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NUTRITIONAL (UNDER NUTRITION) DISORDERS IN CHILDREN WITH THEIR MANAGEMENT

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ABSTRACT-

Childhood is the period in which many organ systems are still growing and continue to mature. Brain development is completed in this period. Therefore, nutritional needs of childhood are much higher than that of adults. The adverse effects of under nutrition will be manifested as functional deficits in organs and systems. The prevalence of nutritional disorders in children has increased significantly in recent decades. Malnutrition (under nutrition) with its two constituents of protein-energy malnutrition and micronutrient deficiencies,continues to be a major health burden in developing countries. It is globally the most important risk factor for illness and death of millions of children. Apart from marasmus and kwashiorkor (two constituents of protein-energy malnutrition), deficiencies of iron, iodine, Vitamin A is the main manifestations of malnutrition in developing countries. This study includes interventions to prevent these diseases by promoting breastfeeding, proper nutrition supplementation schemes and promote children to practice Yoga and giving health education.

KEYWORDS:*Under nutrition, nutritional disorders, protein-energy malnutrition, micronutrient deficiencies, food and nutrition, Yoga.*

INTRODUCTION-

Under nutrition affects billion of children in the world. UNICEF defines it as the outcome of insufficient food intake and repeated infectious diseases. It includes- stunting (low height for age), wasting(low weight for height), underweight(low weight for age), micronutrient deficiencies.

Under nutritional disorders occurs due to the deficiency of one or more of the essential parts of the healthy diet.The person affected is not eating (or fully digesting and absorbing) enough of all of the types of substances that his or her body needs to extract from food in order to both survive and thrive. These deficiencies usually affect growth and immunity but some cause specific clinical conditions such as Protein-Energy Malnutrition, Nutritional anemia, Vitamin A deficiency, Iodine deficiency.

The relevance of this review paper is that, what diet should be given to prevent undernourished children at both global and country level. This paper reviews existing literature on four things.

1. The first aim is to review the basics of under nutritional disorders (PEM, nutritional anemia, VAD, iodine deficiency) like their definitions, prevalence, etiology and symptoms.
2. Second aim is to review, how to prevent /manage undernourished children by providing proper nutrition.
3. Third aim is to review the literature about the programs/schemes about nutrition for children.

4. Fourth aim is to review, how *Yoga* can help in preventing these disorders.

METHODS-

Growth rate of young children is rapid therefore require proportionately more energy for each kilogram of body weight than adults. The problem that arises is in recommending intakes in communities where a large number of children are underweight because of under nutrition. Child under nutrition is highly prevalent in developing countries, resulting in substantial increase in mortality and overall disease burden, particularly Protein-Energy Malnutrition, Vitamin A deficiency, Iron and Iodine deficiency.

Protein-Energy Malnutrition:

PEM is identified as a major health and nutrition problem in India. It occurs particularly in weaklings and children in the first years of life. It is not only an important cause of childhood morbidity and mortality, but lead also to permanent impairment of physical and possibly, of mental growth of those who survive.[1]

It has two clinical forms:KWASHIORKOR and MARASMUS

PREVALENCE-

In Asia: 86.5 million stunted children under5, by united Nations sub-region, 2016.

35.9 million children under 5 are wasted, of which 12.6 million are severely wasted.[2]

In India: The incidence of PEM in pre-school age children is 1-2%.[3] The great majority of cases of PEM, nearly 80%, are the "intermediate" ones, that is the mild and moderate cases which frequently go unrecognized. The problem exists in all States and that nutritional marasmus is more frequent than kwashiorkor.

CAUSES-

1. Economic and Social Factors –

- It affects several poor people in most developing countries.
- Extreme poverty causes unhygienic living conditions, limited availability of food and no or very little child care.
- Reduced breast feeding and poor weaning practices are also some of the contributing causes of PEM.

2. Environmental Factors –

- Infections such as 'diarrhea'often develop due to unsanitary conditions.
- Other factors such as floods, earthquakes, drought and improper agricultural patterns lead to scarcity of food.
- Inadequate storage conditions can also aggravate the problem.

3. Age

- As infants and young children grow, their nutritional requirements also increase quite rapidly. When this requirement is not met properly, it often becomes one of the causes of PEM.
- Poor families with more number of children, resulting in PEM.[4]

4. Biological Factors

- If a woman undergoes maternal malnutrition both during her pregnancy and before it, chances are that she will give birth to a weak and 'underweight baby'.
- Infectious diseases such as diarrhea, respiratory infections, measles and intestinal worms which increase requirements for calories, protein and nutrients, while decreasing their absorption and utilization.[5]

- It is a vicious circle- infection contributing to malnutrition and malnutrition contributing to infection, both acting synergistically.[5]

KWASHIORKOR V/S MARASMUS[6]

FEATURES	KWASHIORKOR	MARASMUS
1. Cause	Deficiency of mainly proteins.	Deficiency of mainly calories.
2. General condition of child	Dull, disinterest in the surroundings, hardly moves from the sitting position.	Child is alert but irritable.
3. Face	Bloated moon like face.	Shriveled monkey like face.
4. Growth failure (Weight loss)	Less severe (moderate).	More severe (very severe).
5. Emaciation (muscle wasting)	Masked (present but not seen because of edema).	Obvious (skin and bone appearance).
6. Fat wasting	Fat is often retained.	Severe loss of subcutaneous fat.
7. Edema	**Always present.**	**Absent.**
8. Hair changes	Hairs are lusterless, show 'flag sign' positive, sparse distribution, loss of curliness and easily pluck able.	Hair show change in texture, thin and silky, show 'flag sign' negative.
9. Skin changes	Skin shows paint like patches (flaky paint dermatoses).	Skin changes are absent.
10. Mental changes	Present.	Absent.
11. Liver enlargement	Often present.	Absent.
12. Prognosis	Bad.	Good.
13. Serum total proteins	Reduced.	Normal.

MANAGEMENT-

Specific protection:

1. The child's diet must contain protein and energy – rich foods.**SOURCES-**
   Animal foods are good sources of protein such as- meat, egg, fish and milk, curd, cheese. Plant foods are- pulses(soyabean, Bengal gram, black gram, etc.), nuts (almond, ground nut, cashew nut etc.), Green leafy vegetables, Fresh fruits.[7]
2. Start with light food which is high in protein and energy: Give water drained from boiled green-grams, sugar cane juice, fruit juices, vegetable soups, porridge of lentil and rice, porridge of pulses and cereals, water drained from boiled green grams, sugar cane juice.
3. Immunization.
4. Food fortification.[8]
5. Use of safe drinking water.
6. Ensuring better hygienic conditions.
7. Many of the services for preventing malnutrition are provided through Government of India's Integrated Child Development Services(ICDS). Under ICDS, each child below 5 years of age is given daily supplementary food, providing 500 kcal and 12-15 g protein.

Nutrients	**0-6 months**	**6-12 months**
Energy(kcal/kg bw)	92	80
Protein (g/kg bw)	1.16	1.69

(Indian Council of Medical Research.Nutrients requirements and recommended dietary allowances for Indians,2010.)[9]

VITAMIN A DEFICIENCY:

- Vitamin A deficiency is a lack of vitamin A in blood and tissues.
- Nyctalopia (night blindness) is one of the first signs of VAD.
- It is common among children between 1 and 3 years. It is one of the serious public health problems.
- Younger the child, more serious is the disorder, because a young child is not having sufficient vitamin A reserve in the body unlike adults.
- Xerophthalmia, keratomalacia and complete blindness can also occur since vitamin A has major role in photo-transduction.

Extent of the problem –

- Nutritional blindness is common among predominantly rice eating states in India like Andhra Pradesh, Karnataka, Tamil Nadu, Bihar, West Bengal because rice is devoid of carotene. Incidence is less in North India.
- Nearly 70,000 children below 3 years are becoming permanently blind only due to vitamin A deficiency every year in India.
- It is predisposed by many social factors, such as poverty, illiteracy, ignorance, etc. Therefore, it is often called 'Social disease'.[10]
- An estimated 5.7% children in India suffer from eye signs of VAD.
- VAD is one of the major deficiencies among lower income strata population in India.
- Though the prevalence of severe forms of VAD such as keratomalacia has in general become rare, Bitot spots were present in varying magnitudes in different parts of the country as reported by National Nutritional Monitoring Bureau in 2003.

- The prevalence was higher than WHO cut-off level of 0.5%, indicating the public health significance of the problem of VAD.
- There is a huge inter-state variation in the prevalence of VAD among children.
- It is also a matter of concern that only 21% of children of age 12 to 35 months receive a vitamin A dose.
- Less than 10% coverage was reported in Nagaland.
- 7.3% coverage was reported in UP.
- Only states such as Tamil Nadu (37.2%), Goa (37.3%), Kerala (38.2%) and West Bengal (41.2%) have better coverage, though it is still low.[11]

ETIOLOGY-

- Low dietary intake of vitamin A.
- Infectious diseases which prevent absorption and utilization of vitamin A aggravate the condition.

SYMPTOMS-

- Infections, including throat and chest infections and gastroenteritis.
- Delayed growth and bone development in children and teenagers.

Eye and vision problems-

- Night blindness.
- Keratomalacia.
- Bitot's spots.
- Perforation of the cornea.
- Severe sight impairment (due to damage to retina) at the back of the eye.

Skin and Hair-

Dry skin, dry hair and itching (Pruritus).

MANAGEMENT:

Prevention and control of VAD must be an integral part of primary health care. An overall strategy can be defined, according to WHO in terms of short – term, medium – term and long – term action.[12]

a) Short–term action: Administer large doses of vitamin A orally, in recommended doses to vulnerable groups.

b) Medium-term action: An approach widely used to promote regular and adequate intake of vitamin A is fortification of certain foods with vitamin A.Addition of vitamin A to *dalda* in India is a typical example.Many other foods have also been considered for vitamin A fortification, viz. sugar, salt, tea and dried skimmed milk.The greatest challenge to successful fortification programs is choosing a food that is likely to be consumed in sufficient quantities by groups at risk.[12]

c) Long-term action: These are measures aimed at reduction or elimination of factors contributing to ocular disease, **e.g.**

- Persuading people in general and mothers in particular, to consume generously dark green leafy vegetables or other vitamin A rich foods.
- **Sources:**

  a) Animal Foods- Foods rich in retinol are liver, eggs, butter, cheese, whole milk, fish and meat. Fish liver oils are the richest natural sources of retinol.

  b) Plant Foods- The cheapest source of vitamin A is green leafy vegetables such as spinach and amaranth. The darker the green leaves, the higher its carotene content.

Vitamin A also occurs in most green and yellow fruits and vegetables (e.g., papaya, mango, pumpkin,tomato) and in some roots (e.g., carrots).

c)Fortified foods- e.g., vanaspati, margarine, milk.

- Promotion of breast feeding for as long as possible.
- Improvements in environmental health such as ensuring safe and adequate water supply and construction and maintenance of sanitary latrines to safeguard against diarrhea.
- Immunization against infectious diseases.
- Better feeding of infants and young children.
- Improved health services for mothers and children.
- Health education.

MINERAL DEFICIENCY DISEASES-

1. <u>NUTRITIONAL ANAEMIA-</u>

It has been defined by WHO as "a condition in which the hemoglobin content of blood is lower than normal as a result of a deficiency of one or more essential nutrients, regardless of the cause of such deficiency".[13]

Cut-off points recommended by W.H.O for the diagnosis of anemia-[14]

	g/dl (venous blood)
Adult males	13
Adult females (non-pregnant)	12
Adult females (pregnant)	11
Children, 6months to 6 yrs.	11
Children, 6to 14 yrs.	12

MAGNITUDE OF THE PROBLEM-

- Nutritional anemia is the worldwide problem with the highest prevalence in developing countries. It is found especially among women of child-bearing age, young children and during pregnancy and lactation.
- In India, this silent emergency is rampant among children (6-35 months) and low socio-economic strata of the population.
- Overall, 72.7% of children up to the age 3yrs.in urban areas and 81.2% in rural areas are anemic.

While analyzing the data for states with anemia level of 70% among children, it was found that, except for Punjab, all other states had more than 50% prevalence of anemia among pregnant women.

Nagaland had the lowest prevalence (44.3%)

Goa (49.3%)

Mizoram (51.7%)

Bihar had the highest prevalence (87.6%)

Rajasthan (85.1%)

Karnataka (82.7%)[15]

CAUSES-

- Too little iron in the diet, poor absorption of iron by the body.
- Exclusive breast feeding beyond six months (not introducing solids).
- High intake of cow's milk in young children less than two years of age.
- Possible gastrointestinal diseases.
- Babies, children and teenagers undergo rapid growth spurts, which increase their need for iron.
- Decreased intake: due to cereal and pulse based diet which is poor in iron or due to social factors like poverty and inability to eat animal food.
- Non-availability of green leafy vegetables during summer often contributes to seasonal variations in the incidence of anemia.
- Milk based diet, which is poor in iron, also predisposes for anemia among young children.
- Excessive losses of iron from the body.[16]

SYMPTOMS-

The signs and symptoms of iron deficiency anemia in children may include-

- Pale skin, lips, tongue and inner surface of eyelids (conjunctiva).
- Fatigue.
- Loss of appetite.
- Irritability.
- Weakness.
- Breathlessness.
- Increased sweating.
- Unusual 'food' cravings (called pica).
- Failure to grow at the expected rate.

CONSECUENCES-

- ✓ Impaired cognitive performance.
- ✓ Significant reduction of physical work capacity and productivity.
- ✓ Increased morbidity from infectious diseases.[17]

MANAGEMENT-

Identification of the cause of deficiency is essential. Iron deficiency especially severe deficiency is serious and even life-threatening. Usually, it cannot be overcome by increasing dietary intake alone. Iron supplements, along with improved diet and eating habits, healthier hygiene and sanitation practices, deworming and other solutions are nearly always required. Oral iron supplements are in the form of ferrous sulfate.

The best absorption of iron is on an empty stomach, but many children are unable to tolerate this and may need to take the supplement with food. Milk may interfere with absorption of iron and should not be taken at the same time as iron supplements. Taking vitamin C supplements or eating vitamin C rich foods at the same time as iron supplements can increase absorption and is essential in the production of hemoglobin.

SOURCES:

Non-vegetarian dietary sources of iron are- red meat, fish, liver and egg yolks.

Vegetarian sources include- Breast milk, lentils and beans, whole grains and products made from these foods.

Sprouting grains and beans enhance the bioavailability of the iron they contain, as does consuming iron-rich foods with "enhancers" -foods that contain vitamin C.

In some parts of South Asia, flour, bread and some cereals are fortified with iron.

Much iron is lost through parasitic infestation. The best way to avoid getting intestinal parasites is to:

- Wash hands frequently and always after using the toilet and before eating food, using soap and safe water.
- Dishes, eating utensils and pots and pans, as well as vegetables and fruits must be thoroughly washed and cleaned and if necessary treated with disinfectant and stored in hygienic conditions.
- Keeping the environment clean and free from excreta (human and animal) is also important to prevent parasites.
- Living areas and latrines used by all members of the family should be swept and washed regularly.
- Animals should be kept in separate, preferably fenced areas, to avoid contamination where children are likely to play, especially on or near the ground.
- Since malaria increases the risk of anemia, bed nets should always be used where malarial mosquitoes are prevalent.[17]

2.<u>IODINE DEFICIENCY DISORDERS</u>-Iodine deficiency is another major nutrition problem in India. Previously, iodine was equated with goiter. In recent years, it has become increasingly clear that iodine deficiency leads to a much wider spectrum of disorders commencing with the intra-uterine life & extending through childhood to adult life with serious health and social implications.

Child/Adolescent- Goiter, Juvenile hypothyroidism, dwarfism, cretinism, impaired mental functions (low IQ), educational backwardness, personalityproblems.

EXTENT OF THE PROBLEM-

Global-

About 190 million people are suffering from goiter and nearly 800 million people in developing countries are at risk.

South-East Asia-

- 8 countries have significant IDD problems. These countries are India, Indonesia, Bangladesh, Bhutan, Burma, Nepal, Sri Lanka & Thailand.
- Out of these 8 countries, 102 million people have goiter, 277 millions are at risk, 1.5 millions are cretins and more than 35 million are physically or mentally disabled.

India-

- In India, the major geographical focus in the Sub-Himalayan region.
- The Sub-Himalayan region extending over 2400 km from Kashmir to Naga-hills is called 'Himalayan Goiter Belt', which is the biggest goiter belt in the world.
- The prevalence of goiter in India is 7.3% of the total population.
- Endemic goiter said to be present and considered as significant public health problem, when the prevalence of goiter exceeds 10% among school children, aged 6 to 11 yrs.

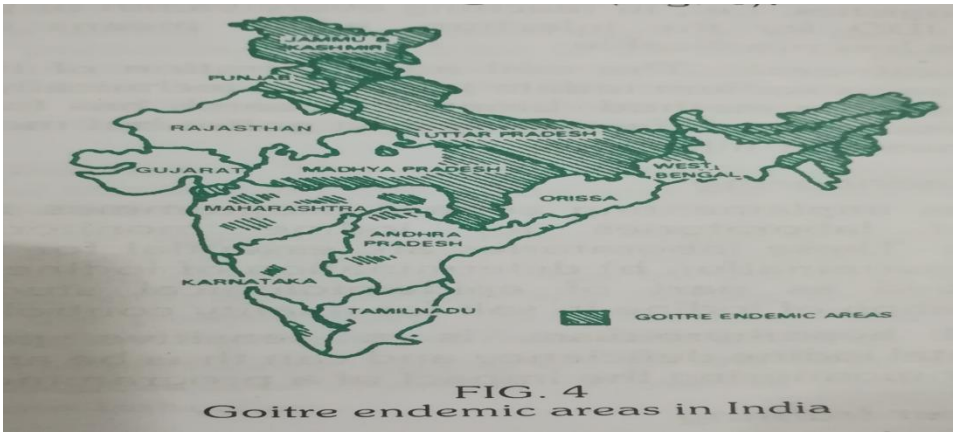

FIG. 4
Goitre endemic areas in India

GOITER ENDEMIC AREAS IN INDIA-

- Jammu and Kashmir.
- Himachal Pradesh.
- Punjab.
- Haryana.
- Delhi.
- Uttar Pradesh.
- Bihar.
- West Bengal.
- Sikkim.
- Assam.
- Arunachal Pradesh.
- Nagaland.
- Mizoram.
- Meghalaya.
- Tripura.
- Manipur.
- Parts of Madhya Pradesh, Maharashtra, Andhra Pradesh, Kerala, Karnataka, Tamil Nadu.[18]

CAUSES-

Environmental factors like soil, drinking water and foods containing goitrogens(compounds that inhibit iodine absorption)are the main factors causing iodine deficiency particularly in goiter affected areas.

Locally grown foods are either low in iodine content or contain goitrogens, which raises the demand for iodine in the body.

In many regions, formation of glaciers, soil erosions and flooding lead to loss of iodide from the surface soil.Thus concentration in some geographic regions is very low especially in hilly regions.

People living in iodine deficient areas and whose staple diets include the foods which contain goitrogens are the main section of society suffering from IDD.

Foods containing goitrogens: cabbage, turnips, pear, peaches, broccoli, strawberry, maize, millet, mustard, peanuts, sweet potato and tea.

Deficiencies of iron and vitamin A exacerbate iodine deficiency.

SYMPTOMS-Infants born to iodine deficient mothers develop cretinism and stunted growth.

MANAGEMENT-

There are four essential components of National Goiter Control Program. These are:

1. **Iodized salt**- It is most economical, convenient and effective means of mass prophylaxis in endemic areas. Under the national IDD control activities, the Government of India proposed to completely replace common salt with iodized salt.[19]The National Institute of Nutrition of Hyderabad has come out with a new product, common salt fortified with iron and iodine.
2. **Iodized oil**- The intramuscular injection of iodized oil(mostly poppy seed oil). N.I.N, Hyderabad has now successfully developed the process to produced iodized oil in safflower or safola oil.[14]The advantage of injection procedure is that an average dose of 1ml will provide protection for about 4 years.
3. **Iodine monitoring**-Countries implementing control programs require a network of laboratories for iodine monitoring and surveillance. These laboratories are essential for a) iodine excretion determination b) determination of iodine in water, soil and food and c) determination of iodine in salt for quality control.
4. **Mass communication**- It is a powerful tool for nutrition education.

Recommended Dietary Allowance for Iodine

AGE	**INTAKE (mcg/day)**
Infant (0-6 months)	Breast milk
Infant (7-12 months)	90
Young children (1-5 yrs.)	90
School children (6-12 yrs.)	120
Adolescents (>13 yrs.)	150
Adults	150
Pregnant women	250

Indian Council of Medical Research.Nutrient requirement and recommended dietary allowances for Indians.A report of the Expert Group of the Indian Council of Medical Research,2010.

SOURCE- The best source of iodine is sea foods (e.g. Sea fish, sea salt) and cod liver oil. Smaller amounts occur in other foods, e.g., milk, meat, vegetables, cereals,etc.

About 90% of iodine comes from foods eaten; the remainder from drinking water.

Other food items include potatoes, banana, legumes, whole grains, nuts, shell fish, tap-water and foods made with iodized salt.

HEALTH PROMOTION:

The promotion of breast feeding and improvement in infant and child feeding practices are the areas where nutrition education can have a considerable effect. Members of families should be educated about the importance of nutritional needs of expectant, nursing mothers and children in the family.

Health Education-

- Parents and elders should set good examples of good eating habits.
- Give variety of food rich in having color, taste and texture.
- Make sure that the child has balanced diet in all three major meals.
- Ensure that the child has a healthy breakfast, milk, fruits and cereals are included.
- Always serve breakfast, even the child is in hurry. Cereal can be provided as a cheese/chutney/vegetable/egg sandwich or chapatti roll.
- Ensure that the child gets adequate number of servings of fruits, vegetables and dairy products.

- Meal timings must correspond with school timings.
- Food preparation should not interfere with their play time during their school recess.
- Parents can modify popular food items to make them more nutritious and interesting and prepare them at home, instead of restricting such foods.
- Teaching about food composition and impact of different foods on health, in very scientific way may not interest them; rather telling these things in an interesting manner or through stories, games may be helpful.
- Involve the children in selection, meal planning and preparation of foods and teach them to make healthy choices by providing opportunities to select foods based on nutritional value.
- Make them understand the difference between nutrient dense and energy dense foods. **Various National Health programs can be of great help to upgrade the health of the children.**

There are following national programs for the health promotion of children:

Vitamin A prophylaxis program.

Prophylaxis against Nutritional Anemia.

Control of Iodine deficiency disorders.

Special Nutrition Program.

Balwadi Nutrition Program.

ICDS(Integrated Child Development Services) Program.

Mid-day meal Program.

Mid-day meal scheme.[20]

YOGA-

School children are advised to do *Asanas* and *Pranayama*.

Asanas- *Tadasana, Shashankasana, Gomukha asana, Katichakra asana, pawanmuktasana, pashimotanasna*etc.

Pranayama- *Bhastrika,Kapalbhati,Ujjayi, Anulom-Vilom, Bhramari.*

CONCLUSION-

In this review study it is concluded that under-nutritional disorders occurs mostly in developing countries due to poverty, illiteracy so it is important to provide health education at every level in the community and on serious note work should be done on programs. It is also necessary to ensure that food is enough in quantity to satisfy hunger; edible and culturally acceptable.

School going children tend to be like their school mates and like to eat things their friends eat. This is also the age of exploration and experimentation. However, this is the age for learning and formation of food habits, which are likely to continue for the rest of life. If they are left unwatched or are not adequately cared for, given easy access to popular, tasty but unhealthy food items, they soon become the part of their food behavior. Thus children are at high risk of developing unhealthy food habits. The whole family should have balanced diets and the goal should be to ensure that the child's growth and development occurs normally while the child maintains a healthy weight. This is the right age for establishment of good food habits.

Asana and *Pranayama*must be taught in schools which help them to get rid of many health issues and it help in assimilation of food easily. It will increase digestion power and increase appetiteand strengthen the body. As children are the future of nation so this time is best to inculcate good things in them.

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