



Functional Foods and Health  
*Reducing Risk  
of  
Non-communicable diseases*

Dr. Parmeet Kaur  
Senior Dietician

# NCD in India –*a big challenge*

Non – communicable diseases in developing countries are a major public health and socio-economic problem. They are the major challenge to development in the 21<sup>st</sup> century (WHO,2009)

## Why fight it?

NCDs cause poverty and poverty increases the risk of NCDs.

The illness, disability and premature death due to NCDs in low-income populations reduce productivity and results in loss of household income

*First Global Ministerial Conference on  
Healthy Lifestyles and Non-communicable Disease Control, Moscow  
(28–29 April 2011)*

## Why fight it?

CVD will be the largest cause of death and disability in India by 2020

- Estimated overall prevalence/1000 popn

*Diabetes- 62.47*

*Hypertension - 159.46*

*Ischemic Heart Diseases (IHD) -37.00*

*First Global Ministerial Conference on Healthy Lifestyles and Noncommunicable Disease Control, Moscow (28–29 April 2011).*

# *Non-communicable diseases diet disease relationship*

## *4 Diseases, 4 Modifiable Shared Risk Factors*

	<b>Tobacco use</b>	<b>UNHEALTHY DIETS</b>	<b>Physical Inactivity</b>	<b>Harmful use of alcohol</b>
Cardio-vascular diseases	√	√	√	√
Diabetes	√	√	√	√
Cancer	√	√	√	√
Respiratory Diseases	√			

# NCD epidemic in India

Individual foods  
or  
a well balanced diet ?

# TRADITIONAL INDIAN DIETS

phytochemicals, dietary fibre, vitamin E, carotenoids and phenolic compounds



*Individual foods/food groups-* Not many proven clinical trials on humans

*Balanced Diet-* Available data may be interpreted to seek affordable solution



# Disease-preventing phytochemicals in plant foods

(Narasinga Rao, *Asia Pacific J Clin Nutr* 2003; 12 (1): 9-22)

Specific foods/food groups	Main health promoting chemical	Useful in the prevention of
Whole cereal, grains	Dietary fibre, tocopherols†	Cancer, diabetes, cardiovascular disease, hypercholesterolaemia
Vegetables, fat	$\alpha$ -linoleic acid, linoleic acid, tocopherols,†	Cancer, diabetes, cardiovascular disease, hypercholesterolaemia
Palm oil	Tocopherols,† tocotrienols,† carotenoids	Cancer, heart diseases, atherosclerosis, cataract, pulmonary diseases, muscle injury
Yellow or green leafy vegetables yellow fruits	, Carotenes,† ascorbic acid,† dietary omega-3 fatty acids, pectinsy fibre,	Cancer, heart diseases, atherosclerosis

# Disease-preventing phytochemicals in plant foods

(Narasinga Rao, *Asia Pacific J Clin Nutr* 2003; 12 (1): 9-22)

Specific foods/food groups	Main health promoting chemical	Useful in the prevention of
Rice bran oil	Sterols, PUFA	Hypercholesterolaemia, diabetes, cardiovascular disease
Linseed oil, fish oil	Omega-3 fatty acid	Hypercholesterolaemia, diabetes, cardiovascular disease
Spices, fenugreek seeds, turmeric	Gums, curcumin, eugenol, capsaicin	Cancer, cardiovascular disease, detoxification of dru

†Antioxidant. PUFA, polyunsaturated fatty acid.

# Hypo-cholesterolaemic and antioxidant potentials of some edible oils consumed in India

(Narasinga Rao, *Asia Pacific J Clin Nutr* 2003; 12 (1): 9-22)

Edible oils	Phytosterols	Triterpene alcohols	Sesaminol	Tocopherols	Tocotrienols	Sesamol†	Carotenoids‡
Palmolein	0.14	0.09	–	0.64	0.49	–	0.50
Rice bran oil	1.66	1.08	–	0.18	0.37	–	–
Corn oil	1.70	0.02	–	0.78	–	–	–
Sesame oil	0.56	0.17	0.85	0.07	–	0.4	–

†Hydrolysed to sesamol.

‡In red palm oil.

△ Hypocholesterolemic agents (%)

△ Antioxidant agents (%)

## COMPONENTS OF DIETARY FIBRE

Major class	Property
Cellulose	Water insoluble - Diabetes, colon cancer, IBS (green beans and dark green leafy vegetables, fruit skins and root vegetable skins, whole-wheat products, wheat oat, corn bran and seeds & nuts)
Non-cellulose polysaccharide	
Pectin	Water soluble- Diabetes, Hyperlipidemia -A (oat bran, legumes, psyllium, nuts, beans, apples, oranges, carrots, strawberries, citrus fruits, soy beans, apricots, dates, raisins, flax seed and beets)-B
Hemicellulose	Water soluble-AB
Gums	Water soluble-AB
Mucilages	Water soluble-AB
Lignin	Water soluble-AB

# BIOACTIVE PHYTOCHEMICALS IN FOODS

Classification	Main groups of compounds	Biological function
NSA	Cellulose, hemicellulose, gums, mucilages, pectins, lignins	Water holding capacity, delay in nutrient absorption, binding toxins and bile acids
Antioxidants	Polyphenolic compounds, flavonoids, carotenoids, tocopherols, ascorbic acid, anthocyanine, phenolic indoles	Oxygen free radical quenching, inhibition of lipid peroxidation
Others	Alkaloids, volatile flavour compounds, biogenic amines, terpenoids and other isoprenoid compounds	Neuropharmacological agents, antioxidants, cancer chemoprevention

Change in consumption pattern of the urban population  
in **Habitual Diets** (kg/month/capita)- Source GOI, NSSO-2001

FOOD ITEMS	1987-88	1993-94	1999-2000
RICE	5.26	5.13	5.10↓
WHEATFLOUR	4.37	4.44	4.45↑
PULSES	0.87	0.77	0.85
LIQUID MILK (LITRES)	4.26	4.89	5.10↑
EGGS (NUMBER)	1.43	1.48	2.06↑
MILK FAT	0.04	0.05	0.07↑
EDIBLE OILS	0.41	0.46	0.74↑
FLESH FOODS	0.39	0.40	0.46↑
VEGETABLES	3.94	3.09	3.00↓
LEAFY VEGETABLES	0.40	0.15	0.17↓
MANGOES	n.a.	0.12	0.16↑
BANANA (NUMBER)	5.10	4.48	5.00
LEMONS (NUMBER)	n.a.	1.23	1.39↑
SUGAR/JAGGERY	0.97	0.97	1.32↑
Tea leaf	60.43	63.93	70.44↑
BISCUITS	0.07	n.a.	2.06↑
SALTED REFRESHMENTS	0.04	n.a.	1.36↑
PREPARED SWEETS	0.11	n.a.	0.40↑

DAILY ANTI-OXIDANT NUTRIENT INTAKE (PER CU) IN INDIA  
 (Narasinga Rao, *Asia Pacific J Clin Nutr* 2003; 12 (1): 9-22)

Group	B Carotene	Ascorbic acid(mg)	Riboflavin(mg)	Vitamin E (mg)
<b>(URBAN) HIG</b>	3524	98	1.5	29.9
<b>MIG</b>	2220	70	1.2	24.5
<b>LIG</b>	1328	47	0.9	18.3
<b>RURAL AVERAGE</b>	736	55	1.5	13.5
<b>RDA</b>	2400	40	1.4	10.0

# SUPPORTING INTERNATIONAL SCIENTIFIC RESEARCH

- **Strong Evidence**

- Substantial scientific agreement relationship of a diet-disease relationship
- Supported by Clinical Trials

- **Examples:**

- Fortified Margarines – Sterols and Stanols
- Psyllum – soluble fiber
- Soy
- Whole oat products
- Fatty Fish, n-3 fatty acids



# SUPPORTING INTERNATIONAL SCIENTIFIC RESEARCH

- **Moderate Evidence**

- Scientific evidence supporting diet-disease relationship is not conclusive

- **Examples:**

- Catechins in green tea – reduce risks of certain types of cancers

- Lycopene in tomato products – reduce prostate cancer

- Probiotics in dairy products – support GI health

# SUPPORTING INTERNATIONAL SCIENTIFIC RESEARCH

- **Low Evidence**

- Some scientific evidence suggest a relations ship but is limited or not conclusive

- **Examples**

- Garlic – reduction of total and LDL cholesterol

- Lutein in spinach, kale, collard greens – reduction of macular degeneration

- Cholesterol lowering effect of probiotics and prebiotics

# Functional Foods & IBS

- IBS patients may have different ratios of normal gut flora
  - ↓ Lactobacilli and Bifidobacterium
  - ↑ Clostridium
  
- Balsari et al, Microbiologica 1982
- Malinen et al, Am J Gastro 2005
- Lin, JAMA 2004

Halpern et al (Am J Gastroenterol 1996)

L. acidophilus (Lacteol Fort)

Dose –  $5 \times 10^9$  q day (heat killed)

Route – capsule

Study – randomized, double-blinded, cross-over

Subjects entered – 18

Criteria – IBS symptoms

6 weeks; self-administered questionnaire

*Mean daily scores were better on Lactobacillus compared to placebo in 9 patients who responded*

Sen et al (Dig Dis Sci 2002)

Lactobacillus plantarum 2990

Dose -  $6.5 \times 10^9$  daily (Pro Viva fruit drink)

Route – oral (approx. 125 cc)

Double-blinded, PC, crossover study

12 subjects entered

Rome criteria; 4 weeks

No improvement in symptoms

O'Mahony et al (Gastroenterology 2005)

Lactobacillus salivarius UCC4331 –  $1 \times 10^{10}$

Bifidobacterium infantis 35624 –  $1 \times 10^{10}$

Route: oral – **malted milk drink**

Randomized, double-blinded, PC

75 subjects entered, 68 eligible for analysis; mean age = 44; 1/3 men and 2/3 women

Rome II criteria – all subtypes included

8 weeks

Sx, Qol, stool microbiologic studies, IL-10 and IL-12 serum levels

- O'Mahony et al, cont.
  - B. infantis improved global symptom scores and individual scores (pain/discomfort, bloating/distention, difficult defecation) significantly more than both Lactobacillus and placebo
  - B. infantis improved QoL score for only domain of health worry
  - No change in stool frequency or consistency

Ringel et al, Clin Gastroenterol. 2011

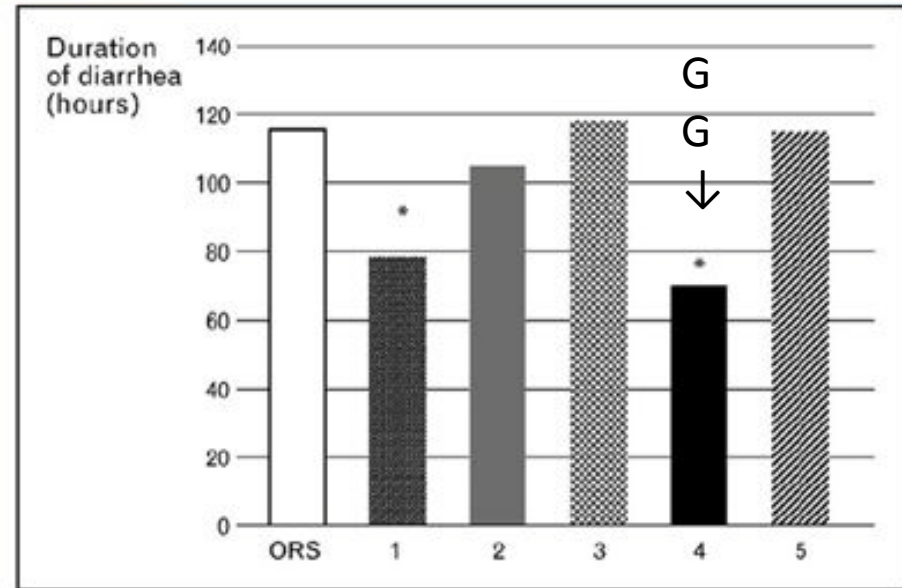
Aim-Clinical efficacy of Lactobacillus acidophilus NCFM (L-NCFM) and Bifidobacterium lactis Bi-07 (B-LBi07) in nonconstipation FBDs

Results -L-NCFM and B-LBi07 twice a day improve symptoms of bloating in patients with FBDs.



## Functional Foods for prevention and treatment for diarrhea

- Probiotics have gained a role as adjunctive treatment of infantile gastroenteritis together with rehydration
- Their efficacy is less convincing in adults, but promising in antibiotic-associated diarrhea.
- However, evidence of efficacy is limited to a few strains



\*= $P < 0.001$  compared with oral rehydration solution alone (Mann-Whitney  $U$  test). The figure shows the effects on the duration of diarrhea of five different probiotic preparations administered in addition to oral rehydration solution. The control group received oral rehydration solution only. The total duration of diarrhea is significantly lower in children receiving *Lactobacillus rhamnosus* GG (group 1) and in those receiving the bacterial mix (group 4) than in patients receiving oral rehydration solution alone. These results demonstrate that not all commercially available probiotic preparations are effective in children with acute diarrhea. □, Oral rehydration solution (ORS) alone; ■, *Lactobacillus casei* subsp. *rhamnosus* GG; ■, *Saccharomyces boulardii*; ▨, *Bacillus clausii*; ■, *Lactobacillus delbrueckii* var. *bulgaricus*, *Lactobacillus acidophilus*, *Streptococcus thermophilus*, *Bifidobacterium bifidum*; ▩, *Enterococcus faecium* Sf 68. Reproduced with permission [22\*\*].

## Functional foods & AAD

Journal of Gastroenterology, 2008 Jul; 42 Suppl 2: S58-63.

- AAD - approx 25% of patients receiving antibiotics
- ↓AAD when probiotics were co-administered with antibiotics.
- McFarland analyzed 25 RCTs of probiotics for the prevention of AAD including 2810 subjects. ↑1/2 trials - efficacy of the probiotic.
- Lactobacillus GG, Saccharomyces boulardii, and the probiotic mixtures were effective.

# Conclusions of the IAP National Task Force for use of probiotics in diarrhea, May 2006

- No studies till date done in developed countries
- The effect of probiotics is **strain related** and there is paucity of data to establish the efficacy of the probiotic species (namely *L. acidophilus*, Lactic Acid Bacteria) available in the Indian market
- The earlier studies have documented a beneficial effect on rotavirus diarrhea which was present in > 75% of cases in studies from the west. Rotavirus constitutes about 25% of diarrhea in hospitalised children and 15% in outpatient practice in India.
- The primary outcome analyzed in all the studies was the duration of diarrhea.
- The more objective parameter of stool output was not evaluated.

Probiotics in the  
Treatment of Diarrhea  
Conclusions of the IAP  
National Task Force for use  
of probiotics in diarrhea,  
May 2006

## Issues to be answered in Indian population ?

- Strain standardization
- Product regulation
- Evaluation of more than one strain for therapeutic effect
- Evaluation of probiotics in subgroups
- Dose and duration of therapy
- Carrier substances
- Interactions with other medication
- Interactions with other enteropathogen

# What is the functional foods prescription for the population for reducing risk of NCD?

- Can be consumed three or more times a day as needed.
- Is priced reasonably.
- Available locally & seasonally
- Causes no unhealthy side effects when consumed according to guidelines.
- Tastes good.
- Is suitable for all ages.
- Needs no prescription.
- Is proven effective throughout a long history of use.
- Is easy to obtain.

Can you guess what it is?

**Answer**

**A variety from each  
food group  
of a balanced diet  
everyday**

**THANK YOU**