Technical Session – IV

“Traditional Indian Functional Foods”

Milk and Dairy Products

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Importance of Milk & Dairy Products in Indian Food Basket

Rural India

- Food Expenditure 55%

Urban India

- Food Expenditure 43%

Analysis:

- Cereals: 31% in Rural India, 22% in Urban India
- Pulses: 6% in both Rural and Urban India
- Milk & milk products: 19% in Rural India, 15% in Urban India
- Edible oil: 8% in both Rural and Urban India
- Vegetables: 12% in Rural India, 11% in Urban India
- Fruits: 3% in both Rural and Urban India
- Sugar: 7% in Rural India, 6% in Urban India
- Processed food: 11% in Rural India, 15% in Urban India
- Egg, fish & meat: 6% in Rural India, 7% in Urban India

Graphs show the distribution of food items in the Indian food basket, highlighting the importance of milk and dairy products in the rural and urban diet.
• **Operation Flood**
  
  • Largest agricultural programme in the world using food aid for development
  
  • Transformed the face of India’s dairy industry through organising farmers into cooperatives

![Graph showing milk production from 1968-69 to 2009-10.](image)

• The world’s largest Milk producer

• ** Produces 16 % of the world’s milk **

• **Milk production in 2009-10 : 112.6 million tonnes**
Demand of Milk & Dairy Products

- Increasing GDP
- Government welfare programmes like NREGA
- Increasing Urbanization
- Emphasis on Healthy Eating
- Shift: CEREALS
- Projected demand for milk: about **200 million tonnes by 2021-22**
- Milk production is increasing by 3 million tonnes annually Must henceforth increase by **6 million tonnes annually**
National Dairy Plan to double milk production

Increase in milk production by increasing productivity of our animals
  • scientific approach to feeding and breeding

Increase of Organized sector’s share of marketable surplus
  • from 30 percent to 60 percent
  • improve milk handling & product quality

Encouragement of milk producer to produce more milk
  • Increasing income from sale of milk
  • Value added product

..... to meet the growing demand
Milk Utilization Pattern

Total Milk Produced
- Traditional Dairy Products: 45%
- Western Milk Products: 5%
- Liquid Milk: 50%

Total Milk Produced
- Surplus milk available for consumers: 52%
- Consumed/used in production areas: 48%

Surplus Milk
- Organized Sector: 30%
- Unorganized Sector: 70%

- Dominated by unorganized sector
- Marked with
  - Unhygienic production
  - Energy inefficient process
  - Inconsistent quality
  - Low shelf life

Value addition in Traditional dairy products: Double
Classification of Traditional Indian Dairy Products

- **Milk**
  - **Heat and acid coagulated**
    - Paneer
    - Chhana
  - **Cultured product**
    - Dahi
    - Mishti Doi
    - Chhach/Lassi/Matha
    - Shrikhand
- **Fat rich dairy product**
  - Ghee
  - Malai
  - Makkhan
  - **Heat Desiccated Products**
    - Kulfi
    - Rabri
    - Basundi
    - Khoa
    - Peda/Burfi
    - Kalakand
    - Gulabjamun
    - Sandesh
    - Rasogolla/Rasmalai
    - Patua
    - Shrikhand
To tap the immense potential of organized manufacturing & marketing of indigenous milk products

devolved mechanized process and packaging systems

to produce products with uniform quality and extended shelf life
NDDB’s Contribution towards Organized Manufacturing of Traditional Dairy Products

Dahi
- Mother Dairy, Delhi
- Jaipur Dairy
- Sikkim Milk Union
- Himul Dairy
- Ambathur Dairy
- Lucknow Dairy
- Kolhapur Dairy

Lassi/Chhas
- Dimapur Dairy
- Islampur Dairy
- Himul Dairy

Mishti Doi
- Mother Dairy, Kolkata
- Bhubaneshwar Dairy
- Mother Dairy, Delhi
- Lucknow Dairy
- Dimapur Dairy
- Visakha Dairy

Shrikhand
- Sugam Dairy
NDDB’s Contribution towards Organized Manufacturing of Traditional Dairy Products

Paneer
- Jaipur Dairy
- Kolhapur Dairy
- Jalgaon Dairy
- Islampur Dairy
- Mandi Dairy
- Bhagirathi Dairy
- Bhubaneshwar Dairy
- Vidya Dairy
- Sabar Dairy
- Sumul Dairy
- Kanpur Dairy

Chhana Podo
- Bhubaneshwar Dairy

Gulabjamun/Peda/Khoa & Khoa based Sweets
- Sugam Dairy
- Sumul Dairy
Bioactive Functions Associated with Milk & Milk Products and their Components

• Functional foods:
  • Any food or food ingredient that may provide a health benefit beyond the traditional nutrients that it contains
  • Foods that are consumed as part of normal food pattern
  • have beneficial effects on body functions that go beyond adequate nutritional effects
  • relevant to an improved state of health and well being
  • and/or a reduction of the risk of disease

• Like many foods and their components, milk & dairy products fit this definition
Milk (Dugdha)

- Milk and its byproducts accounted as best among all life-sustaining substances
- Appetizing, Healing wounds & fracture, Increase semen strength, Nourishes ojas (vigor of the body)
- Milk is effective in Acidity, Anemia, Diarrhea and Beneficial for nursing mother
- Adjuvant of medicines
- Rasayana (immuno-booster) in therapeutic formulations
- Bhavana (bio-enhancer to detoxify/increase the therapeutic property of the formulations)
Ayurvedic Perspective of Indian Traditional Milk Products

Ghee (ghrita)

- Judicious use of ghee
  - Prolongs life
  - Enables good digestion (stomachic)
  - Promotes intellect, memory, strength and good complexion (emollient)
  - Good for eyes and voice

- Therapeutic values of ghee:
  - Cleanses and heals ulcers
  - Therapeutic qualities used in conditions like Wasting, Fatigue, Skin disorders, Mental diseases & certain types of Fever
  - Helpful in transferring herbal influences to tissues
  - Essential for snehana treatment which is done as part of shodhana to flush the toxins
  - Best antidote for metal, mineral & herbal poisoning
Ayurvedic Perspective of Indian Traditional Milk Products

**Butter (makkhan)**
- Used in Piles, Chronic dysentery, Anorexia & in Facial paralysis

**Curd (dahi)**
- Appetizing, Digestive & Cooling properties
- Increases adipose tissue, Marrow, Semen strength & Blood

**Lassi/Chhach (takra)/Whey (mastu)**
- Reduces Bloating of stomach, Soothes intestines in IBS & helps in Indigestion
- Eases symptoms of Hemorrhoids & Constipation
- Tonic, Stimulant & Invigorating
- *Takra* is effective against Emesis, Piles, Anemia & Obesity
Major Bioactive Functional Compounds of Milk

- **Protein**
  - Casein
  - Whey Proteins
  - Enzyme, Immunoglobulin

- **Carbohydrate**
  - Lactose

- **Fat**
  - Fatty acids
  - Minor fat constituent

- **Minerals and Vitamins**
Biofunctionality of Casein

Milk

Protein

Casein

- $\alpha_{s1}$ - casein
- $\alpha_{s2}$ - casein
- $\beta$ - casein
- $\kappa$ - casein

Whey Proteins

Enzyme, Immunoglobulin

- Act as Ion carrier (Ca, Fe, Zn, Cu)
- Enzyme activity
- Glycomacropeptide
- Antiviral, Antibacterial, bifidogenic
Products

Milk

Protein

- Casein
  - $\alpha_{s1}$ - casein
  - $\alpha_{s2}$ - casein
  - $\beta$ - casein
  - $\kappa$ - casein

- Whey Proteins
- Enzyme, Immunoglobulin

Enzyme activity

Milk, paneer, icecream, khoa & chhana based sweets, fresh cheese

γ - casein

Glycomacropeptide

Cheese whey & whey based products
Biofunctionality of Whey Protein

Milk

Protein

Casein

Whey Proteins

Enzyme, Immunoglobulin

α-Lactalbumin

β-Lactoglobulin

Calcium carrier, Immunomodulation, anti-carcinogenic

Retinol carrier, Fatty acid binding, antioxidant activity
Products

Milk

Protein

Casein

Whey Proteins

Enzyme, Immunoglobulin

α - Lactalbumin

β - Lactoglobulin

Milk and whey from paneer, dahi, cheese & whey based drinks, powder
Biofunctionality of Enzymes & Immunoglobulin

Milk

Protein

Casein

Whey Proteins

Enzyme, Immunoglobulin

Lysozyme

Lactoferrin

Lactoperoxidase

Immunoglobulin A, M & G

Antimicrobial, synergistic with Immunoglobulin and Lactoferrin

Toxin binding antimicrobial, immunomodulation, anticarcinogenic, antioxidative, iron absorption

Antimicrobial

Immunity
Products

Protein
- Casein
- Whey Proteins
  - Enzyme, Immunoglobulin

Milk
- Lysozyme
- Lactoferrin
- Lactoperoxidase
- Immunoglobulin A, M & G

Colostrum based sweets

Milk and Milk products
Bioactive peptide derived from Casein

Milk

- Immunopeptide
  - Immunostimulant
- Casomorphin
  - Opioid agonists
- Casokinins
  - Antihypertensive
- Casecidin
  - Antimicrobial
- Phosphopeptide
  - Mineral carrier
- Casoplatelins
  - Antithrombotic
- Casoxins
  - Opioid Antagonists
Products

Milk

Protein

Casein

\( \alpha_{s1} \) - casein

\( \alpha_{s2} \) - casein

\( \beta \) - casein

\( \kappa \) - casein

Whey Proteins

Enzyme, Immunoglobulin

Immunopeptide

Casomorphin

Casokinins

Casecidin

Phosphopeptide

Casoplatelins

Casoxins

Fermented Dairy Products
Products

Milk

Protein

Casein

Whey Proteins

Enzyme, Immunoglobulin

α - Lactalbumin

β - Lactoglobulin

α - Lactorphins

Lactokinins

β - Lactorphin

Dahi and whey based fermented dairy drink
Bioactive peptide derived from minor components

Milk

Protein

Casein

Whey Proteins

Enzyme, Immunoglobulin

Lactoferrin

Lactoferroxin

Lactoferricin

Opioid antagonists

Antimicrobial
Products

Milk

Protein

- Casein
- Whey Proteins
- Enzyme, Immunoglobulin

Lactoferrin

Colostrum based Sweets, Milk & Milk Products

- Lactoferoxoxin
- Lactoferricin

Products

Colostrum based Sweets, Milk & Milk Products
Biofunctionality of Milk Sugar

Milk

Carbohydrate

Lactose

Lactulose

Heating

- Low glycemic index suitable for diabetics, less cariogenic
- Stimulates growth of probiotic
Milk

Carbohydrate

Lactose

Lactulose

Heating

Traditional retort sterilized milk

Milk & Milk Products
Biofunctionality of Milk Fat Constituents

Milk
- Protein
  - Casein
  - Whey Proteins (Enzyme, Immunoglobulin, peptides)
- Carbohydrate
  - Lactose
- Fat
  - Fatty acids
  - Minor fat constituent (Butyric acid)
  - Conjugated Linoleic Acid
- Other minor constituents
- Minerals
- Vitamins

Important in cell interaction with hormone and ion
Phospholipid
Sphingolipid

Reduce CVD, breast & colon cancer tumour

Inhibit colon cancer, reduce serum cholesterol, protect against bacterial toxins and infection

Stimulates growth of probiotic
Reduce CVD, breast & colon cancer tumour

Conjugated Linoleic Acid
Butyric acid

Stimulates growth of probiotic
Products

Milk

Fat

- Fatty acids
  - Conjugated Linoleic Acid
  - Butyric acid
- Minor fat constituent

- Phospholipid
- Sphingolipid
  - Ghee, Makkhan, Malai
Conclusions

- The bio-functionality of milk and milk products is well established in various in-vitro and in-vivo studies:
  - Cow Milk
  - Buffalo Milk: Infancy

- Milk and milk products, particularly Traditional Dairy Products: part of regular diet and thus its functional benefits could reach to a wide population

- Efforts needs to be made to study functionality of the bio-active components in traditional dairy products:
  - Naturally and As a Vehicle

- This would facilitate value addition to milk product:
  - Provide health & wellness to larger population
  - More return to milk producers
Thank You!

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