Dietistica e della Scuola di Specializzazione in
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BRAIN AND MALNUTRITION
Chronic Diseases Association ONLUS

VII CONGRESSO NAZIONALE B&M 2018

UPDATE SULL'UTILIZZO DELLA FIBRA NELLA SINDROME METABOLICA

HELLAS CENA

Università degli studi di Pavia

BRAIN AND MALNUTRITION
Chronic Diseases Association ONLUS

VII CONGRESSO NAZIONALE B&M

Update sull'utilizzo della fibra nella sindrome metabolica

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Dietetics and Clinical Nutrition Laboratory
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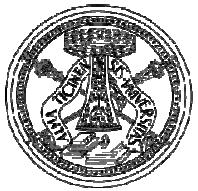


Milano, 10-11 maggio

Update sull'utilizzo della fibra nella sindrome metabolica

- Definizione fibra alimentare
- Caratteristiche ed effetti della fibra
- Assunzione raccomandata
- Ruolo della fibra nella sindrome metabolica
- Fibra, microbiota e sindrome metabolica

16 proposte di definizioni di fibra alimentare dal 1976 al 2000

TABLE 1 Definitions of Dietary Fiber

Reference	Definition
Trowell et al., 1976	Dietary fibre consists of the plant polysaccharides and lignin which are resistant to hydrolysis by digestive enzymes of man.
Health and Welfare Canada, 1985	Dietary fibre is the endogenous components of plant material in the diet which are resistant to digestion by enzymes produced by humans. They are predominantly non-starch polysaccharides and lignin and may include, in addition, associated substances.
U.S. Food and Drug Administration (USFDA), 1987	Dietary fiber is the material isolated by AOAC method 985.29 (see Table 2).
Life Sciences Research Office (LSRO), 1987	Dietary fiber is the endogenous components of plant materials in the diet which are resistant to digestion by enzymes produced by humans.
Health Canada, 1988	A novel fibre source is a food that was manufactured to be a source of dietary fibre, and that (1) had not traditionally been used for human consumption to any significant extent, or (2) had been chemically processed (e.g., oxidized) or physically processed (e.g., finely ground) so as to modify the properties of the fibre, or (3) had been highly concentrated from its plant source.
Anonymous, 1989 (Germany)	Dietary fiber is substances of plant origin, that cannot be broken down to resorbable components by the body's own enzymes in the small intestine. Included are essentially soluble and insoluble non-starch polysaccharides (cellulose, pectin, hydrocolloids) and lignin and resistant starch. Substances like some sugar substitutes, organic acids, chitin and so on, which either are not or are incompletely absorbed in the small intestine, are not included.
Anonymous, 1992 (Belgium)	Dietary fiber is the components of the foods that are normally not broken down by the body's own enzymes of humans.
Anonymous, 1993 (Italy)	Dietary fiber is the edible substance of vegetable origin which normally is not hydrolyzed by the enzymes secreted by the human digestive system.
FAO/WHO, 1995 (Codex Alimentarius Commission)	Dietary fibre is the edible plant or animal material not hydrolysed by the endogenous enzymes of the human digestive tract as determined by the agreed upon method. (The Codex also approved AOAC methods 985.29 and 991.43 [see Table 2]).

continued

TABLE 1 Continued

Reference	Definition
Jian-xian, 1995 (China)	Dietary fiber is the sum of food components that are not digested by intestinal enzymes and absorbed into the body.
Denmark, 1995[a]	Dietary fiber is the material isolated by AOAC methods 985.29 and 997.08 (see Table 2).
Ministry of Health and Welfare, 1996 (Japan)	Dietary fiber is the material isolated by the AOAC method 985.29. In addition, non-digestible, low molecular weight carbohydrate determined by high performance liquid chromatography is classified as dietary fiber.
Committee on Medical Aspects of Foods (COMA), 1998 (United Kingdom)	Dietary fibre is non-starch polysaccharide as measured by the Englyst method.
Finland, 1998[a]	Dietary fiber is part of the carbohydrate obtained when using AOAC methods 985.29 and AOAC 997.08 (see Table 2).
Norway, 1998[a]	Dietary fiber is the material isolated by AOAC method 985.29 (see Table 2) and inulin and oligofructose.
Sweden, 1999[a]	Dietary fiber is edible material that cannot be broken down by human endogenous enzymes. Dietary fiber is determined with AOAC method 985.29. In addition, the fructan AOAC method 997.08 may be used (see Table 2).
American Association of Cereal Chemists (AACC), 2000	Dietary fiber is the edible parts of plants or analogous carbohydrates that are resistant to digestion and absorption in the human small intestine with complete or partial fermentation in the large intestine. Dietary fiber includes polysaccharides, oligosaccharides, lignin, and associated plant substances. Dietary fibers promote beneficial physiological effects including laxation, and/or blood cholesterol attenuation, and/or blood glucose attenuation.
Hignett, 2000 (U.K. Food Standards Agency)	Dietary fiber is the material isolated by AOAC methods 985.29 and/or 991.43, combined with 997.08 (see Table 2).
Australia New Zealand Food Authority (ANZFA) (Proposed), 2000	Dietary fibre is that fraction of the edible part of plants or their extracts, or analogous carbohydrates, that are resistant to digestion and absorption in the human small intestine, usually with complete or partial fermentation in the large intestine. The term includes polysaccharides, oligosaccharides (degrees of polymerization >2), and lignins. Dietary fibre promotes one or more of these beneficial physiological effects: laxation, reduction in blood cholesterol, and/or modulation of blood glucose.

[a] N-G Asp, Division of Applied Nutrition, Lund University, personal communication, February 22, 2001.

AACC REPORT

[1] Report of the Dietary Fiber Definition Committee to the Board of Directors of the American Association Of Cereal Chemists. 2001

The Definition of Dietary Fiber[1]

"Dietary fiber is the edible parts of plants or analogous carbohydrates that are resistant to digestion and absorption in the human small intestine with complete or partial fermentation in the large intestine. Dietary fiber includes polysaccharides, oligosaccharides, lignin, and associated plant substances. Dietary fibers promote beneficial physiological effects including laxation, and/or blood cholesterol attenuation, and/or blood glucose attenuation."

- È la parte commestibile delle piante o carboidrati analoghi che sono **resistenti alla digestione e all'assorbimento** nell'intestino tenue umano con fermentazione completa o parziale nell'intestino crasso.
- Comprende polisaccaridi (cellulosa, emicellulose, pectine, gomme), oligosaccaridi (inulina, FOS, oligosaccaridi dei legumi), lignina e sostanze vegetali associate (tannini, fitati).
- Promuove **effetti fisiologici benefici**, tra cui effetti regolazione dell'alvo e/o modificazione del profilo lipidico e/o della glicemia.

CONSTITUENTS OF DIETARY FIBER

Non-Starch Polysaccharides and Resistant Oligosaccharides

- Cellulose
- Hemicellulose
  - Arabinoxylans
  - Arabinogalactans
- Polyfructoses
  - Inulin
  - Oligofructans
- Galactooligosaccharides
- Gums
- Mucilages
- Pectins

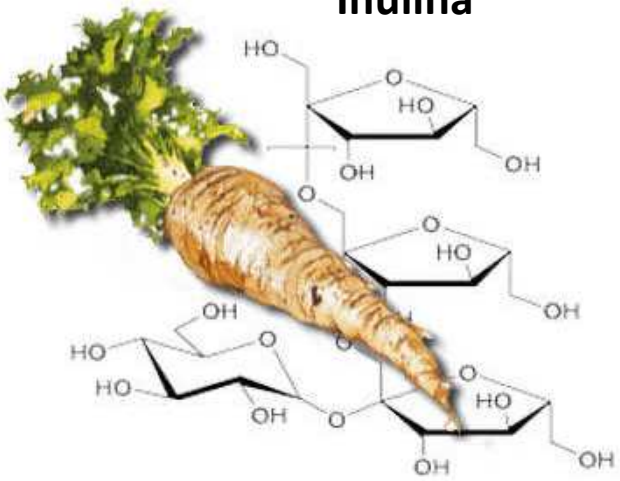
Analogous Carbohydrates

- Indigestible Dextrins[b]
  - Resistant Maltodextrins (from corn and other sources)
  - Resistant Potato Dextrins
- Synthesized Carbohydrate Compounds
  - Polydextrose
  - Methyl cellulose
  - Hydroxypropylmethyl Cellulose
- Indigestible ("resistant") Starches[c]

Lignin

Substances Associated with the Non-Starch Polysaccharide and Lignin Complex in Plants

- Waxes
- Phytate
- Cutin
- Saponins
- Suberin
- Tannins



Inulina

Glucomannano nella radice del Konjac

β-glucani nell'avena

Pectina

FIBRA INSOLUBILE	FIBRA SOLUBILE
CELLULOSA, EMICELLULOSA, LIGNINE → soprattutto negli alimenti integrali	PECTINE, GOMME, GALATTOMANNANI, MUCILLAGINI → soprattutto in frutta, verdura e legumi
• Grado di fermentabilità molto basso • Elevata proprietà igroscopica • Aumento della massa e pastosità fecale • Diminuzione del tempo di transito • Diminuzione della pressione colica intraluminale	• Grado di fermentabilità elevato (nel cieco e nel colon destro) • Incremento della massa batterica • Elevata viscosità con rallentamento del transito intestinale • Capacità di legare sali biliari e ioni • Produzione di acidi grassi a catena corta (SCFA), gas e composti minori

Il **rapporto** di assunzione consigliato tra fibra **solubile** e fibra **insolubile** è di **3:1.**

→ Mediamente l'assunzione di fibra solubile è inferiore rispetto alla insolubile.

eat right.

FROM THE ACADEMY

Position Paper

http://dx.doi.org/10.1016/j.jand.**2015**.09.003

Position of the Academy of Nutrition and Dietetics: Health Implications of Dietary Fiber

ABSTRACT

It is the position of the Academy of Nutrition and Dietetics that the public should consume adequate amounts of dietary fiber from a variety of plant foods. Dietary fiber is defined by the Institute of Medicine Food Nutrition Board as "nondigestible carbohydrates and lignin that are intrinsic and intact in plants." Populations that consume more dietary fiber have less chronic disease. Higher intakes of dietary fiber reduce the risk of developing several chronic diseases, including cardiovascular disease, type 2 diabetes, and some cancers, and have been associated with lower body weights. The Adequate Intake for fiber is 14 g total fiber per 1,000 kcal, or 25 g for adult women and 38 g for adult men, based on research demonstrating protection against coronary heart disease. Properties of dietary fiber, such as fermentability and viscosity, are thought to be important parameters influencing the risk of disease. Plant components associated with dietary fiber may also contribute to reduced disease risk. The mean intake of dietary fiber in the United States is 17 g/day with only 5% of the population meeting the Adequate Intake. Healthy adults and children can achieve adequate dietary fiber intakes by increasing their intake of plant foods while concurrently decreasing energy from foods high in added sugar and fat, and low in fiber. Dietary messages to increase consumption of whole grains, legumes, vegetables, fruits, and nuts should be broadly supported by food and nutrition practitioners.

J Acad Nutr Diet. 2015;115:1861-1870.

POSITION STATEMENT

It is the position of the Academy of Nutrition and Dietetics that the public should consume adequate amounts of dietary fiber from a variety of plant foods.

The Adequate Intake for fiber is:

- 14 g total fiber per 1,000 kcal
- or **25 g** for adult women & **38 g** for adult men

Mean intake of dietary fiber in the United States is only 17 g/day

SINU
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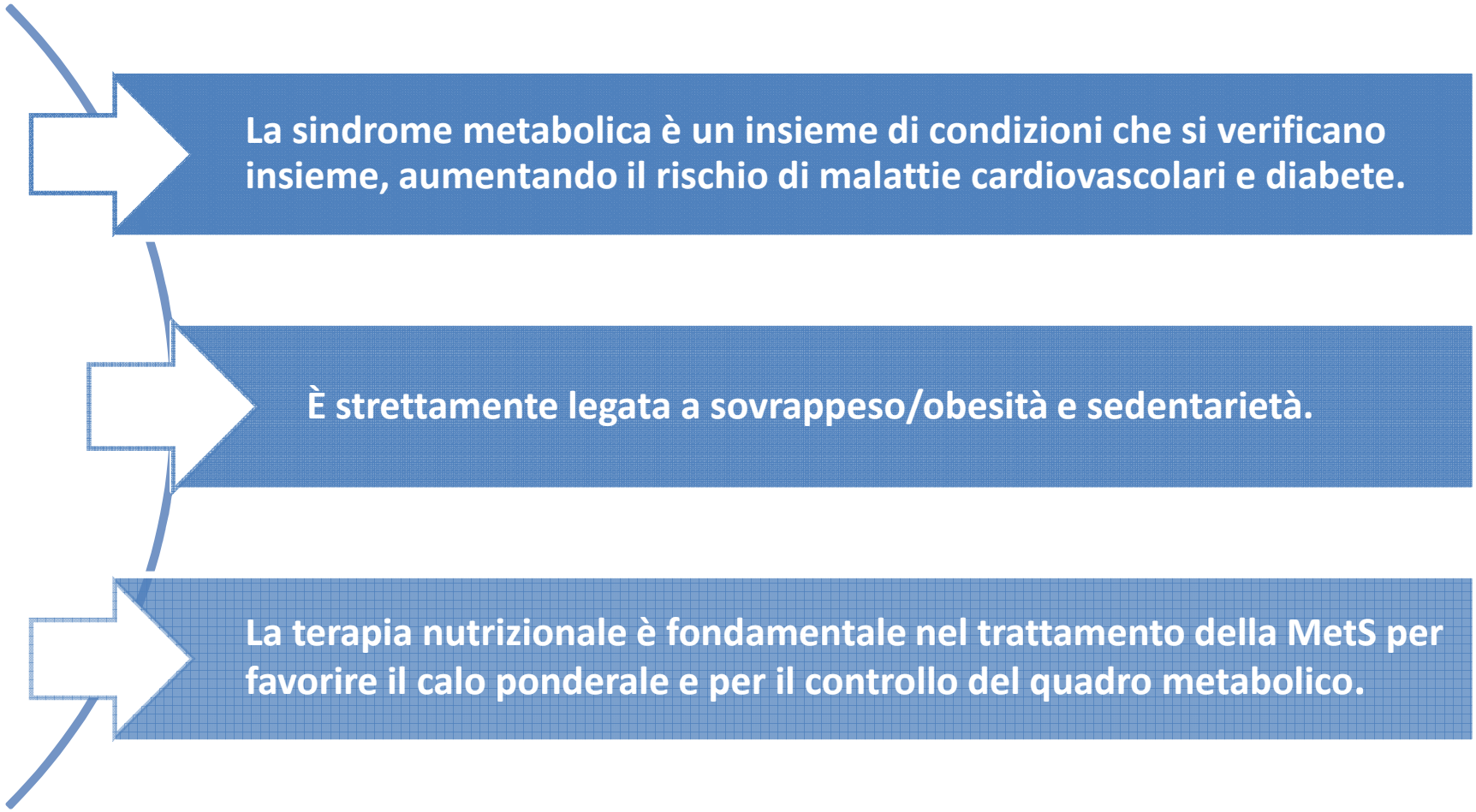
DI NUTRIZIONE UMANA

Livelli di Assunzione di Riferimento di Nutrienti ed energia per la popolazione italiana

LARN PER CARBOIDRATI E FIBRA ALIMENTARE			
Componente	**SDT** Obiettivo nutrizionale per la prevenzione	**AI** Assunzione adeguata	**RI** Intervallo di riferimento per l'assunzione di macronutrienti
Fibra alimentare	Preferire alimenti naturalmente ricchi in fibra alimentare quali cereali integrali, legumi, frutta e verdura. Negli adulti, consumare almeno 25 g/die di fibra alimentare anche in caso di apporti energetici <2000 kcal/die.	Età evolutiva: 8,4 g/1000 kcal (2 g/MJ)	Adulti: 12,6-16,7 g/1000 kcal (3-4 g/MJ)

http://www.sinu.it/html/pag//tabelle_larn_2014_rev.asp

Sindrome metabolica



Criteri IDF

Si ha diagnosi di sindrome metabolica in presenza di:

- **obesità addominale**: definita con cut-off di circonferenza addominale specifici per sesso ed etnia di appartenenza
  → per gli europei: maschi > 94 cm e femmine > 80 cm

- e **almeno due tra i seguenti criteri**:
  - trigliceridi > 150 mg/dl
  - HDL < 40 mg/dl nei maschi e < 50 mg/dl nelle femmine (o terapia ipolipemizzante)
  - pressione arteriosa > 130/85 mmHg (o terapia antiipertensiva)
  - glicemia a digiuno > 100 mg/dl (o pregressa diagnosi di DM 2)

International Diabetes Federation "The IDF Consensus Worldwide definition of Metabolic Syndrome"
Available at: https://www.idf.org/e-library/consensus-statements/60-idfconsensus-worldwide-definitionof-the-metabolic-syndrome.html

Ruolo della fibra nella sindrome metabolica

1) Impatto favorevole della fibra sulle <u>singole componenti</u> attraverso:

- AUMENTO DELLA SAZIETÀ
- RALLENTAMENTO SVUOTAMENTO GASTRICO
- MODULAZIONE ASSORBIMENTO NUTRIENTI
- MIGLIORATA SENSIBILITÀ INSULINICA

Satija, A. & Hu, F.B. Curr Atheroscler Rep (2012) 14: 505. https://doi.org/10.1007/s11883-012-0275-7

nutrients ; Published: 26 December 2017 MDPI

Review

Dietary Fiber and Metabolic Syndrome: A Meta-Analysis and Review of Related Mechanisms

Jia-Ping Chen, Guo-Chong Chen, Xiao-Ping Wang, Liqiang Qin * and Yanjie Bai *

Our meta-analysis shows that dietary fiber intake is inversely associated with the risk of MetS and the association is supported by a wide range of mechanism studies. However, the findings are limited by scant cohort data; thus, no definitive conclusion could currently be drawn. The evidence needs further validation due to the high heterogeneity in cross-sectional studies and the absence of statistical significance in cohort studies. As some inherent limitations in the original studies were observed, we recommend that important potential confounding factors, such as physical activity, should be taken into account (e.g., by statistical adjustment) in further studies. The effect of fiber types on the risk of MetS is also an interesting subject for further investigation. Overall, our meta-analysis suggests that more well-designed prospective studies are needed to confirm the relationship between intake of dietary fiber and risk of MetS.

L'intake di fibra è **inversamente associato** al rischio di MetS, tuttavia

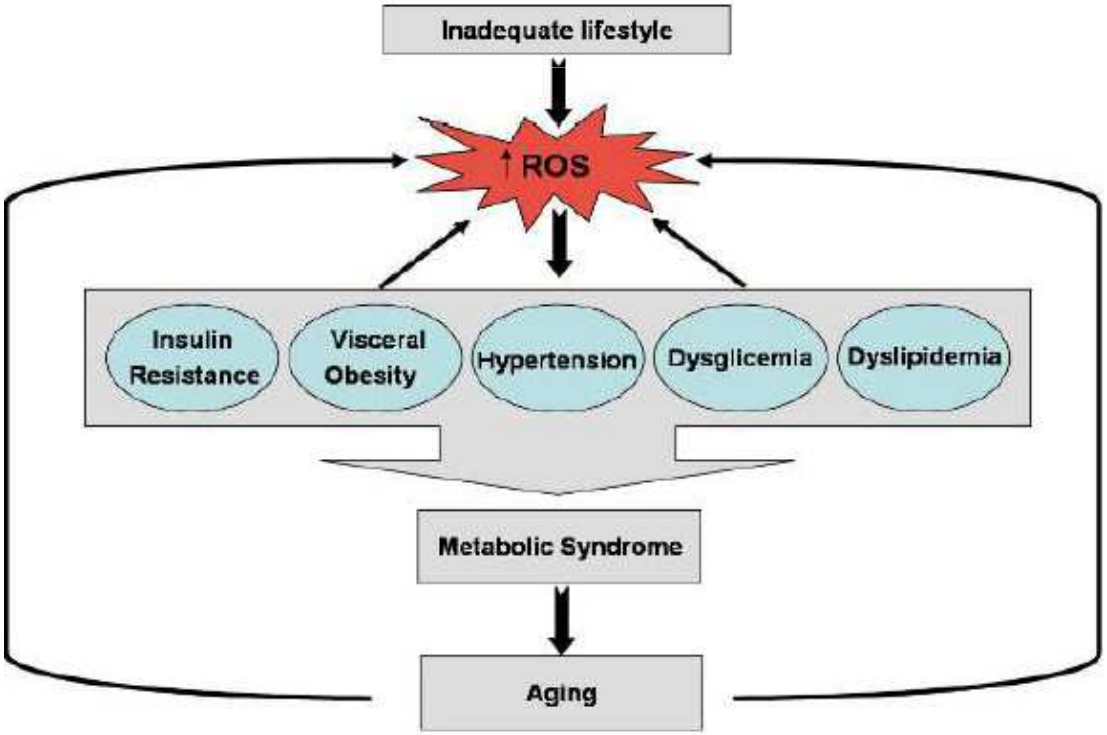
- Elevata **eterogeneità** negli studi trasversali
- **No significatività** statistica negli studi di coorte

→ Necessari ulteriori studi per considerare **l'effetto dei diversi tipi di fibra e fattori confondenti (es. attività fisica).**

2) Ruolo protettivo contro lo stress ossidativo

- Riduzione di ROS (O_2) e di perossidi lipidici nel plasma (perossidazione lipidica → componente essenziale dell'aterogenesi)
- Riduzione delle citochine proinfiammatorie TNF-α e IL-1β
- Riduzione dell'aumento delle concentrazioni di LPS e dell'espressione di TLR-4 e CD14.

Ghanim, 2017
https://doi.org/10.1210/jc.2016-2669



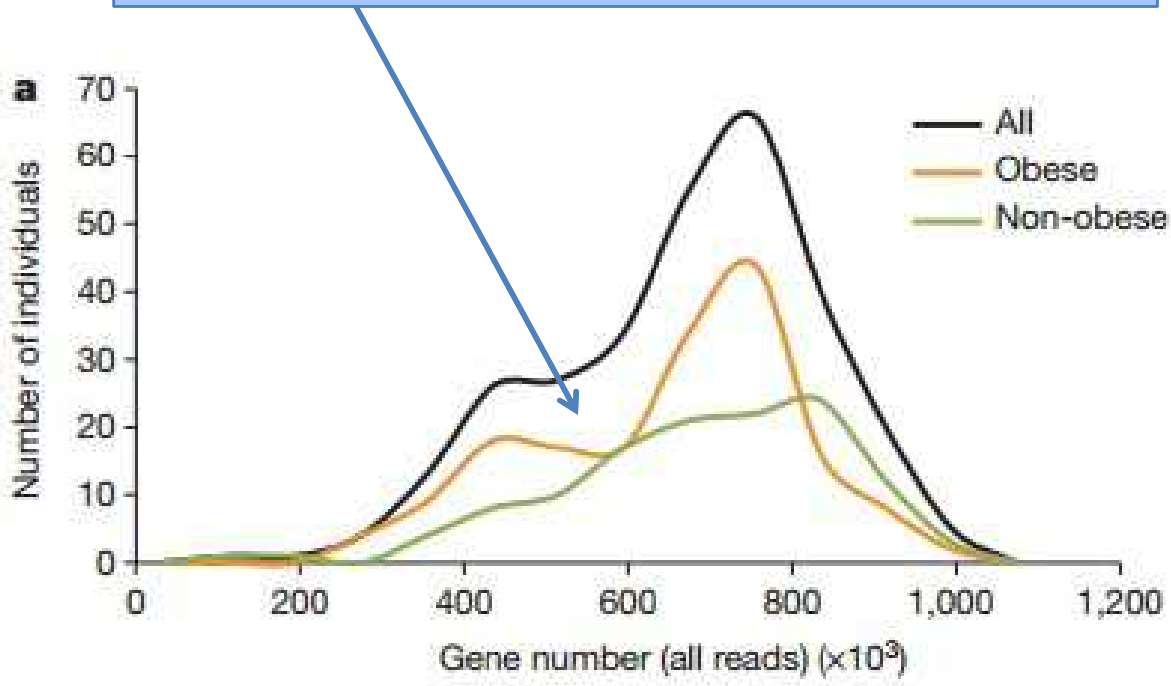
Lo stress ossidativo svolge un ruolo importante nella patogenesi delle alterazioni vascolari innescando o esacerbando processi biochimici coinvolti nella MetS.

Relationship between ROS production and metabolic syndrome. Bonomini. A&D. 2015

Correlazione tra ricchezza del microbioma intestinale umano e markers metabolici

nature

- Metabolsimo glucidico alterato
- Metabolismo lipidico alterato
- Aumentato grasso corporeo
- Infiammazione cronica di basso grado



Distribution of low and high gene count individuals (*n* = 292).

- Lo studio descrive la composizione microbica dell'intestino umano in un campione di 123 individui non-obesi e 169 obesi.
- I 2 gruppi differiscono per il numero di geni microbici intestinali e quindi per la ricchezza batterica intestinale.
- **Gli individui obesi nel gruppo con minor diversità batterica guadagnano più peso nel tempo.**

Le Chatelier et al. **Nature** *500, 541–546 (2013) doi:10.1038/nature12506*

World Journal of Gastroenterology

Submit a Manuscript: http://www.wjgnet.com/esps/
Help Desk: http://www.wjgnet.com/esps/helpdesk.aspx
DOI: 10.3748/wjg.v20.i43.16079

World J Gastroenterol 2014 November 21; 20(43): 16079-16094
ISSN 1007-9327 (print) ISSN 2219-2840 (online)

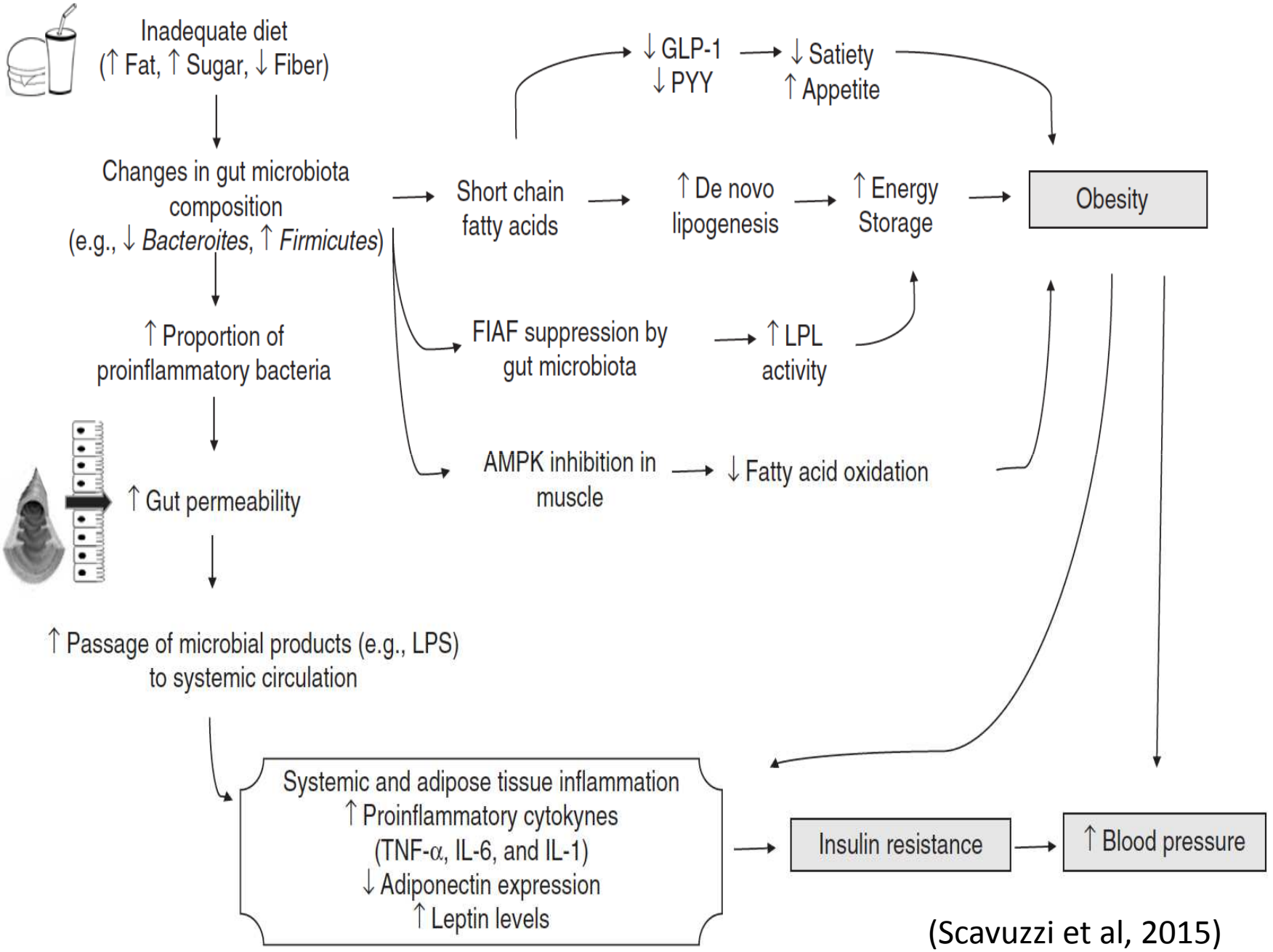
TOPIC HIGHLIGHT

WJG 20th Anniversary Special Issues (17): Intestinal microbiota

Gut microbiota and metabolic syndrome

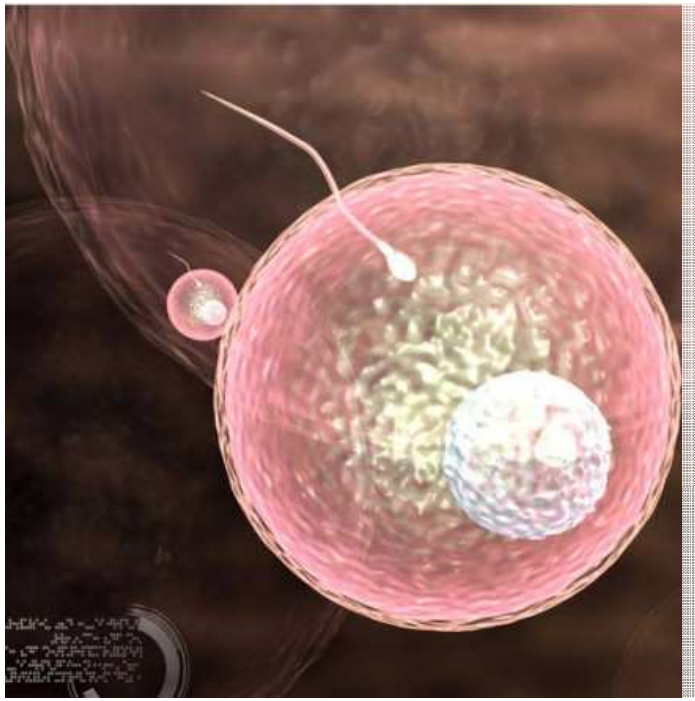
- La composizione e le funzioni microbiche dell'intestino sono fortemente influenzate dalla dieta.
- Il microbiota **sembra influenzare l'equilibrio metabolico** modulando l'assorbimento di energia, la motilità intestinale, l'appetito, il metabolismo di glucosio e lipidi, così come l'accumulo di grassi epatici.
- La compromissione del buon equilibrio tra microbiota e sistema immunitario potrebbe culminare nella traslocazione intestinale dei frammenti batterici e nello sviluppo di "endotossiemia metabolica", **portando a infiammazione sistemica** e **resistenza all'insulina**.

Componenti della sindrome metabolica e disbiosi: meccanismi



(Scavuzzi et al, 2015)

Prior to conceiving…



Developmental programming is not only due to intrauterine environment:
it may also occur prior to conception by the **programming of gametes**

Maternal MS can affect the **quality of oocytes** and embryos which can program the **resulting offspring to have an increased risk of developing adiposity and metabolic syndrome.**

Smith, Rickman, Epigenetic and developmental influences on the risk of obesity, diabetes, and metabolic syndrome. 2015

Microbiota intestinale come regolatore chiave nelle Malattie Metaboliche: *Ipotesi*

L'assunzione di fibra è in grado di regolare il microbiota e invertire la situazione?

Modern lifestyle, including high fat diet and low activity

Increased intestinal permeability

Microbial componenets LPS entering the circulation

Tissue inflammation

Systemic complications Insulin resistance

Metabolic Syndrome Type 2 diabetes

3) Influenza sulla struttura filogenetica del microbioma intestinale

- Dati di analisi del genoma hanno dimostrato che l'**integrazione di fibre alimentari** ha indotto cambiamenti nel microbioma gastrointestinale di adulti sani.
- Spostamento nel rapporto Bacteroidetes: Firmicutes osservato dopo l'assunzione di **polidestrosio** e **fibra solubile di mais**, aumentando l'abbondanza relativa di Bacteroidetes rispettivamente del 12% e 13% rispetto a placebo.
- I cambiamenti nelle popolazioni batteriche sono stati associati a cambiamenti nel metagenoma batterico.

Holscher et al. 2015. https://doi.org/10.3945/ajcn.114.092064

- **I benefici osservati dall'assunzione di fibra nella prevenzione della sindrome metabolica possono essere, almeno in parte, mediati attraverso il regolamento del microbioma intestinale**.

Diabetes & Metabolic Syndrome: Clinical Research & Reviews 10S (2016) S150–S157

Contents lists available at ScienceDirect

Diabetes & Metabolic Syndrome: Clinical Research & Reviews

journal homepage: www.elsevier.com/locate/dsx

Review

Gut microbiome and metabolic syndrome

Mohsen Mazidi [a,b], Peyman Rezaie [c], Andre Pascal Kengne [d], Majid Ghayour Mobarhan [c,e,*], Gordon A. Ferns [f]

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ARTICLE INFO

Keywords:
Metabolic syndrome
Microbiome
Human gut
Diet

ABSTRACT

The gut microbiome contributes approximately 2 kg of the whole body weight, and recent studies suggest that gut microbiota has a profound effect on human metabolism, potentially contributing to several features of the metabolic syndrome. Metabolic syndrome is defined by a clustering of metabolic disorders that include central adiposity with visceral fat accumulation, dyslipidemia, insulin resistance, dysglycemia and non-optimal blood pressure levels. Metabolic syndrome is associated with an increased risk of cardiovascular diseases and type 2 diabetes. It is estimated that around 20–25 percent of the world's adult population has metabolic syndrome. In this manuscript, we have reviewed the existing data linking gut microbiome with metabolic syndrome. Existing evidence from studies both in animals and humans support a link between gut microbiome and various components of metabolic syndrome. Possible pathways include involvement with energy homeostasis and metabolic processes, modulation of inflammatory signaling pathways, interferences with the immune system, and interference with the renin-angiotensin system. Modification of gut microbiota via prebiotics, probiotics or other dietary interventions has provided evidence to support a possible beneficial effect of interventions targeting gut microbiota modulation to treat components or complications of metabolic syndrome.

nature biomedical engineering

ARTICLES

https://doi.org/10.1038/s41551-017-0181-y

Engineered commensal microbes for diet-mediated colorectal-cancer chemoprevention

Chun Loong Ho[1,2], Hui Qing Tan[3], Koon Jiew Chua[1,2], Aram Kang[1,2], Kiat Hon Lim[4], Khoon Lin Ling[3], Wen Shan Yew[1,2], Yung Seng Lee[2,5], Jean Paul Thiery[1,2] and Matthew Wook Chang[1,2*]

Chemoprevention—the use of medication to prevent cancer—can be augmented by the consumption of produce enriched with natural metabolites. However, chemopreventive metabolites are typically inactive and have low bioavailability and poor host absorption. Here, we show that engineered commensal microbes can prevent carcinogenesis and promote the regression of colorectal cancer through a cruciferous vegetable diet. The engineered commensal *Escherichia coli* bound specifically to the heparan sulphate proteoglycan on colorectal cancer cells and secreted the enzyme myrosinase to transform host-ingested glucosinolates—natural components of cruciferous vegetables—to sulphoraphane, an organic small molecule with known anticancer activity. The engineered microbes coupled with glucosinolates resulted in >95% proliferation inhibition of murine, human and colorectal adenocarcinoma cell lines in vitro. We also show that murine models of colorectal carcinoma fed with the engineered microbes and the cruciferous vegetable diet displayed significant tumour regression and reduced tumour occurrence.

- Benefici nel cancro al colonretto (patologia associata alla **western diet**) attraverso l'assunzione di batteri programmati e composti bioattivi presenti nella dieta.
- Possibile in futuro prevenire/curare altre patologie **fenotipo specifiche** con i probiotici nel contesto di una dieta sana ricca di **fibra** e di **antiossidanti**?

Grazie dell'attenzione

HELLAS CENA

UPDATE SULL'UTILIZZO DELLA FIBRA NELLA SINDROME METABOLICA

DIETETICS & CLINICAL NUTRITION LABORATORY
DEPARTIMENT OF PUBBLIC HEALTH,
EXPERIMENTAL AND FORENSIC MEDICINE
UNIVERSITY OF PAVIA

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