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PROS AND CONS OF CONSUMING SUGAR

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ABSTRACT

Sugars belong to carbohydrate group of chemicals. Sugar is vital for defraying many physiological functions of our body, normally "Craving for sugar" is very common. So we are at higher risk of over consumption of sugar. In fact, sugar sweetened beverages are a marker of an unhealthy lifestyle and their drinkers consume more calories. Carbohydrates are composed of carbon hydrogen and oxygen and have general formula that approximates CH_2O. The main function of carbohydrates is to offer energy to our body for its functioning and physical activities. These are the main source of energy for our body cells, tissues and organs. Everyone should be careful while consuming excess amount of sugar in our diet, but rather advertently avoid it. Human body would cease to work properly if there is low sugar intake. Naturally occurring sugars causes immense benefits in our diet, these sugars found in fruits, milk sugar, *etc*. Some common types of sugar that we generally consume in our diet are as follows: Glucose, fucose, Sucrose, Galactosamine, Galactose, Mannose, Neuraminic acid, Xylose etc.

KEYWORDS: Carbohydrate, Fucose, Galactosamine, Mannose, Unhealthy lifestyle, Health, Sugar etc.

INTRODUCTION

Sugars are polyhydroxy aldehydes or ketones and belonging to glycans/ carbohydrate group. Carbohydrates are the main source of energy for our body cells, tissues and organs. Carbohydrates have earned the name of macronutrients which are found in several foods and beverages. This immediate energy is fulfilled by intake of sugars.[1] Many drugs consists of glycans as an essential ingredient. Drugs such as heparin, erythropoietin, some anti-flu drugs and drugs treating against cancer contain glycans.[2] Even though there are many uses of sugar but yet the fight of sugar being a friend or a enemy. In certain aspects, sugar considered to be a enemy, yet its complete absence in our diet will affect our health to a great extent. Thus, this review highlights the effect of sugar intake on human health.

Role and effect of its intake on human health- Human body would cease to work properly if there is low sugar intake. Sugars added during processing of food, beverages and other preparations are harmful to our body called as "added sugar" , while the "essential sugars" are the carbohydrates required by the body.[3] Its nutrients are recognized as glyconutrients obtained from fruits and vegetables.[4] Intake of the fruit sugars does not harm our body, as besides fructose it also contains fibers as well as some other nutrients. The fructose provides our body with a quick energy while fibers counterbalances the fructose effects, leading to long lasting energy to body. Sugars in dairy foods are also beneficial for our body as they provide us with other nutrients too. Certain complex carbohydrates like whole grains and starchy vegetables also contain some healthy sugars and other nutrient fibers.[5] Some common types of sugar that we generally consume in our diet and their effects on our health are given below.

Glucose- Intake of glucose stimulate pancreas to secrete insulin. This increase in insulin signals by brain, instructs to stop eating as we had enough of it. There are many processes going in our body after consuming glucose but one that occurs in the liver produces very low density lipoproteins (VLDL) that causes cardiovascular disease in our body. However, about 1 out of 24 calories of the glucose we consume is processed in the liver and gets converted into VLDL.[6]

Sucrose and high fructose corn syrups (HFCS) – Both sucrose and HFCS contain a big amount of fructose. Intake of these sugars is harmful to our body because fructose is metabolized only by liver that means a large amount of VLDL is produced along with fats. Also, intake of these sugars cannot be controlled by brain, as brain resists leptin (a protein for energy intake regulation

and to check the efficacy of metabolism) This does not mean that intake of these sugars is always harmful to our body. In athletes, intake of HFCS leads to accumulation of glycogen in their liver which is used later in their exercises. Intake of HFCS is good to persons performing higher physical activity and requiring instant energy.[6]

Fucose is a hexose sugar with the chemical formula $C_6H_{12}O_5$. It is found in large amounts in mammalian breast milk, sea kelp, Brewer's yeast and even in some of the mushrooms. These are important in blood transfusion, selection–mediated leukocyte-endothelium adhesion, host microbe interaction and ontogenetic events. An alteration in their expression is associated with pathological conditions like cancer and artherosclerosis.[7] Intake of this sugar encourages long term memory, prevents respiratory infections and growth of tumors. Besides, they also act as powerful modulators for immune system.[8] Glycoproteins and glycolipids associated with this sugar are vital for toning immune system as well as controlling inflammation.[9] This sugar perform antibodies function as well as that of major histocompatibility complexs, platelets, interaction of egg-sperm or connective tissue health, exchange of substance across and building up of tissues.[10] It also performs some hormonal functions. Lack of this sugar is associated with rheumatoid arthritis. In patients suffering from ailments like cystic fibrosis, diabetes, hepatic disorders, low levels of fucose are observed. Fucose is also important in extruding herpes virus from body.[11] Administering, this sugar also reduces wrinkles by thickening the skin and their hydration. Brown algae and some sea weeds as well as animals like sea cucumber contains fucoridan polysaccharides which are used in some dietary supplements.[12]

Galactosamine- These are found in shark cartilage and in red algae (Phaeophyceae). Although it is least essential, but helps intercellular communication. Administering these sugars help in regulating immune system and inflammation. It is also necessary for proper health of joints. Its low level is are associated with cardio vascular diseases.[13]

Glucosamine- This is helpful in maintaining health of the joints. Being precursor of cartilage, it helps in managing osteoarthritis problems. It is found in shark cartilage and crustaceans shells. On administering in our body some of it gets oxidized while the remaining ones are converted into glycoproteins and glycolipids.[13]

Galactose- This sugar which is found in milk is composed of lactose- a disaccharide in combination with glucose (nearly 5% solids in dairy products). This sugar is also present in variety of fruits, vegetables and also in some herbs. Galactose helps in speedy healing of injuries, aids in absorption of calcium and improve memory power.[14]

Mannose is an integral component of our immune system. Lack of this sugar leads to inflammation and some diseases. As compared to glucose it is absorbed in the body at a relatively slower rate. After absorption it directly enters bloodstream. It is found in Aloe Vera, sea kelp, beans, capsicum, cabbage, eggplant, tomatoes etc.[14]

Neuraminic acid or N-acetyl–neuramic acid (or NANA) - A unique sugar found in colostrums. It is the first ever food a mammalian gets after his/her birth from his/her mother. This sugar is vital constituent of gangliosides present in grey matter of brain. The Follicle stimulating hormone (FSH) needed for ovulation also contains it.[15]

Xylose- Xylose, found in embryo of most edible plants and is known for preventing digestive tract cancers. It is found in a number of fruits and vegetables, and to name few are *Aloe vera.*, blackberries, broccoli, eggplant, green beans, guava, pears, peas, raspberries, sea kelp and spinach.[13]

Sugar metabolism in the body

Each cell in our body requires energy for its physiological activities and this is accomplished by enzyme catalyzed oxidation of the sugar. The flow of sugars in our body takes place as follows:

Glucose (sugars) small intestine blood stream liver blood circulation (released by liver) absorption by tissues as required.

After being processed by the digestive system and subsequent metabolism, the sugar gets converted into glycoproteins and glycolipids.[16] Glycans also serve as ZIP codes, to direct the newly synthesized proteins to proper place of their use in the body. Some of them also act as anchors to attach viruses on cell surfaces signaling to immune system and ensuring proper brain functioning.

The primary function of sugar is to provide energy for our brain and nervous system that regulate performance of daily activities.[17,18]

Besides, there are several other necessary reasons for us to consume sugar in our diet. Some of these are-

- Reservoir source of energy**:** Glucose can be stored¬ in liver in form of glycogen which act as reservoir of energy. This energy is used up by the body during exercise or when glucose is not available as energy source. Reservoirs also maintain our blood sugar level stable.
- Intake of sugar activates two hormones serotonin and beta -endorphin which serve as pain reliever and overcoming anxiety.
- Maintains body temperature
- Production of myelin.
- Transportation of monocytes- Monocytes are the¬ largest known leucocytes and an essential part of the

immune system. Intake of sugars helps in their transportation.

- Muscle formation- Muscle is a connective tissue of¬ the animals, filaments of which contain actin and myosin. These slide past over one another; provide contraction, maintains posture, movement, locomotion and function of the interior organs. Glucose and its derivative glucosamine are essential for formation of muscle.
- Skin formation- Skin is the outer protective and sensory covering of our body. Collagen and elastin, the two main constituents of the skin, require glucose as well as glucosamine for its formation.
- Fucose, by stimulating elastin formation, deposition and maintaining density of fibres improves skin elasticity.[23]
- Lack of sugars in the diet leads to low blood sugar level which cause a number of problems like restlessness, distracted, feeling hungry and weakness. Some other observed symptoms include chills, lack of coordination, sweating and clammy skin. Persons on low sugar diet for longer time also experience blurred vision, headache, confusion and difficulty in performing even simple tasks. They may experience nightmares and crying.[24] It is well known that excess of everything is bad and so is true for the sugars as well. Higher consumption of sugars leads to several health problems or accelerate and may give rise to many diseases. Sugar intake is solely not responsible for its harmful affect on human health but improper functioning of glands and organs are equally important.

Some important points associated with higher dietary sugar intake are as follows

- Suppression of immune system
- Defence against bacterial infection- By
- Impairing functions of WBCs.
- Chromium deficiency.
- Macular degeneration of eyes.
- Ageing-sugar molecules enter into the blood along with proteins and produce some harmful molecules.
- *Sucrose intolerance*- when it is not produced in small intestine in sufficient quantities, sucrose intolerance occurs. Symptoms are abdominal cramps and bloating, diarrhea or constipation, hypoglycaemia, headache, poor growth, viral infection in the upper respiratory tract, anxiety, etc.
- *Sugar sensitivity*- Due to unstable blood sugar levels, low levels Serotonin and beta-endorphin decreased.[36]
- Increase level of triglycerides elevate cholesterol levels leading to cardiovascular diseases.
- Association of excess sugar consumption with other diseases like, cancer o*besity* Tooth decay or dental caries and Arthritis.[37]

Diseases in men or women due to excess intake of sugar

- For males, American Heart Association (AHA) has recommended average consumption of sugar to be 150 calories per day which is equivalent to 37.5g.[37,38]
- Increase in this amount may lead to exclusive problems in men like increases estradiol level, decrease in testosterone level and affects their sexual life, cardiovascular diseases, association with memory loss and brain functioning, atherosclerosis ,cataract and myopia.[37]
- For females, AHA recommends an average consumption of sugar to be 100 calories per day which is equivalent to 25 g.[41]
- Increase in this amount may lead health problems like breast cancer, higher breast density in women who have not attained menopause.
- It may also increase risk of neural tube defects in embryos.
- It also affects pre-menstrual syndrome (PMS), a hormonal imbalance associated with women craving for sugar.[42] The latter worsens the situation in women with Polycystic Ovary Syndrome (PCOS) due to a rise in insulin level.[43]
- Excess consumption of sugar in pre-diabetic and diabetic women even causes brain decay and pancreatic cancer.[45]

CONCLUSION

Sugar is one of the important ingredients in our food products in today's life. Sugar is hidden in many foods, we consume every day, Although consumption of sugar activates the "feel good hormone" of the brain but on other side it can even make us addicted towards it. No matter how sweet does the sugar tastes, it has some negative effects on human beings and its excess consumption overweighs its positive effects on our health. Intake of fucose sugar encourages long term memory, prevents respiratory infections and growth of tumors. Besides, they also act as powerful modulators for immune system. Glycoproteins and glycolipids associated with this sugar are vital for toning immune system as well as controlling inflammation Fucose are important in blood transfusion, selection–mediated leukocyte-endothelium adhesion, host microbe interaction and ontogenetic events. Galactosamine necessary for proper health of joints. Its low level is are associated with cardio vascular diseases. Lack of sugars in the diet leads to low blood sugar level which cause a number of problems like restlessness, feeling hungry and weakness. Some other observed symptoms include chills, lack of coordination, sweating clammy skin, nightmares and crying. Even in non-diabetic persons, excess intake of sugars is certainly harmful. So, we should be careful while consuming excess amount of sugar in diet.

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