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ROLE OF MACRONUTRIENT IN HEALTH

[1]Dr. Vijay Kumar, [2]Dr. Amit Kumar Shukla, [3]Dr. Priyanka Sharma, [4]Dr. Bishanu Choudhury, [5]Dr. Pratyush Singh and [6]Dr. Shambhu Kumar

[1]Associate Professor, Dept. of Swasthavritta & Yoga, North Eastern Institute of Ayurveda & Homoeopathy (NEIAH), Shillong.
[2]Professor, Dept. of Sharir Rachana, J.D. Ayurvedic Medical College, Aligarh.
[3]Assistant Professor, Dept. of Swasthavritta & Yoga, P.B.A.A.S. Patanjali Yoga Peeth, Haridwar.
[4]Lecturer, Dept. of Kayachikitsa, North Eastern Institute of Ayurveda & Homoeopathy (NEIAH), Shillong.
[5]Associate Professor, Dept. of Swasthavritta & Yoga, P.B.A.A.S. Patanjali Yoga Peeth, Haridwar.
[6]Associate Professor, Dept. of Samhita & Siddanthta , P.B.A.A.S. Patanjali Yoga Peeth, Haridwar.

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***Corresponding Author**
Dr. Amit Kumar Shukla
Professor, Dept. of Sharir Rachana, J.D. Ayurvedic Medical College, Aligarh.

ABSTRACT

Nutrition is the study of the action of biologically active components of food and their role in maintaining human health. Nutrition is an applied medical science. The basic nutritional needs of humans are to supply energy and raw materials for all the various activities and processes that occur in the body. In addition to the need for water, humans require five types of nutrients from their food supply; three of these are required in relatively large amounts and are called macronutrients, consisting of carbohydrates, proteins, and fats. The other two types of nutrients, vitamins and minerals, are required in small amounts and are known as micronutrients.

KEYWORDS: nutrient, nutrition, macronutrient, protein, carbohydrates, fats.

INTRODUCTION

A balance diet has become an accepted means to safeguard a population from nutritional deficiencies.

In constructing balanced diet, the following principles should be done in mind:

(a) First and foremost, the daily requirement of protein should be met. This amount to 10-20% of the daily energy intake.

(b) Next comes the fat requirement, which should be limited to 15-30% 0f the daily energy intake.

(c) Carbohydrates rich in natural fiber should be constitute the remaining food energy and the requirement of micronutrient should be met.

In other words we can say that a normal diet then can only be called as BALANCE DIET when it provide proper nutrition to an individual in order to gain a healthy body.

Now the question arises that what is nutrition?

- "Nutrition" may be defined as the science of food and its relationship to health.
- It is concerned primarily with the part played by nutrients in body growth, development and maintenance.
- The word nutrient or "food factor" is used for specific dietary constituents such as protein, vitamins and minerals.
- Good nutrition means maintaining and nutritional status that enables up to grow well and enjoy good health.
- Most of the people know that a balance of good nutrition and physical activity can help them to reach and maintain a healthy weight .But the benefits of good nutrition go beyond weight. Good nutrition can also:

(1) Improve cardiovascular and other body system functions, mental well-being, school/cognitive performance and wound healing or recovery from illness or injury.

(2) Reduce the risk for disease, including heart disease, diabetes, stroke, some cancers and osteoporosis.

(3) Increase energy and body's ability to fight of illness.

NURIENTS

Nutrients are organic or inorganic complexes contained in food. There are about 50 different nutrients which are normally supplied through the food we eat. Each nutrient has specific functions in the body. Most natural food contain more than one nutrient. These may be divided into:

(i) MACRONUTRIENTS: These are the protein, carbohydrates and fats which are often called "proximate principles" because they form the main bulk of food. In the Indian dietary, they contribute to the total energy intake in the following proportion:

Protein: 7 to 15%

Fat: 10 to 30%

Carbohydrates: 65 t0 80%

(ii) MICRONUTIENTS: These are vitamins and minerals. They are called micronutrients because they are required in small amounts which may vary from a fraction of a milligram to several grams. A short review of basic facts about these nutrient is given below:-

PROTIENS: The word "protein" derived from Greek, means "to come first". Protein is the most abundant components of the body. Indeed they are of greatest importance in human nutrition. Proteins are organic nitrogenous compounds. They are composed of carbon, hydrogen, oxygen, nitrogen and sulfur in varying amounts. Some protein also contain phosphorus and iron and occasionally other elements. Protein contain an average of 16% nitrogen. Proteins constitutes about 20% of the body weight in an adult. Proteins are made up of smaller unit called Amino Acid. Some 20 amino acid are stated to be needed by the human body, of which 9 are called "essential" (*isoleucine, leucine, lysine, methionine, phenylalamine, threonine, tryptophan, valine and histadine*) because the body can not synthesize them in amounts corresponding to its needs and therefore, they must be obtain from dietary proteins. Both essential and non essential amino acid are needed for synthesis of tissue proteins, the essential amino acid must be supplied through diet, whereas non essential amino acid (*glycine, alanine, serine, cysteine, cystine, aspartic acid, glutamic acid, arginine, hydroxylysine, tyrocine, proline and hydroxyproline*) can be synthesized by body from an available source of nitrogen and carbon skeleton.

A protein is said to be "Biologically complete", if it contains all the essential amino acid in amounts corresponding to human needs. When one or more essential amino acid are lacking, the protein is said to be "biologically incomplete". Animal proteins are rated superior to vegetable proteins because they are biologically complete. For example milk and egg protein have a pattern of amino acid considered most suitable for humans.

FUNCTIONS OF PROTEINS

Protein are needed by the body for Body building, repair and maintenance of body tissues.

Maintenance of osmotic pressure, synthesis of certain substances like antibodies, plasma proteins, hemoglobin, enzymes, hormones and coagulation factors. Immune protein maintain

the body's resistance to disease. Protein are al so involve in the controle of acid-base balance in the tissues when they act as buffers.

Dietary Sources

Protein are widely distributed in nature. All foods exept refined sugar, oil and fats contain protein to varying degree. Animal foods such as meat, poultry, fish, milk, cheese and egg contain high quality protein. However, plant are al so significant source: soyabeans is a complete protein, equal in quality to most animal protein.

Protein contents of some foods

Food	**Proteins** (g/100g of food)
Animal foods	
Milk	3.2 - 4.3
Meat	18.2- 26.0
Egg	13.0
Fish	15.0- 23.0
Plant foods	
Cereals	6.0 – 13.0
Pulses	2.0 – 28.0
Vegetables	1.o – 4.0
Fruits	1.0 – 3.0
Nuts	4.0 – 29.0
Soybeans	43.2

- Recommended Dietary Allowances for protein is 60g/day for men.

FATS

Fats are solid at 20 deg C, they are called "oils", if they are liquid at that temperature.

Fats and oils are concentrated sources of energy. They are classified as:

(a) Simple lipids e.g. triglycerides

(b) Compound lipids e.g. phospholipids

(c) Derived lipids e.g. cholesterol

- The human body can synthesize triglyceride and cholesterol endogenously.
- Most of the body fats (99%) in the adipose tissue in the form of triglycerides.
- In normal human subjects, adipose tissue constitutes between 10 t0 15% of body weight.
- The accumulation of one kilogram of adipose tissue correspond to 7,700kcal of energy.

FATTY ACIDS

Fats yield fatty acid and glycerol on hydrolysis. Fatty acid are divided in to saturated fatty acid such as lauric, palmitic and stearic acid. And unsaturated fatty acids which are further divided in to monounsaturated(MUFA) e.g.oleic acid and poly unsaturated fatty acid (PUFA) e.g. linoeic acid and α-linoeic acid.

The polyunsaturated fatty acid are mostly found in vegetable oils and the saturated fatty acid are found in animal fats. However, there are exceptions as for example, coconut and palm oils, although vegetable oils have an extremely high percentage of saturated fatty acid.

On the other hand, fish oils, although they are not vegetable oils, contain poly and mono-unsaturated fatty acid.

ESSENTIAL FATTY ACID

Essential fatty acid that can not be synthesized by humans.

They can be derived only from food. The most important essential fatty acid is "linoleic acid", which serve as a basic for the production of other essential fatty acid e.g. linoleic and arachidonic acids. However all polyunsaturated fatty acid are not essential. Linoeic acid in abundantly found in vegetable oils.

Essential fatty acid deficiency in human beings: Phrynoderma

One of the common disorders of malnutrition observed in adult and children in India and others developing countries Phrynoderma or "Toad Skin". The condition is characterized by the presence of horny popular eruption on the posterior and lateral aspect of limbs, on back and buttock. Phrynoderma is cured by administration of linseed or sunflower oil rich in essential fatty acid along with vitamins of B2 complex but not by Vit. –A.

Functions of Fats

1. **ENERGY:** The primary functions of fat is to supply energy. Each gram of fat when oxidized yields approximate 9kcal, twice as much energy as one gm of carbohydrate or protein.
2. **Insulation and padding:** Fats are deposited in adipose tissue, subcutaneous tissue and abdominal cavity. This serves as reserve source of energy during starvation, further adipose tissue functions like insulating material against cold. The vital organs such as kidney are protected against physical injury ba padding of fat.

3. **Carrier of the fat soluble vitamins;** Dietary fat is the carrier of the fat soluble vitamins-A,D,E,K.
4. **Satiety function;** Fat improve the palatability of the diet and gives a satiety value, e.i. a filling of fullness in stomach.
5. **Essential fatty acid:** Linoleic acid and linolenic acid are essential fatty acid, that is they can not be synthesized in the body and must be present in the diet. Linoleic acid and linolenic acid are converted in to prostaglandins, thromboxines and prostacyclines which have extremely important function in such areas as regulating blood pressure, blood viscosity, muscles contraction, pain relief, male fertility and female conception and normal delivery.

The dietary sources of essential fatty acid are shown below:-

Essential fatty acid	Dietary sources	Percent content
Linoleic acid	Safflower oil Corn oil Sunflower oil Soyabean oil Sesame oil Groundnut oil Mustard oil Palm oil Coconut oil	73 57 56 51 40 39 15 9 2
Arachidonic acid	Meat, egg Milk(fat)	0.5- 0.3 0.4- 0.6
Linoleic acid	Soyabean oil Leafy greens	7 Varied
Eichsapentaenoic acid	Fish oil	10

Fat Requirement

	% of total calories
Adult ,expectant & nursing mother	10-20%
Children and adolescents	15-20%
Infants(birth -1year)	25-30%

Dietary source of fats may be classified as

(a) Animal fats: Major source are ghee, butter, milk, cheese, egg and fat of meat & fish.

(b) Vegetable fats: In plan seeds e.g. ground nut, mustard, sesame, coconut etc. are source of vegetable oils.

(**c) Other sources**: Some quantities of fat are found in cereals, pulses, nuts and vegetables like rice -3%, wheat-3%, Jowar-4%, Bajra -6-5%.

Important source of fats:

Rich source	Fat %
Pure oils and fats	100%
Ghee and vanaspati	100%
Butter	80%
Nuts & oil seeds	40-60%
Milk powder,	26%
Esggs	14%
Meat, fish	10=15%
Milk(Caw)	4%
Milk(buffalo)	7%
Pluses,	3-5%
Cereals	2-3%

Note: The liquid fat becomes a solid fat and the unsaturated fatty acid contents decrease as a result of hydrogenation. Vanaspati ghee is the example of hydrogenated fats. During hydrogenation trans fatty acid are produced which are not good for the Heart.

CARBOHYDRATES

The 3rd major component of food is carbohydrates, which is the main source of energy, providing 4kcals/g.

Carbohydrates are al so essential for oxidation of fats and for synthesis of certain non essential amino acid.

There are three main sources of carbohydrates viz.

- Starches
- Sugar
- Cellulose

Starch is basic to the human diet. It found in abundance in cereals, roots & tubes. Sugar comprises monosaccharide (glucose, fructose and galactose) and disaccharides (sucrose, lactose and maltose). These free sugars are highly water soluble and easily assimilated. Free sugar along starches constitute a key source of energy. Cellulose, which is indigestible component of carbohydrate with scarcely, any nutritive value contribute to dietary fiber. The carbohydrate reserve (glycogen) of a human adult in about 500g. This reserve is rapidly exhausted when a man is fasting. If the dietary carbohydrates do not meet the energy need of the body, protein and glycerol from dietary and endogenous sources are used by the body to maintain glucose homeostasis.

Functions of Carbohydrate

The main function of carbohydrate is to supply energy for the body. Another important function of dietary carbohydrates is its protein-sparing action. Some carbohydrate is necessary in the diet so that the oxidation of fats can proceed normally.

Lactose promotes the growth of desirable bacteria, some of which are useful in the synthesis of B-complex vitamins. It also enhances the absorption of calcium.

The five-carbon sugar ribose is a constitute in the important compounds DNA & RNA.

Dietary sources

Sugar, cereal grains, fruits, dry fruits, banana, dates, potatoes, sweet potato, cheese, milk, eggs etc.

Dietary fibers

Dietary fibers are plant constituent that are not digested by the enzymes of human gastrointestinal tract. The consist of cellulose, hemicelluloses, pectin, mucilages, gums and lignin.

Roles of Dietary fibers

Dietary fibers hold water so that stool are soft, bulky and readily eliminates. Thus a higher fiber intake prevent constipation. Fiber generally increases motility of the small intestine and colon, decreases transit time. Soluble fiber bind water and increase viscosity of intestinal contents, they bind cholesterol and increase excretion of bile acid.

Fiber containing plant foods are important for decreasing the risk of metabolism disorder such as diabetes and cardiovascular disease and also diverticulitis and colon cancer.

Sources of dietary fibers

Dried fruits, whole-grain cereals, nuts, fruits and vegetables are the best source of dietary fiber.

RDA for energy

Sedentary work-Men-2400kcal/day

Women-1900kcal/day

Moderate work Men 2800 Kcal/day

Women-2200kcal/day

Heavy work Men-3900kcal/day

Women-3000kcal/day

Pregnant women: +300kcal/day

Lactation :+550kacl/day

CONCLUSION

All the macronutrients can be used as a source of energy, normally only carbohydrates and fats do so while proteins provide the raw materials, or building blocks, required for the synthesis of essential metabolites, growth and tissue maintenance Research has shown that many significant diseases are influenced by nutrition and beneficial changes in diet can, therefore, reduce the risk of developing these conditions. The benefits of several nutritional concepts such as fiber, monounsaturated oils and low-carbohydrate diets have made headlines and influenced lifestyle changes. All these concepts promise better health and are, in fact, dependent on a greater consumption of plants in the human diet.

REFERENCES

1. Park's Text book of Preventive and Social Medicine, K. park, 21st edition 2011.
2. WHO (1988) World health May 1988.
3. WHO (1971) Techn. Rep. Ser, no. 477.
4. ARC (MRC 1974) REPORT: Food & Nutrition Research, London, HMSO.
5. ICMR (2010), Nutrient Requirement and recommended Dietary Allowances for Indians, A reprt of the expert group of the ICMR.
6. Beaton G.H. (1976) Nutrition in preventive medicine, p-482, WHO Monograph Sr No. 62.
7. National Institute of Nutrition (1983), Nutrition news March 1983.
8. Mc Laren, D.S. (1981). Nutrition and its disorders, 3rd, Edinburgh, Churchill Livingstone.
9. Passmore, R et al (1974). Hand book on Human Nutritional Requirements, Geneva, WHO.