CNR-IBBA

BENEFICIAL EFFECTS OF NATURAL COMPOUNDS: STUDIES IN VITRO AND IN VIVO

Vincenzo Longo

Institute of Agricultural Biology and Biotechnology, National Research Council, Pisa, Italy

CNR-IBBA

FUNCTIONAL FOOD AND NUTRACEUTICALS

FUNCTIONAL FOOD: is a food given an additional function (often related to health-promotion or disease prevention) by adding new ingredients or more of existing ingredients.

Example: addition of iodine to table salt; Vitamin D to milk ;
Fermented foods can be considered functional foods

NUTRACEUTICAL: **is a combination of the words "nutrition" and "pharmaceutical**

Nutraceuticals are products derived from food sources that can provide extra health benefits, in addition to the basic nutritional value found in foods.

They can prevent diseases , improve health, delay the aging process, increase life expectancy or support the structure or function of the body

CNR-IBBA

FUNCTIONAL FOOD AND NUTRACEUTICALS *and* RESEARCH

Functional Foods and Nutraceuticals are an emerging field in ***FOOD SCIENCE***

The activity of Researchers has allowed to find out that many traditional foods, mainly those of plant origin, contain substances with beneficial to health.

Several studies already report positive effects of substances present in Food in reducing :

- METABOLIC DISORDERS
- OXIDATIVE STRESS
- INFLAMMATION

CNR-IBBA

OPPORTUNITIES FOR AGRI-FOOD COMPANY

Nutraceuticals and Functional Foods represent a potentially significant opportunity for

FARMERS AND FOOD PRODUCERS

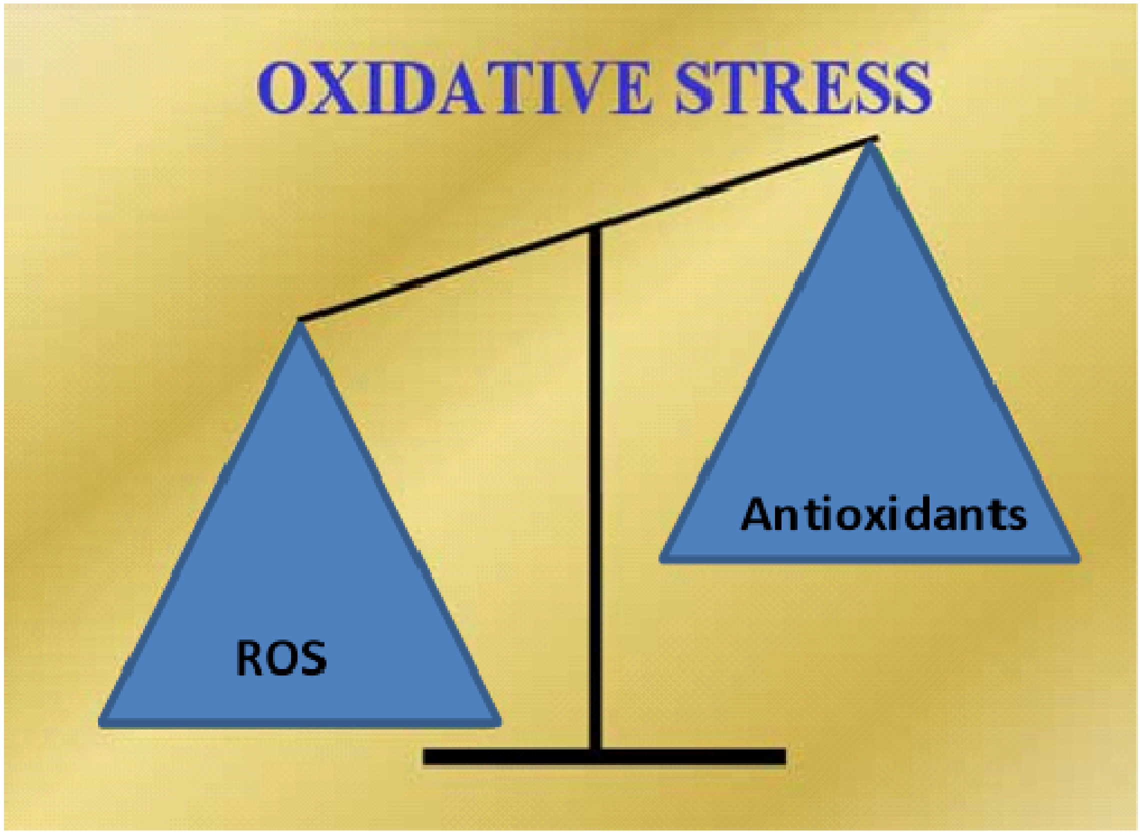
They can use health claims (It exists a stringent regulation) to promote their products

It is very important the collaboration between Researchers and Food Company to enhance the food products through nutraceutical and functional studies

CNR-IBBA

OXIDATIVE STRESS

Oxidative stress is the presence of active oxygen species (ROS) and other free radicals in excess of the available antioxidant buffering capacity .



CNR-IBBA

OXIDATIVE STRESS

Diseases Related to Oxidative Stress

Diabetes

Heart Disease

Cancers

Arthritis

Autism

Asthma

Alzheimer Disease

Parkinson's Disease

Liver Diseases

Blood Vessel Damage

Common Cold

Prostate Problems

Cystic Fibrosis

Dementia

Skin Disorders

Emphysema

Kidney Failure

Hepatitis

Crohn's Disease

Aging

Hypertension

Hypertension

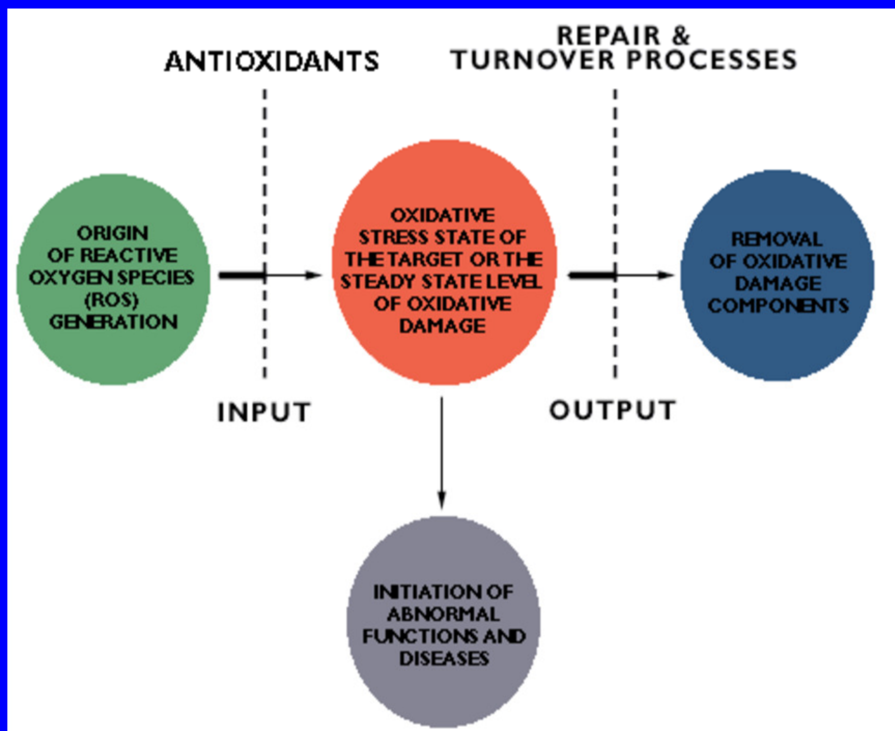
Macular Degeneration

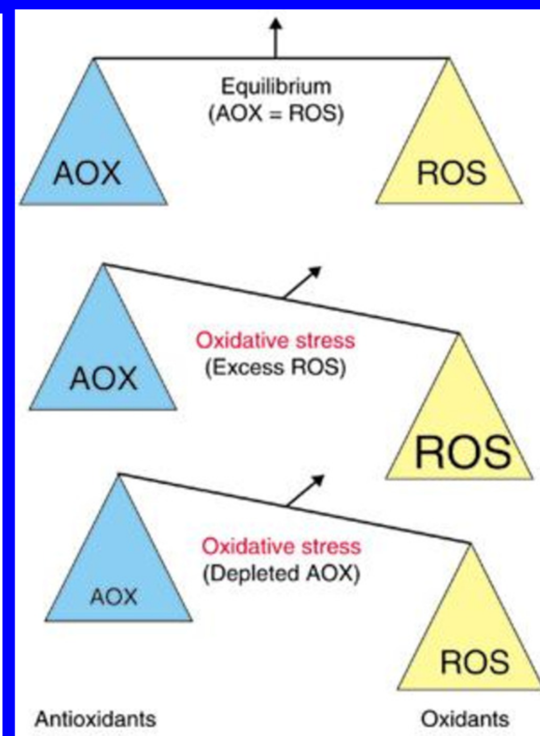
Bronchitis [chronic & acute]

Athletic Performance [stamina & endurance]

Chronic Fatigue Syndrome

OXIDATIVE STRESS

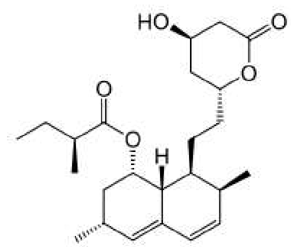




SOME OF OUR RESEARCH

Lisosan G: a fermented of grain (*Triticum Sativum)*

Glucosinolates (Brassicaceae),



Fermented red rice(Monacolin K)

CNR-IBBA

LISOSAN G

Main components of the Lisosan G	
Protein	208 g/kg
Lipids	70 g/kg
Glucids	166 g/kg
Lactobacilli	10^2 ufc/g
Magnesium	4.1 g/kg
Iron	0.1 g/kg
Zinc	0.13 g/kg
Copper	0.01 g/kg
Selenium	57 mg/kg
→ Linolenic acid (**ω-3**)	3 g/kg
→ Linoleic acid (ω**-6**)	33 g/kg
Oleic acid	7.4 g/kg
Tocopherols	0.02 g/kg
Vitamin B1	3.8 mg/kg
Vitamin B2	0.9 mg/kg
Vitamin B6	2.2 mg/kg
→ Lipoic acid	66 mg/kg

CNR-IBBA

LISOSAN G

Antimutagenic and antioxidant activity of Lisosan G in Saccharomyces cerevisiae.
Frassinetti S, Della Croce CM, Caltavuturo L, Longo V. Food Chem. 2012 Dec 1;135(3):2029-34. 2.
Beneficial effect of Lisosan G on cultured human microvascular endothelial cells exposed to oxidised low density lipoprotein.
Lubrano V, Baldi S, Napoli D, Longo V. Indian J Med Res. 2012 Jul;136(1):82-8.

Cisplatin induced toxicity in rat tissues: the protective effect of Lisosan G.
Longo V, Gervasi PG, Lubrano V. Food Chem Toxicol. 2011 Jan;49(1):233-7.

Lisosan G, a powder of grain, does not interfere with the drug metabolizing enzymes and has a protective role on carbon tetrachloride-induced hepatotoxicity.
Longo V, Chirulli V, Gervasi PG, Nencioni S, Pellegrini M. **Biotechnol Lett. 2007** Aug;29(8):1155-9.

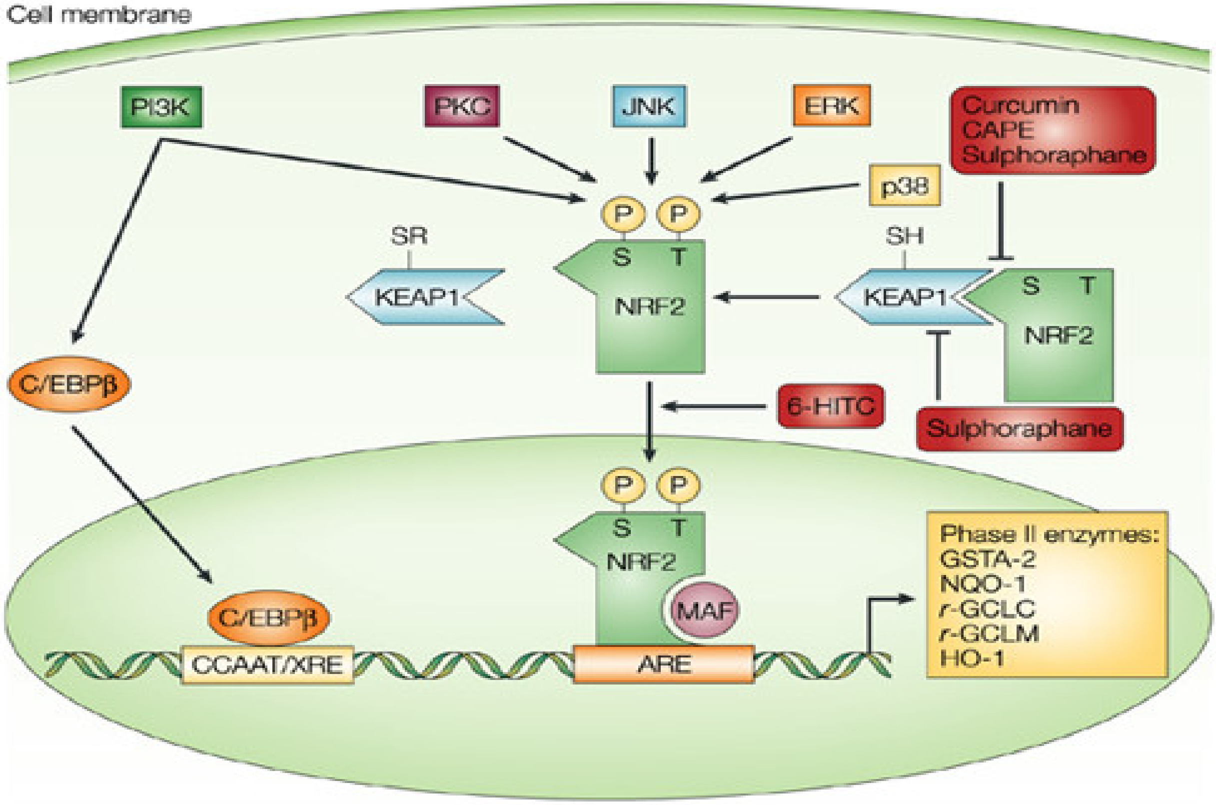
CNR-IBBA

LISOSAN G

Lisosan G, a fermented powder of wheat, is an inducer of the antioxidant/detoxifying system in primary rat hepatocytes

La Marca M, Beffy P, Pugliese, Longo V (PLOSONE, 2013)

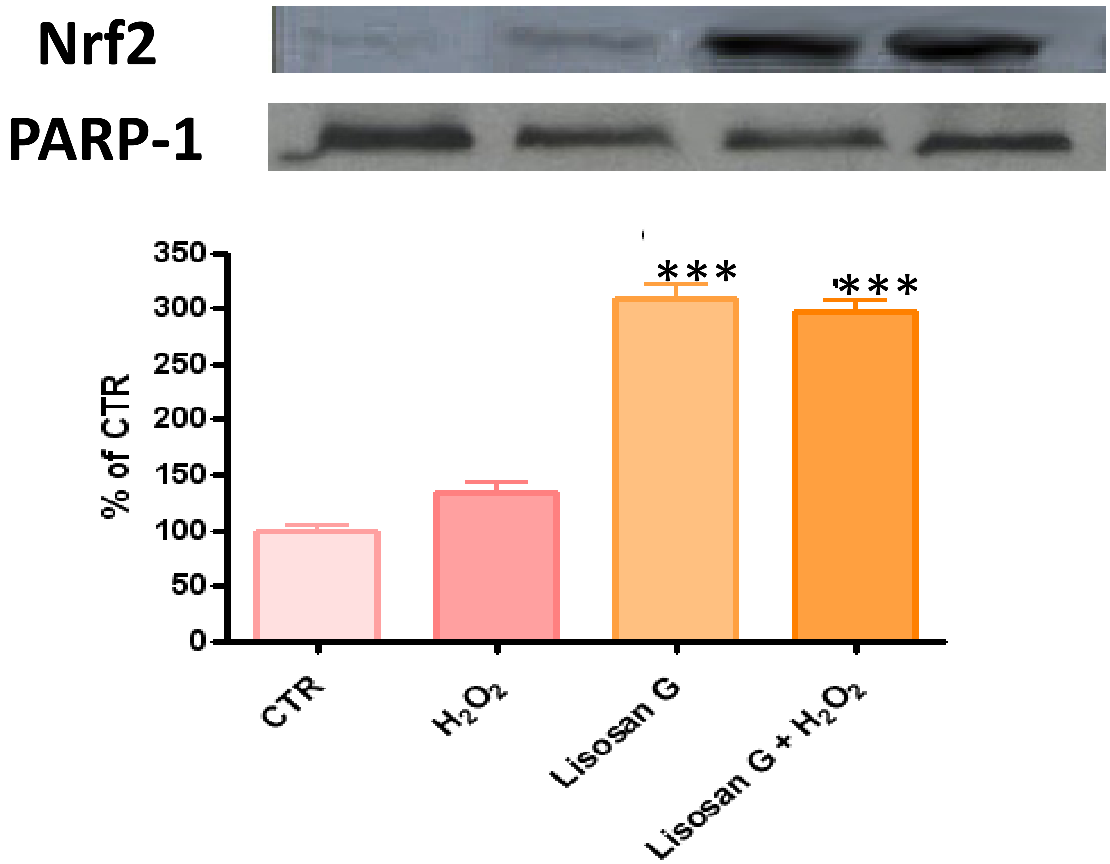
Nrf2 pathway



Nature Reviews | Cancer

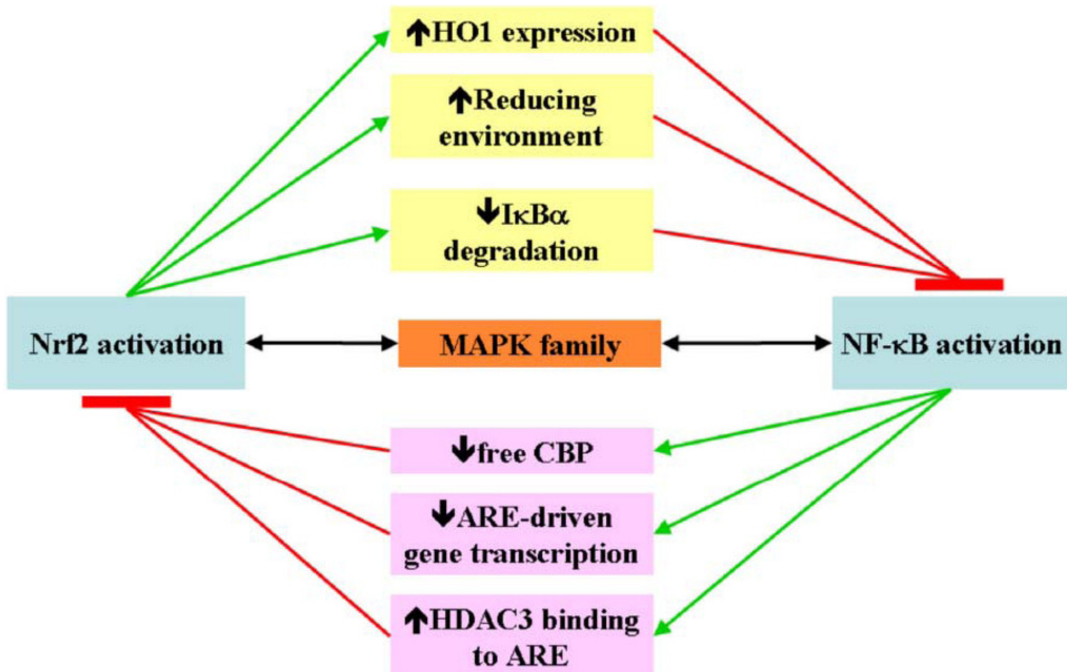
CNR-IBBA

Nrf2 pathway



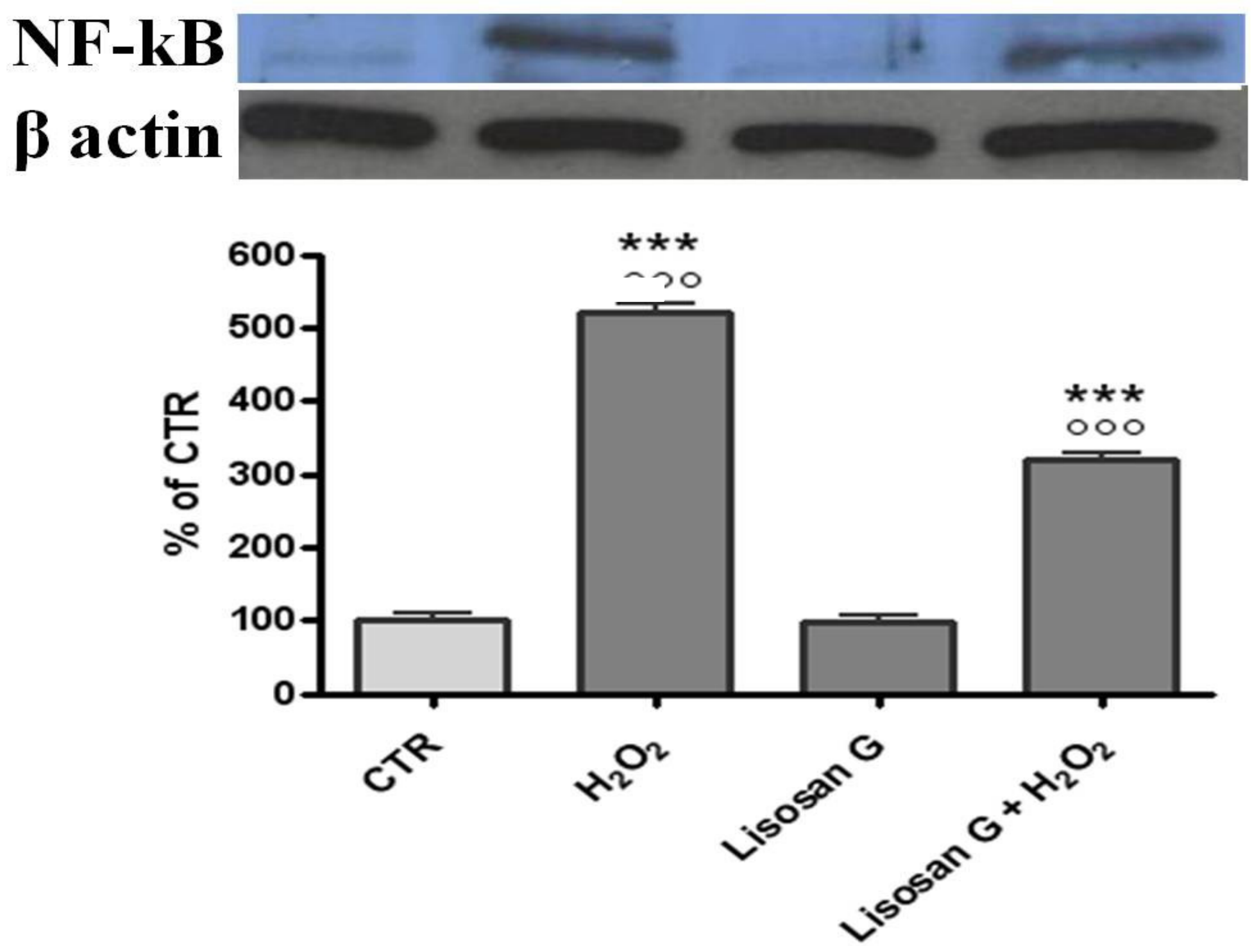
CNR-IBBA

Cross-talk between Nrf2/ARE and the nuclear factor-kappa B (NF-kB)



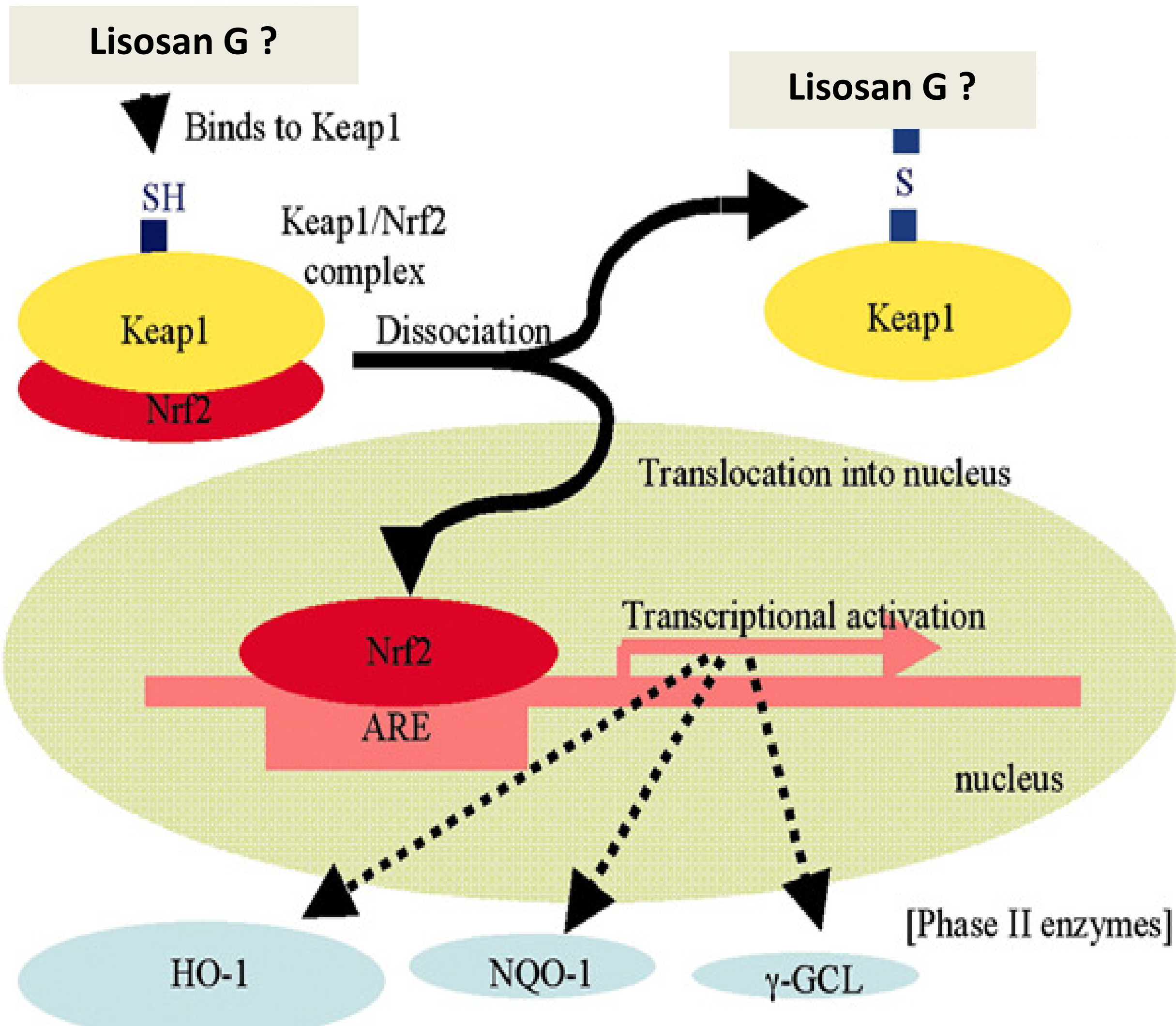
CNR-IBBA

NF-kB pathway



CNR-IBBA

HYPOTHESIS



CNR-IBBA

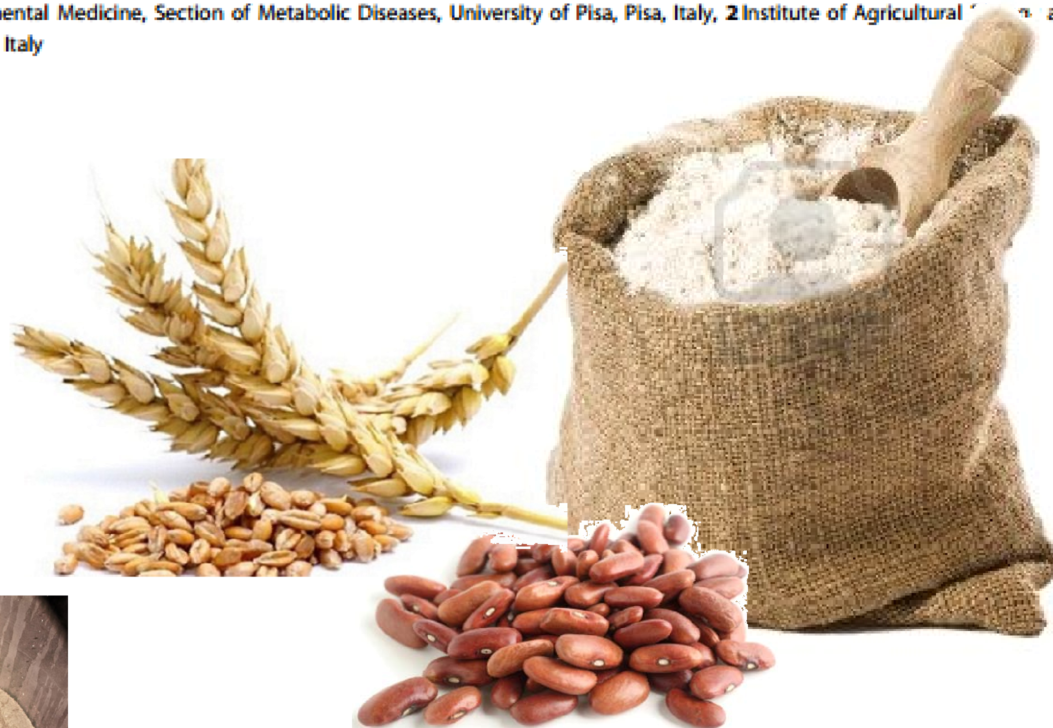
OPEN ACCESS Freely available online

PLOS ONE

Grain and Bean Lysates Improve Function of Endothelial Progenitor Cells from Human Peripheral Blood: Involvement of the Endogenous Antioxidant Defenses

Daniela Lucchesi[1], Rossella Russo[2], Morena Gabriele[2], Vincenzo Longo[2], Stefano Del Prato[1], Giuseppe Penno[1], Laura Pucci[2]*

1 Department of Clinical and Experimental Medicine, Section of Metabolic Diseases, University of Pisa, Pisa, Italy, 2 Institute of Agricultural [illegible] and Biotechnology, National Research Council, CNR, Pisa, Italy

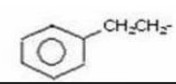
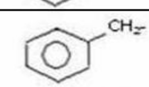
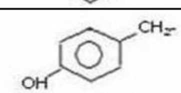


CNR-IBBA

Food and Chemical Toxicology 50 (2012) 2822–2830

Structural influence of isothiocyanates on expression of cytochrome P450, phase II enzymes, and activation of Nrf2 in primary rat hepatocytes

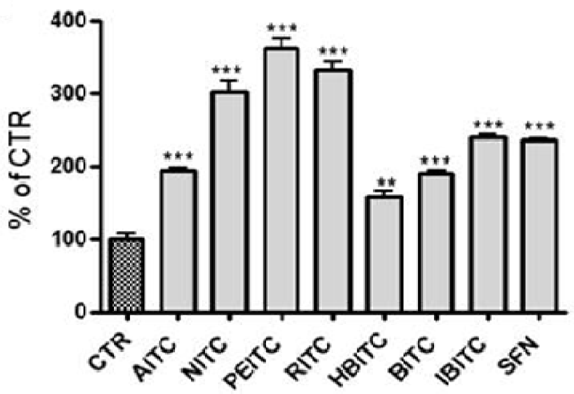
M. La Marca [a], P. Beffy [b], C. Della Croce [a], P.G. Gervasi [b], R. Iori [c], E. Puccinelli [b], V. Longo [a,*]

Glucosinolates	**Isothiocyanates (ITCs)** R− N=C=S	**-R groups**
Glucoraphanin	Sulforaphane (SFN)	$CH_3S(O)CH_2CH_2CH_2CH_2$-
Glucoiberin	Iberin isothiocyanate (IBITC)	$CH_3S(O)CH_2CH_2CH_2$-
Glucoraphasatin	Raphasatin isothiocyanate (RITC)	$CH_3SCH{=}CHCH_2CH_2$-
Gluconapin	Napin isothiocyanate (NITC)	$CH_2{=}CHCH_2CH_2$-
Sinigrin	Allyl isothiocyanate (AITC)	$CH_2{=}CHCH_2$-
Gluconasturtin	Phenethyl isothiocyanate (PEITC)	
Glucotropeolin	Benzyl isothiocyanate (BITC)	
Glucosinalbin	4-hydroxybenzyl isothiocyanate (HBITC)	

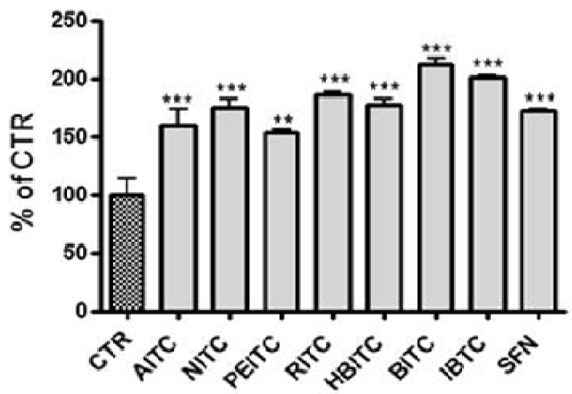
CNR-IBBA

GLUCOSINOLATES

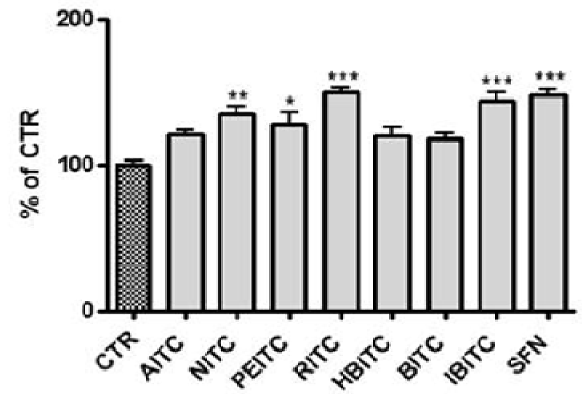
NAD(P)H:quinone oxidoreductase



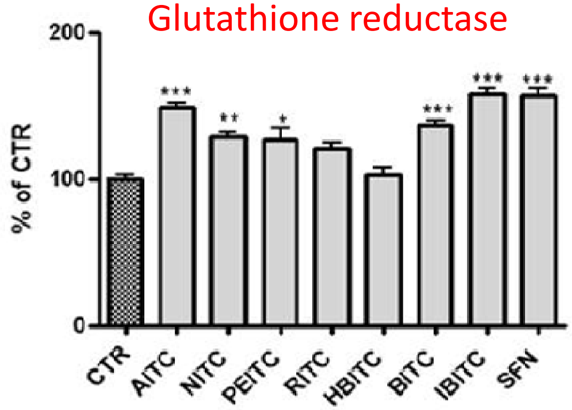
Heme oxygenase-1



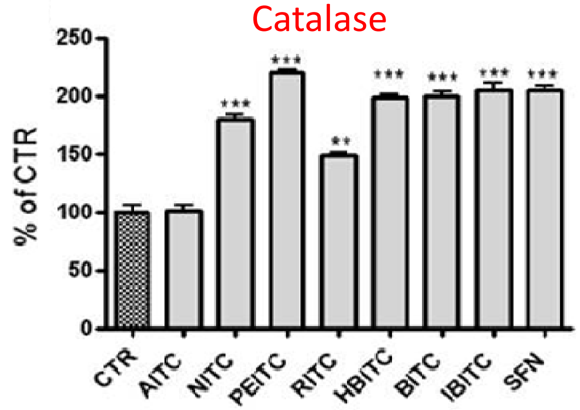
Glutathione-S-transferase



Glutathione reductase

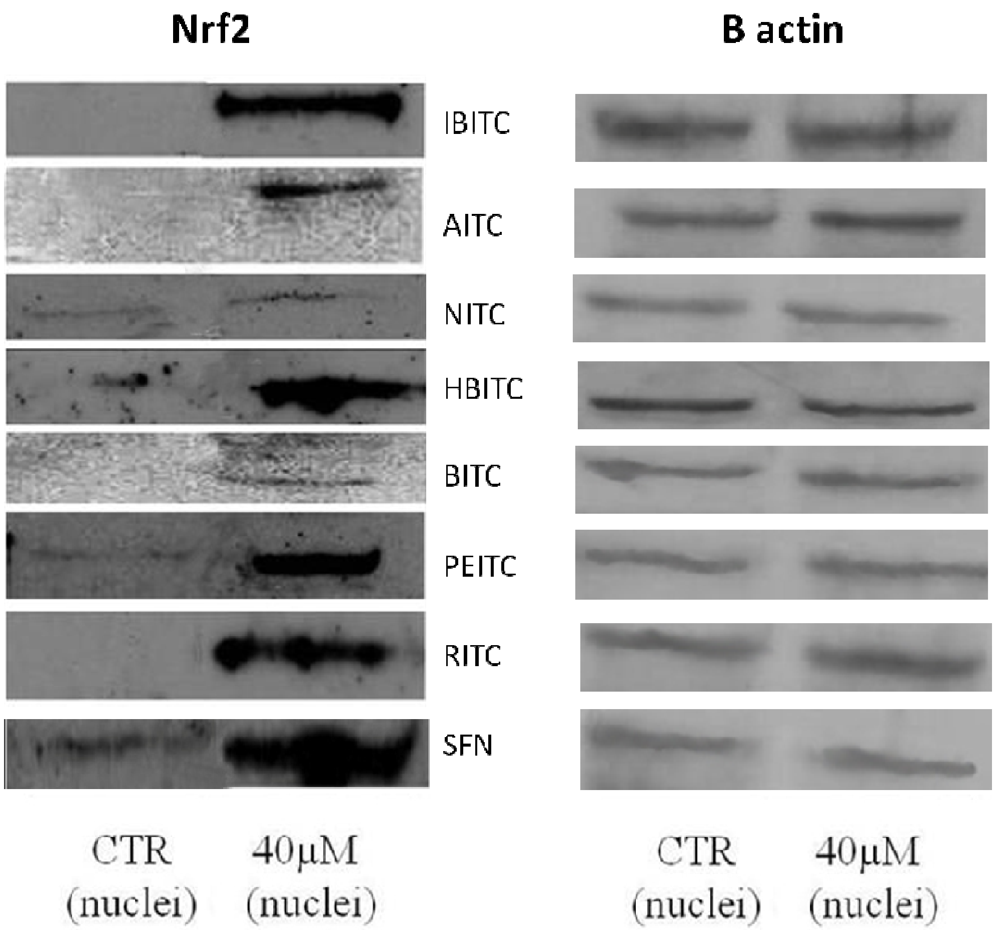


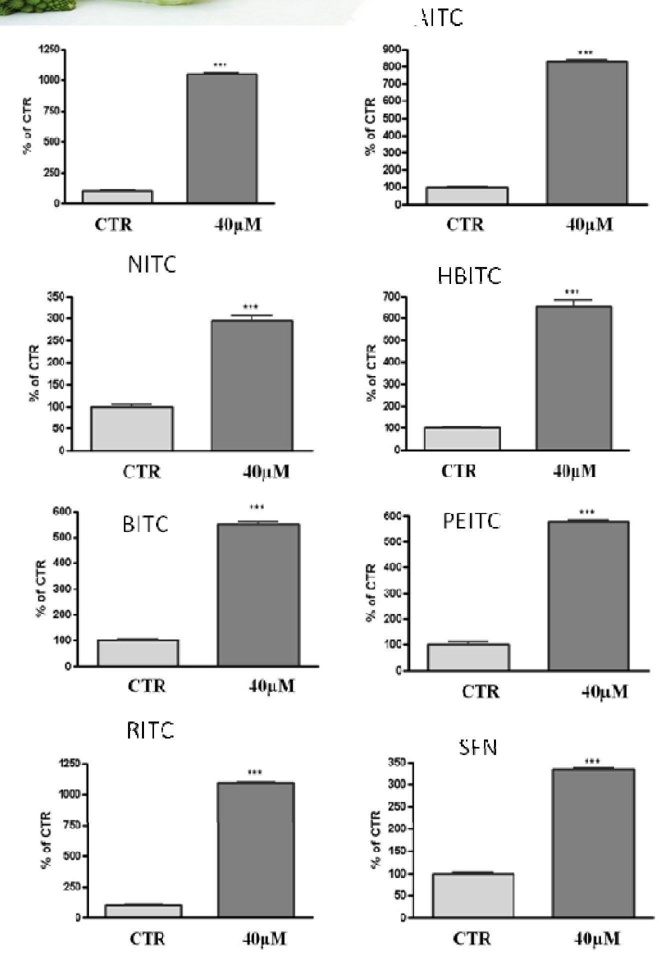
Catalase



CNR-IBBA

GLUCOSINOLATES





CNR-IBBA

Journal of the
Science of
Food and Agriculture

Research Article

Effect of white wheat bread and white wheat bread added with bioactive compounds on hypercholesterolemic and steatotic mice fed a high fat diet

Luisa Pozzo[1,*], Laura Pucci[1], Guglielmo Buonamici[2], Lucia Giorgetti[1], Maristella Maltinti[3] and Vincenzo Longo[1]

Issue

Journal of the Science of Food and Agriculture

CNR-IBBA

BREAD + NUTRACEUTICALS (Cyclanthera pedata , Glycine max, Monascus-fermented red rice, Cynara scolymus , Medicago sativa)

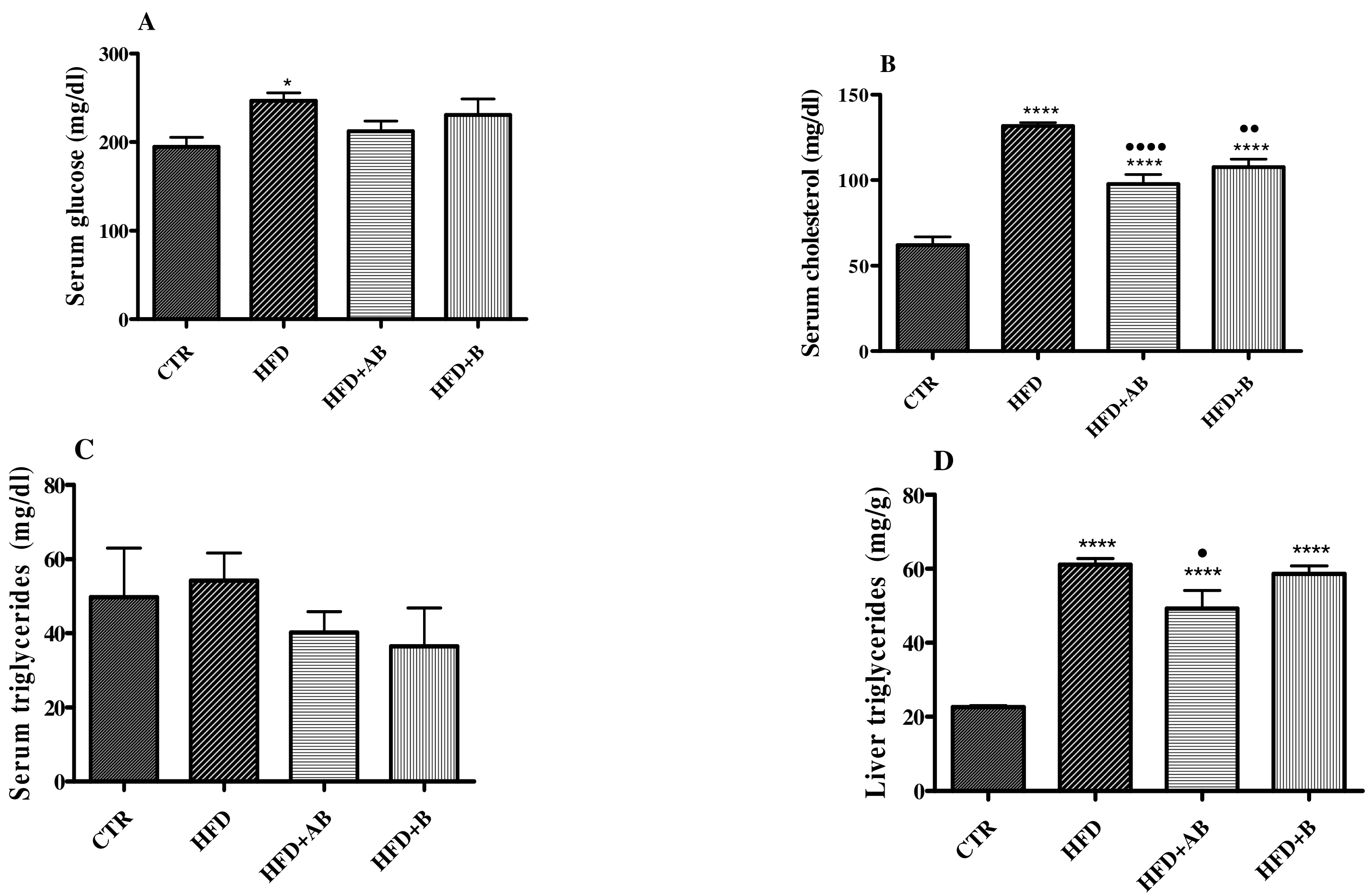
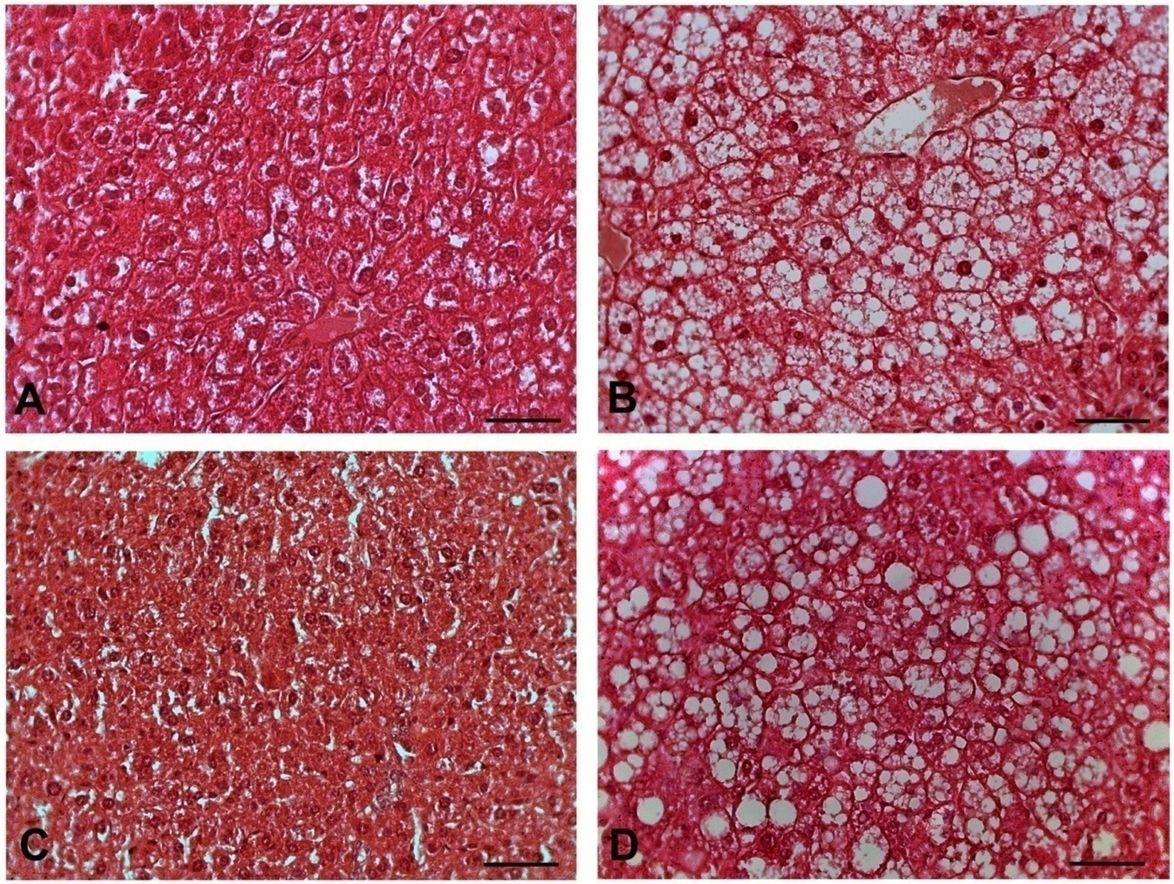


Figure 1. Plasma glucose (A), cholesterol (B) and triglycerides (C) and liver triglycerides (D) from mice exposed CTR, HDF, HFD+AB and HDF+B diets. Values are reported in the means ± s.d. of relative levels (n=6 per group). Data were tested using a one-way ANOVA coupled with T*ukey's multiple-comparison* post hoc *tests*.



bar= 50 μm

Figure 2. Hematoxylin and eosin staining of liver tissue of the CTR (A), HFD (B), HFD+AB (C) and HFD+B (D) groups. Magnification. Bar, 50 μm.

CNR-IBBA

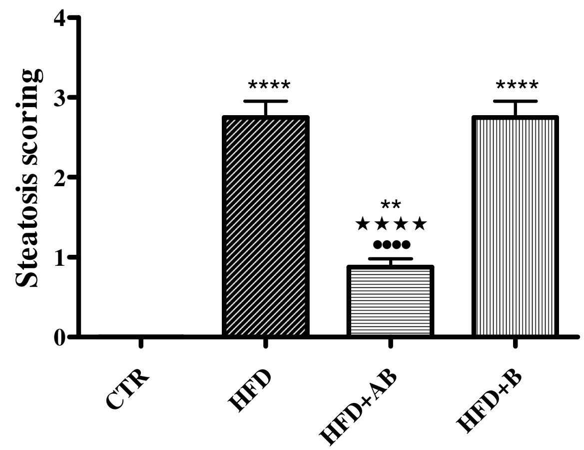


Figure 3. Steatosis scores for mice fed CTR, HDF, HFD+AB and HDF+B diets. Bars represent the means ± s.d. of relative levels (n=4 per group). Data were tested using a one-way ANOVA coupled with T*ukey's multiple-comparison* post hoc *tests*.
** ($p<0.01$) and **** ($p<0.001$) compared to CTR group;
●●●● ($p<0.001$) compared to HFD group;
★★★★ ($p<0.001$) compared to HFD+B group.

CNR-IBBA

UOS IBBA PISA

CNR-IBBA

THANK YOU FOR ATTENTION