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FOOD SUPPLEMENTATION

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Food Supplementation is of great importance to the researchers and the industry attempting to cope with the issues of malnutrition, particularly in the third world countries. Supplementation improves the nutritive value (NV) of the food without necessarily improving its biological value (B.V.) and includes addition of proteins, essential aminoacids (EAA), vitamins, minerals and essential fatty acids singly or in combinations. Fabrication and Enrichment are other methods used to improve the NV of various foods. Homogenized milk, for example, is 'fortified' with Vitamin D. Margarines are fortified with Vitamin A. Flour is 'enriched' with iron and thiamine before being used to make bread or cereal.

This paper will acquaint the reader with different types of supplementation and the need for resorting to them.

1. Protein Supplementation:

Protein supplementation is aimed at preventing various diseases caused by the deficiency of proteins or of individual aminoacids. Kwashiorkor, for example, is a major protein deficiency disease affecting infants and young children (aged 1-4 years) who show growth-failure, retarded development, loss of appetite, mental apathy, edema, diarrhea, skin disease and changes in the texture and color of hair.

Protein in food could be supplemented in a variety of ways. If plants are the major part of diet, it should be noted that plants may lack some of the essential aminoacids (particularly lysine. methionine, threonine and tryptophan) and hence should be consumed in combination with other foods with complete proteins such as milk, yogurt, cheese, eggs, fish, poultry and meat.

A suitable combination of several plant foods (such as[2] legumes with whole grains, nuts and vegetables) may also be a desirable way to ensure that all the necessary aminoacids are provided for. Considerable research is being done to develop such combinations and has already yielded the plant protein mixture INCAPA RINA[3] which approaches the biological value of milk and hence valuable in infant feeding.

Synthetic aminoacids may be added to the food. Lysine is not only missing from the plants consumed but it is also heat lable. Hence, its addition in some suitable form just before the food is consumed, would be extremely desirable. Addition of lysine to the food as spray before the food is consumed, for example, has proven useful in enriching bread for school children.

2. Vitamin Supplementation:

We are familiar with the various diseases caused by the deficiency of various vitamins. However, it must be remembered that such deficiencies and hence the need for supplementation will not come about if the diet is balanced and is selected on the basis of Four Food Groups (FFG - milk group, meat group, vegetable group, fruit group, bread group and cereal group) because Recommended Dietary Allowance (RDA) for the vitamins are easily met or exceeded. Where the need for some of the vitamins is exaggerated, such as in the case of pregnant and lactating mothers or growing children, foods fortified in necessary vitamins may be used. Most textbooks list the foods rich in various vitamins to assist in the selection of appropriate combinations in view of the needed vitamins.

TABLE I
Natural Sources of Vitamins

A. Fat-Soluble Vitamins

Name of Vitamin	Sources
1. Vitamin A.	1. Animals - liver, egg yolk, butter, cream 2. Plants - green and yellow vgetables, margarine, apricots, cantaloupes
2. Vitamin D.	1. Animals - irridiated foods (milk, etc.), small amounts in butter, egg yolks, liver, salmon, sardines, tuna fish 2. Plants - none 3. Ergos
3. Vitamin E	1. Animals - egg yolk 2. Plants - wheat germ, leafy vegetables, vegetable oils, legumes, peanuts, margarine
4. Vitamin K	1. Animals - liver 2. Plants - cabbage, cauliflower, spinach, leafy vegetables, soybean oil, other vegetable oils

3. Minerals Supplementation:

Minerals such as calcium, iron, iodine etc., are necessary for health. Should the diet be deficient in

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them or if they are destroyed in cooking or due to a chemical reaction or abnormal body reaction, deficiency diseases may result. Rickets, osteomalacia, osteoporosis, anemia and goiter are some of the examples. Three major minerals, calcium, iron and iodine, have always been recognized as important. More recently, however, Mg and K are drawing attention particularly among those who drink coffee, tea and beverages.

TABLE II
Natural Sources of Minerals

Element	Sources
1. Calcium (Ca)	1. Animals - milk, cheese 2. Plants - green vegetables
2. Phosphorus (P)	1. Animals - milk, poultry, fish, meats, cheese 2. Plants - nuts, cereals, legumes
3. Iron (Fe)	1. Animals - liver, meat, egg yolk 2. Plants - legumes, whole or enriched grains, potatoes, green vegetables, dried fruits
4. Iodine (I_2)	1. Animals - seafood 2. Salts - iodized salt 3. Plants - seaweed
5. Potassium (k)	1. Animals - meats 2. Plants - cereals, vegetables, legumes, fruits, bananas
6. Sodium (Na)	1. Animals - seafood, animal products 2. Salt - common salt (table salt)
7. Magnesium (Mg)	1. Plants - nuts, cereals, legumes, green vegetables
8. Copper (Ca)	1. Animals - liver 2. Plants - nuts, legumes

4. Essential Fatty Acids (EFA) Supplementation:

Information on the significance of fat in food is accumulating. We now realize that not all fatty acids can by synthesized de novo in human and animal tissues.

We have learned that Linoleic, Linolenic and arachidonic acids have been found to be essential fatty acids. Experiments have shown that complete exclusion of fat from the diet induces cessation of growth, scaliness of skin, impaired reproduction and kidney damage in young rats and in infants. A decrease in the plasma levels of these fatty acids is noted to parallel the occurance of skin lesions such as eczematous dermatitis. These abnormalities are prevented or cured by feeding small amounts of linoleic or arachidonic acids. Minimum requirements for EFA is between 3 and 4% of the total caloric requirements. EFA's are abundant in natural vegetable oils, in the fat of mammalian organ tissues, poultry fat and in fish oils. It is interesting to note that EFA (unsaturated) are inversely related to the proportions of ordinary saturated fats in the diet. Hence, the balance between saturated and unsaturated fats in the diet attains significance.

The following recommendations stem from the accumulated knowledge and experience in the field of improving the adequacy of diets for public health purposes:

1. Education is a prime factor in helping people to appreciate the nutritional needs for themselves and their families.
2. To increase the nutritive values of the locally consumed foods while decreasing their cost.
3. To encourage people to have mixed diets, especially those from the plant kingdom, so as to increase the nutritive value of the diets, i.e., supplementing one diet from another.
4. The idea of food supplements may be considered if the cost is resonable.
5. The idea of Ovo-Lacto vegetarianism might be temporary solution to increase the nutritive value. the use of eggs (ovo-) in the daily diet and the use of milk, cheeses and other dairy products (Lacto-) with vegetables and fruits are good dietary practices to be followed so as to improve the nutritive value of the diet.
6. Encouraging people to include a mixture of wild, edible plants grown locally; this improves the nutritive value at a very low cost.
7. Encouraging people to raise small farm animals and birds, such as chickens, rabbits, goats, ducks, turkeys, geese, pigeons, and the like.
8. Encouraging people to have small gardens next to their houses.
9. Improve the NV and BV without increasing the cost. Some of the recombinations to achieve this are:

For the sake of getting high NV and BV of foods at a low cost, the following recommendations are suggested:

1. Reduce consumption of meat, as it is expensive;
2. Use mixed vegetables at a time;
3. Use milk with cereals and other plant foods at meals;
4. Use plain yogurt daily in your diets, as it improves the BV, GI microfilaria, and reduces gases in the stomach;
5. Use eggs as a source of protein. Don't worry

much about cholesterol, as the quantity you eat is not much to worry about. The presence of lecithin in egg yolk helps to mobilize cholesterol in the body. The presence of biotin in egg yolk is the best source in nature.

6. Fish is cheaper than beef, It has high BV for its proteins, and the fats have a high concentration of PUFA that are best for good health.
7. Chickens are cheaper than beef. They have good NV for their protein. They have better quality of fats and oils than in beef.
8. Fruit salad is very good to have daily as it supplies vitamins, minerals, essential amino acids, and some essential oils. They help digestion and reduce cholesterol.
9. For those who drink soft drinks, coffee and tea, they are requested to eat peanuts as it has a high concentration of magnesium (Mg), while the soft drinks deplete the body from the electrolytes and especially magnesium and potassium (Mg and k).
10. Use honey instead of sugar as the first does contain amino acids. minerals, vitamins and other useful sugars.
11. A high concentration of Vitamin D mobilizes calcium (Ca) from bones into the bloodstream and deposits the calcium into soft tissues. Hence, one has to be aware of it.
12. Use natural foods as a source of natural vitamins.
13. Stop smoking as it consumes 70 mg of Vitamin C per
14. Stop drinking alcohol as it affects CNS, heart, brain, RBC, stomach, liver, pancreas, absorption and general metabolism.
15. Drugs do affect stomach microfilaria, thus reducing the BV; even antibiotics do the same.

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