Traditional Functional Foods

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Most traditional Foods were functional

Traditionally, Food was considered at times as medicine

Traditionally used, culture and agro climatic region specific

Traditional sources, unique composition and traditional processes of preparation and consumption

Traditional System of Ayurveda – based on the functionality of of traditional foods and the science utilized this knowledge to prevent, treat, or manage diseases(Sarkar et al, 2015)

The intent of use decides whether it is a food or a medicine

Functional Food is somewhere n between

Raw Food	Process	Components	Functionality
Cereals	Fermentation	Carbohydrates	digestibility
Legumes	Soaking	Remove anti nutrients	Bioavailability
Cereals	minimal	Resistant starch	Low glycemic Good gut bacteria
Millets	Primary	Micronutrients Soluble fiber	Healthy living
Fruits	fresh	Nutrients and fiber	Good heath. Consumed while fasting
Spices	minimally	Bioactives	Anti oxidannt Anti inflammatory Anti bacterial Hypolipidemic

Table 2
Classification of weaning foods.

Serial number	Food	Ingredients	P
1	Malt based foods	Flours of malted foxtail millet, barnyard millet, roasted soybean flour and skim milk powder	
		Flours of malted wheat, chick pea, nonfat dry milk, sucrose	
		Flours of malted finger millet, Green gram	
		Flours of Sorghum malt, Green gram malt, sesame flour	
2	Chapati based foods	Wheat, Green gram, Bengal gram	
		Maize, Green gram, Bengal gram	
		Sorghum, Green gram, Bengal gram	
3	Popped food	Pearl millet, Green gram, Bengal gram	
4	Flaked food	Rice and soya bean	
		Skim milk powder	
5	Shotti	Rhizome of *Curcuma angustifolia* Roxb.	
6	Sattu	Bengal gram, wheat, jaggery	
7	Banana based weaning food	Ripened banana or banana pulp four and cooked rice	
8	Amaranth based weaning food	Amaranth seeds, green gram, chick pea dal	
		Rice flakes, puffed amaranth	
9	Weaning gruel	Wheat flour, Jaggery, oil, germinated cereal flours (amylase rich food)	
		Spinach or any green leafy vegetable, germinated millet	

Table 1: Major Food categories and their functional components

No.	Category	Functional Components
	Cereals	Minerals, vitamin E and γ-oryzanol (rice bran), insoluble fibre (wheat bran), beta-glucan (oats)
	Legumes and pulses	Isoflavones and dietary fibre
	Oil	Omega-3 fatty acids (flax seed oil), γ-oryzanol (rice bran oil), oleuropein (olive oil)
	Fruits and vegetables	Dietary fibre, carotenoids (carrot), dithiolthiones (cruciferous vegetables), beta-carotene and lutein (green leafy vegetables), lycopene (tomato), resveratrol (grapes), sulphur compounds (alliums), wide range of polyphenols
	Fishes	Omega-3 fatty acids (Tuna, salmon, mackerel)
	Dairy products	Probiotics
	Spices and herbs	Curcuminoids (turmeric), piperine (pepper), Eugenol (clove, bail and cinnamon), gingerol and shogol (ginger), disogenin, 4-hydroxyisoleucine and galactomannan (fenugreek), flavonoids and diallyl sulphate, alliin, ajoene, and allicin (garlic), cinnamtanninB1 (cinnamon).

K Bhaskarachary et al. 2016

What is a Bioactive Molecule

- A naturally occuring molecule from any living system– plant/ animal/ fungi/ bacteria/ algae/terrestrial/ marine which has a biological activity eg anti proliferative, anti oxidant, anti infective, growth promoting, cholesterol lowering etc

Functional Component (bioactive molecules)	Source	Health Benefit
Alpha-carotene	carrots	
Beta-carotene	fruits, vegetables	neutralize free radicals,
Lutein	green vegetables	reduce risk of macular degeneration
Lycopene	tomato	reduce risk of prostate cancer
Insoluble Fibre	wheat bran	reduce risk of breast or colon cancer
Beta-Glucan	oats	reduce risk of CVD
Soluble Fibre	psyllium	,,

Bioactives	Food Source	Health benefit
Omega-3	Fish and fish oils	reduce risk of CVD improve mental, visual functions
Flavonoids Anthocyanidins	fruits	neutralize free radicals reduce cancer risk
Catechins	tea	,,
Flavanones	citrus	,,
Flavones	fruits/vegetables	,,

Functional component	Source	Health Benefit
stanol ester	corn, soy, wheat,	inhibit cholesterol absorption
Fructo-oligosaccharides (FOS)	onion	Pre biotics
Lactobacillus	yogurt, other dairy	Gut health
Isoflavones:		
Daidzein	soya- soy-based foods	menopause, CVD
Genistein		lower LDL
Lignans	flax, vegetables	,,
Proanthocyanidins	cranberries, cocoa,chocolate	improve urinary tract health
		reduce CVD
		? Complications of DM

Historical Characterisation

- Source / sources of Bioactive Compound – Taxonomy of plant

  Eg Lycopene – Tomatoes, Red Carrots, Red Capsicum, Water melon

- History of Safe human use – traditional or Published data

- Safe level of consumption / upper safe limit through food eg fenugreek was 6 Gms , as functional food – 20 gms

Physico Chemical Characterization

- Structure of the compound, molecular formula- Chemical fingerprint

- Available single or a family of molecules

- Category and variants eg Carotenoids/ Curcuminoids

- Molecular weight, solubility, stability etc

- Thermodynamic and spectral data

- Isolation of compound/ sample separation , synthesis

- Purity of final substance and impurities

- Preservation, storage , interactions with other substances

Pharmacokinetics

- Bioavailability
- Absorption
- Half life
- Accumulation in tissue
- Distribution
- Metabolism
- Excretion

Biological Activity

- Anti Oxidant/ anti Inflammatory / anti cancer etc

- Method of assessing and quantifying this activity and validated assay methods

- In vitro and In vivo methods

- ED 50

- Toxicokinetics

Biological Activity

- Adverse effect level –LOAEL / NOAEL

- Safe Upper Limit

- Acceptable Daily Intake

- Effect in physiological states like pregnancy, Children, Lactation

Bioinformatics

- Structure function similarities with other known molecules

- Compare in allergen database

- Toxicity Database and Drug interaction database

Identification of Biomarkers

- Identified and validated for their predictive value.

❖ Markers related to level of consumption and bioavailability-

Eg: Plasma levels of the bioactive molecule

❖ Markers correlated to outcomes are indicator markers/ effect markers

Eg: Stanol consumption and Serum Cholesterol

❖ If the markers are related to risk of disease they are known as susceptibility markers.

Eg : Ratio of LDL cholesterol to Total Cholesterol and risk of CHD

Risk assessments

- ❖ **Risk assessment :**
- ❖ **Hazard identification (Adverse effects)**
- ❖ **Hazard characterisation (including dose-response assessment);**
- ❖ **Exposure assessment**
- ❖ **Risk characterisation.**
- ▶ **Risk-benefit analysis**

PRINCIPLES FOR ADDITION OF DIETARY ACTIVE COMPOUNDS IN FOODS

- ➢ **Active compounds should be present at a level which will not result in either excess or insignificant intake**

- ➢ **Should be sufficient to exercise its beneficial effect**

- ➢ **Should not result in an adverse effect on the metabolism of any other nutrient**

- ➢ **Should be stable in food under customary conditions of packaging, storage, distribution and use**

- ➢ **Should be biologically available from the food**
- ➢ **Methods of measuring should be available**

HUMAN STUDIES

- ➢ Data from other countries

  Target population – Indian men / women / children / elderly

- ➢ Comparative study

  Placebo Vs. Nutraceuticals

  Low dose Vs. High

  Traditional Vs. test

- ➢ Clear cut end points/outcomes: Biomarkers if validated.

CLAIMS

➢ **Nutrient content claim : eg. low sodium, low fat, rich in n3, high soluble fiber etc**

➢ **Structure/function claim eg. Calcium builds strong bone, lycopene reduces prostate cancer risk**

➢ **Risk reduction claim : eg. Fibre and CHD , folic acid and NTD**

Conclusion

- Translate traditional to new knowledge and into product
- Ensure Safety and Quality
- Evaluate Efficacy – limited studies
- Make content Claim
- Evaluate product for specific health outcomes
- Make a product Claim

NIN

Thank You