## contents

- Food as medicine
- Definition of nutraceutical
- Global market
- Safety and quality indicators
- Nutrigenomics
- Nutrigenomics v/s nutrigenomics
- Some commonly used nutraceuticals
- Food as a nutraceutical
- Advantages of nutraceuticals
- Limitations of nutraceuticals
- Amazing facts
- Functional foods
- Medical foods
- Dietary supplements
- Farmaceuticals
- Cosmoceuticals
- Aquaceuticals
- Galenicals
- Niche for nutraceuticals
- Regulatory bodies
- Brief review
- Nutraceuticals in ayurveda
- Traditional concept
- Rasayanas
- Ahara and Aushadha
- Conclusion
Food as medicine…….

- Let thy food be thy medicine, and medicine be thy food- Hippocrates
- Indian, Egyptian, Chinese and Sumerian civilizations provide evidence
- Ayurveda, the 5000 yr old health science have mentioned benefits of food for therapeutic purposes
Food......medicine

- Nearly two thirds of the world’s 6.1 billion people rely on the healing power of plant-based materials for many reasons—availability, affordability, safety or their belief in traditional cures.
- Medical benefits of food have been explored for thousands of years.
- Modern nutraceutical industry began to develop in Japan during the 1980s.
Nutrition + Pharmaceuticals

Term commonly used in marketing but has no regulatory definition

Term commonly used synonymously for designer foods, health foods, fortified foods, medifoods, vita foods, f(ph)arma foods, functional foods and dietary supplements
Term coined by Dr. Stephen L De Felice, Founder and Chairman of the Foundation for Innovation in Medicine, New Jersey, USA

Nutraceutical industry was established at Rutgers
A nutraceutical is any substance considered as a food, or its part which, in addition to its normal nutritional value provides health benefits including the prevention of disease or promotion of health.

Eg: lycopene, beta carotene
A nutraceutical is “any non-toxic food component that has scientifically proven health benefits, including disease treatment or prevention.”

- The functional component of the food must be standardized in the nutraceutical product and produced under good manufacturing practices (GMPs).
The groups of nutraceuticals

- Allium compounds
- Anti-oxidants
- Digestive stimulants
- Flavonoids
- Glucosinolates
- Microflora
- Phytoestrogens

Vitamin C  Carotenoids  Vitamin E

Carotenoids are plant pigments that give yellow, orange and red fruits and vegetables colour. Over 500 different carotenizes have been identified. However, about 60 have been found to be present in the foods we eat and many are converted in the body into vitamin A.

Following recent research, vitamin A is also linked with:

HEALTH BENEFIT CLAIM
Less chance of heart disease, strokes, cataracts and some cancers.
GLOBAL MARKET

- Constantly growing market
- Nearly 2/3rd of Americans & 47% of Japanese consume at least one type of nutraceutical annually
- Industry worth 86 billion$ annually in USA
- Slightly higher in Europe
- Industry amounting to 60 billion$ annual food sales in Japan
Nutraceutical market estimate (in $ billions)

WE FOSTER HEALTH

- JOHNSON & JOHNSON
- MONSANTO
- NOVARTIS
- ABBOTT LABORATORIES
- SMITHKLINE BEECHAM
- HIMALAYAS
- DABUR
- ZANDU PHARMACEUTICALS
- CIPLA
- RANBAXY
- WARNER-LAMBERT
- AMERICAN HOME PRODUCTS
- GLAXO
- DUPONT
IT'S OUR IDEA, SIRJI...!
SCENARIO..our nation

- Indian market growing at the rate of 21% per year
- AMWAY- highest market share - over 15%
- Dabur
- Ranbaxy
- Pfizer
- Other major companies
Did you know?

- 35% of people have an undiagnosed chronic disease
- Cancer can live 90% of its life before being detected
- 50% of the time the first indication of a heart problem is a fatal heart attack
- More than 196,000 people die and 2.2 million are injured each year by adverse reactions to prescription drugs. (Alternative Medicine, March 2000)
- The use of prescription drugs is the 3rd leading cause of death
- 65% of adult Americans are overweight, 30% are obese (National Center for Health Statistics)
Nutraceuticals...

- Increased public demand
- Trends in demography
- Socio-economic scenario
- More researches and studies
ARE THEY SAFE…?

- Optimal doses of many yet to be discovered
- Animal studies revealed that some phytochemicals (allyl isothiocyanate) known for cancer prevention is carcinogenic at high concentration
- Additional research necessary to substantiate potential health benefits
- Soy phytoestrogens- "a double edged sword"
- Crude form of the drug <total extract<isolated component: more harmful in succession
BRIDGING THE GAP BETWEEN FOOD AND MEDICINE.....
NUTRIGENOMICS

- Study of the effects of food and food constituents on gene expression
- Influence of genetic variations on nutrition
- Personalized nutrition based on genotype
- Science still in infancy
Nutrigenomics....

- Nobel laureate Linus Pauling
- Genetic test to discover nutritional needs
- Using Applied Genomic Technologies
- Develop functional foods based on genetic make up.
Nutrigenomics: Vitamins, aminoacids, minerals, trace elements etc. Less than 60 compounds identified so far.

Nutragenomics: More than 1000 compounds. Eg. Resveratrol from grapes, Genistein from Soy proteins, Lutein from Kiwi fruits and broccoli, Lycopene from Tomato.
SOME COMMONLY USED NUTRACEUTICALS
Curcuminoids, which are among the most well researched phyto-nutrients, are found in turmeric.

Research to date indicates that curcuminoids have a powerful antioxidant action.
Turmeric...

- Curcuminoids also offer the body support in its anti-inflammatory function, as well as lending circulatory and immune support.

- The anti-oxidant activity of curcuminoids is approximately 3 times more powerful than Polycyanidolic Oligomers (PCO).
Lycopene Effect in Diseases

cancers:

- prostate
- digestive tract
- bladder
- skin
- lung
- breast
- cervical
- cardiovascular disease (Sesso et al, 2002)
- asthma (Neuman et al, 2000)
Nutraceuticals in Orange

Contain hesperidin, tangeretin, nobiletin, and limonene
ANTIOXIDANTS

Superheroes and Supervillains of the Circulatory System

Auntie Oxidant kicks out the Free Radicals.
Compound retarding or preventing the oxidation

Prolong the life of oxidizable matter

Egs of naturally occuring antioxidants are glutathione and its precursors, Vit E, Iron and Selenium.
How do free radicals form?

- Ultra Violet Rays
- Atmospheric Pollution
- Stress
- Poor Nutrition

Free Radicals

[Diagram showing the formation of free radicals and their protection by antioxidants]
# Poly Unsaturated Fatty Acids

<table>
<thead>
<tr>
<th></th>
<th>Vegetable Oils</th>
<th>Animal Oils</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUFA</td>
<td>OMEGA-6</td>
<td>OMEGA-3</td>
</tr>
<tr>
<td>Function</td>
<td>REDUCE CHOLESTEROL FORMATION</td>
<td>REDUCE THROMBOXANE FORMATION</td>
</tr>
<tr>
<td>Examples</td>
<td>FLAX SEED AND CANOLA</td>
<td>COD, SALMON, TUNA, SARDINES</td>
</tr>
</tbody>
</table>
Friendly Bacteria
L. acidophilus, L. salivarius, L. casei, L. thermophilus,
B. bifidum, B. longum, etc.

Unfriendly Bacteria
Pathogenic bacteria & fungi, such as Candida albicans, etc.
PROBIOTICS

- Living microorganisms
  - Taken with or without food
- Improve intestinal microbial balance
  - Help functioning of large intestine
- Present in sour milk and yoghurts
  - Eg: *lactobacillus acidophilus*
Many of these bacteria possess enzymes that can cleave \( \alpha \)-glycosidic linkages.

**Major Bacteria Present**

- Prevotella
- Streptococcus
- Veillonella
- Helicobacter

**Probiotics**

- Enterococcus
- Lactobacillus

- Bacteroides
- Ruminobacteria

- Clostridium
- Enterobacteria
- Enterococcus
- Escherichia
- Eubacteria
- Klebsiella
- Lactobacillus
- Peptococcus
- Peptostreptococcus
- Proteus
- Ruminococcus
- Staphylococcus
- Streptococcus


SOURCES OF PROBIOTICS
PREBIOTICS

• Nutraceuticals which promote the flourishing of probiotics
• Food substances reaching the colon in intact form
• Best known prebiotic: inulin found in chicory
DIETARY FIBRES

FIRSTLY INCREASE BULK OF FAECES

NORMALIZE TRANSIT TIME
11 Tomatoes
Vitamin A

10 Cups
Green Beans
Folate

30 Broccoli
Selenium

19 Wheat Slices
Zinc

96 Blueberries
Antioxidants†

Certified Organic
Aloe Vera Gel

5 Cups
Green Tea
(EGCG Content)

12 Orange Slices
Vitamin C
ADVANTAGES OF NUTRACEUTICALS

- Improve health
- Delay aging
- Increases life expectancy
- Reduced side effects with desirable outcomes
- Holistic approach
advantages...

- Food supplies being on a dwindling mode
- Markets focusing on supply of highly processed foods lacking sufficient and appropriate nutrients
- Media drawing people’s attention to nutraceuticals
- Baby boomers reaching golden ages
LIMITATIONS

- Not subjected to same testing and regulations as pharmaceuticals
- Majority not regulated by FDA in USA
- Companies creating unregulated products to create a wide profit margin
- Bioavailability of nutrients is lower
- No regulatory definition
- Effect may be attributed to that of a placebo
If you're of northern European ancestry, you can probably digest milk, and if you're south-east Asian, you probably can't.

In most mammals, gene for lactose tolerance switches off once an animal is weaned.

Iceland’s largest diary company has introduced world’s first milk to lower blood pressure.
Something we ought to know....
Functional foods

- Often used to refer to nutraceuticals
- Closely related
- Foods, not drugs, having no therapeutic effects
- Concept introduced by Japan in 1991
- Legally defined as ‘Foods for Specified Health Use’ (FOSHU)
- Expected to have a specific health effect
- Allergens have been removed
- Addition or removal scientifically evaluated
- Permission granted to make claims regarding beneficial health effects
Canadian view.....

Functional foods similar in appearance to conventional foods...consumed as a part of a usual diet

Nutraceuticals produced from foods but sold in pills, powders & medical forms not generally associated with food
British version...

- Food with a component incorporated into it
- Gives a specific medical or physiological benefit
CONTRADICTION

Functional food is essentially a food

Nutraceutical is an isolated or concentrated form
Medical foods

Food formulated to be consumed or administered orally under supervision of a physician

Intended for specific dietary management of a disease

Also in conditions of distinctive nutritional requirements based on a recognized scientific principle
DIETARY SUPPLEMENTS

In US, a **dietary supplement** is defined as a product that is intended to supplement the **diet**.

eg: hormones **DHEA**, **pregnenolone** and **melatonin**
Dietary supplements......

Should contain any of

- a **vitamin**
- a **mineral**
- an **herb** or other **botanical** (excluding tobacco)
- an **amino acid**
- a concentrate, metabolite, constituent, extract, or combination of any of the above
Furthermore...

It must
- be intended for ingestion in pill, capsule, tablet, powder or liquid form
- not be represented for use as a conventional food or as the sole item of a meal or diet
- be labeled as a "dietary supplement"
FARMACEUTICALS

- Blending of words ‘farm’ and ‘pharmaceuticals’
- Medically valuable compounds from modified agricultural crops or animals
- Uses biotechnological methods usually
COSMOCEUTICALS

- Represent the marriage of cosmetics and pharmaceuticals
- Cosmetic products with biologically active ingredients having medical or drug-like benefits
- Examples: anti-aging creams and moisturizers.
AQUACEUTICALS

Found in soft drinks
GALENICALS

- Medicines prepared according to Galen’s formulae
- Now used to denote standard preparations containing one or several organic ingredients in contrast to pure chemical substances
- Many of the products classified as nutraceuticals very well fit into the definition of GALENICALS
Niche for *nutraceuticals*

- People believing more in prevention than cure
- People having chronic diseases and have found no solution in allopathic medicines
- Pediatric and geriatric patients
- Economically challenged patients
REGULATORY BODIES

- Foods For Specified Health Use (FOSHU) - Japan
- Joint Health Claims Initiative (JHCI) - UK
- Codex Alimentarius - FAO and WHO
- Functional Food Science in Europe (FUFOSE) - European Union
- Food Safety and Standard Act 2006 - India
A Brief Review.....

- Food which is being prepared with scientific intelligence is called functional food.
- When functional food aids in prevention or treatment of diseases other than anaemia it is called a nutraceutical.
- A functional food for one consumer can act as a nutraceutical for another.
NUTRACEUTICALS IN AYURVEDA

Different paths ........same destiny
“न च आहारसमस्म् किन्निचित् भैषज्यमुतपलभ्यते
शक्यते अप्यन्नमात्रेण नरः कर्तुम् निरामयः
भैषजन उपपन्नोपि निराहारो न शक्यते
तस्मात् भिषग्भि: आहारो महोषध्मम् उच्यते!!”
(Kas.Sam. 4th chapter)
Although the concept of nutraceuticals is gaining more popularity more recently, its roots can be traced to the ancient Indian system of medicine, ‘Ayurveda’.

The concept of ‘Aajasrik Rasayana’ (general rejuvenation) deals with food products that can be consumed daily for improving quality of life by offering protection from external and internal stressors.
Commonly used nutraceuticals in Ayurveda

- *Chyavanprasha* (for general health and prevention of respiratory disorders)
- *Brahma Rasayana* (for protection from mental stress)
- *Phala Ghrita* (for reproductive health)
commonly used nutraceuticals…

- *Arjuna Ksheerapaka* (for cardioprotection)
- *Shatavari Ghrita* (for general health of women during various physiological states)
- *Rasona Ksheerapaka* (for cardio-protection).
TRADITIONAL CONCEPT

- Hithahitham sukham dukham……
  embraces everything that sustains, nurtures and maintains life
- Samadosha: samagnischa…..
  holistic approach in defining health
- Nithyam hithahara viharasevi…..
  highlights prevention of diseases
Contd…

- seshatwadayusha: pathair yapya: emphasizes the importance of pathya in yapya rogas
- Jatha pramehi madhumehino va na sadhya….
  focus on preventive aspect rather than curative
RASAYANAS....

- “Rasayana thantram nama vaya sthapanam ayurmedhabalakaram rogapaharanana samarthham cha!”
  Maintain youth, increase longevity, intellectual capacity, physical strength and cures diseases
- “Rasayanam cha tat jneyam yajjaravyadhi nasanam”
  Helps to retard aging and disease
Rasayanas are individualized and are age, tissue and organ specific.

Mechanism of action is at three levels:

- **RASA**
  - As nutrient for plasma
  - Eg: satavari, pravala

- **AGNI**
  - Promoting enzymatic systems
  - Eg: pippali, sunti

- **SROTHAS**
  - Improving transport systems
  - Eg: guggulu
Some age specific rasayanas

<table>
<thead>
<tr>
<th>DECADES OF LIFE</th>
<th>NATURAL BIO-LOSSES</th>
<th>SUGGESTED RASAYANAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>Balya(corpulence)</td>
<td>Ksheera, ghrita, Gambhari</td>
</tr>
<tr>
<td>11-20</td>
<td>Vriddhi(growth)</td>
<td>Bala, Amalaki</td>
</tr>
<tr>
<td>21-30</td>
<td>Chhavi(lustre)</td>
<td>Amalaki, Haridra</td>
</tr>
<tr>
<td>31-40</td>
<td>Medha(intellect)</td>
<td>Brahmi, Sankhapushpi</td>
</tr>
<tr>
<td></td>
<td>Twak (skin quality)</td>
<td>Bhringaraja, Haridra</td>
</tr>
<tr>
<td>-------</td>
<td>--------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>41-50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51-60</td>
<td>Drishti (vision)</td>
<td>Thriphala, Jyothishmathi</td>
</tr>
<tr>
<td>61-70</td>
<td>Sukra (virility)</td>
<td>Aswagandha, Kapikachu</td>
</tr>
<tr>
<td>71-80</td>
<td>Vikrama (physical strength)</td>
<td>Amalaki, Bala</td>
</tr>
<tr>
<td>81-90</td>
<td>Buddhi (thinking)</td>
<td>Brahmi, Sankhapushpi</td>
</tr>
<tr>
<td>91-100</td>
<td>Karmendriyapadavum (sensory perception)</td>
<td>Bala, Sahachara</td>
</tr>
</tbody>
</table>
In classics, food is considered to be rasapradhana whereas aushadha (drugs) is veeryapradhana.

Primary metabolites such as carbohydrates are the major ingredients in food.

In aushadha, secondary metabolites such as alkaloids are seen in greater amounts.

E.g.: Inulin in Pushkaramula (1° metabolite) is used as food and active principle called triterpenoids (2° metabolite) is made use of as a drug.
Isolated principles and extracts are to be consumed only in small quantities but crude/raw drugs are needed in greater amounts.

The levels at which an ahara becomes preventive or curative (i.e. an aushadha) depends on a lot of factors like properties and qualities of ahara used, prakriti, sara and dosha of the individual etc.
THERE ARE NO GOOD OR BAD FOODS BUT THERE ARE GOOD OR BAD DIETS.....
THANK YOU