PRINT ISSN 2319-1775 e-ISSN 2320-7876, www.ijfans.org
Volume.11, Issue13, Nov- 2022

Research Paper
UGC CARE Listed (Group -I) Journal

Feasibility of iron and zinc fortification in Jaggery Powder

Dr. Sulakshana Mane
Assistant Professor, NSS Program officer, Department of Nutrition and Dietetics,
SVT College of Home Science, SNDT Women's University, Juhu, Mumbai.

Abstract:

Fortification of iron and zinc in jaggery powder can be an effective strategy to increasethe intake of these essential minerals in populations at risk of deficiencies. However, itis important to ensure that the fortified product is safe, effective, and acceptable to thetarget population. The feasibility of fortifying jaggery powder with iron and zinc depends on several factors, including the availability of iron and zinc compounds, the cost of fortification, the stability of the fortified product, and the acceptability of the fortified product to the target population. Jaggery powder, a traditional sweetener derived from sugarcane juice or palm sap, is known for its nutritional value and rich mineral content. Fortification of jaggery powder with iron and zinc has emerged as a potential solution to address these deficiencies. This article explores the feasibility of iron and zinc fortification in jaggery powder, considering various aspects such as availability of fortificants, stability of fortified product, cost implications, and consumer acceptability.

Keywords: Fortification, fortifying jaggery, jaggery, jaggery powder,

Introduction:

Iron and zinc fortification of jaggery powder is technically feasible, but there are several factors that need to be taken into consideration. Jaggery powder, a traditional sweetenerderived from sugarcane juice or palm sap, is known for its nutritional value and rich mineral content. However, it is often deficient in essential minerals like iron and zinc. Iron and zinc play vital roles in human health, and deficiencies in these minerals can lead to significant health issues, particularly in populations with limited access to diverse and balanced diets. Jaggery powder is rich in carbohydrates, but it is low in essential micronutrients such as iron and zinc. Iron and zinc are important micronutrients that play a critical role in many physiological processes in the human body. Iron is required for the production of hemoglobin, which is a protein in red blood cells that carries oxygen throughout the body. Zinc is important for immune function, growth and development, and wound healing. Fortification of jaggery powder with iron and zinc can help to address micronutrient deficiencies in populations that consume this traditional sweetener. However, there are several factors that need to be taken into consideration:

Stability:

Iron and zinc can interact with other components in jaggery powder, which can affect their stability and bioavailability. Therefore, it is important to select a suitable fortificant that is stable in jaggery powder.

Bioavailability:

The bioavailability of iron and zinc in jaggery powder can be influenced by factors such as the presence of inhibitors or enhancers of absorption. For example, the presence of phytates in jaggery powder can inhibit the absorption of both iron and zinc. Therefore, it is important to select a fortificant that has high bioavailability. The bioavailability ofiron and zinc in jaggery can be limited due to the presence of inhibitors of absorption such as phytates and polyphenols. However, processing methods such as soaking and fermentation can help to improve the bioavailability of these nutrients. Fortification with bioavailable forms of iron and zinc can also help to increase the amount of these nutrients available for absorption in the body.

Sensory properties:

The addition of iron and zinc to jaggery powder can affect its sensory properties, such as taste, color, and texture. Therefore, it is important to conduct sensory evaluations to ensure that the fortified jaggery powder is acceptable to consumers. It is important to note that the addition of iron and zinc to jaggery should not significantly affect the taste and color of the product if the fortificant is added in appropriate amounts. In addition, the fortification process should be carefully designed to ensure that the particle size of
the fortificant is appropriate for the jaggery product, and that the fortificant is evenly distributed throughout the product.

Cost:

The cost of fortification can be a barrier to implementation, especially in resource- limited settings. Therefore, it is important to consider the cost-effectiveness of fortification, and to explore strategies for reducing costs, such as using low-cost fortificants.

Chemical Properties of Jaggery:

Jaggery is a natural sweetener that is produced from the sap of sugarcane or palm trees. It is composed primarily of sucrose, glucose, and fructose, with smaller amounts of other carbohydrates such as maltose and raffinose. Jaggery also contains several minerals and vitamins, including iron, magnesium, potassium, and vitamins B1, B2, and B3. The mineral content of jaggery can vary depending on the specific type and source of the product. Fortification of jaggery powder with iron and zinc is technically feasible, but it is important to

consider factors such as stability, bioavailability, sensory properties, and cost when designing and implementing a fortification program.

The amount of iron and zinc in jaggery:

The amount of iron and zinc in jaggery can vary depending on several factors such as the source of the jaggery, the processing method used, and the soil in which the sugarcane or palm trees were grown. Generally, jaggery is not considered to be a goodsource of iron and zinc. According to the USDA Food Composition Database, 100 grams of jaggery contains approximately 0.5 milligrams of iron and 0.2 milligrams of zinc. However, these values may vary depending on the specific type and source of jaggery. It is important to note that the bioavailability of these nutrients in jaggery powder can be low due to the presence of phytates and other inhibitors of absorption. Therefore, if iron and zinc fortification of jaggery powder is desired, it would be necessary to add additional amounts of these nutrients to the product to achieve meaningful levels that can address nutrient deficiencies in the population.

How to measure iron from jaggery powder? (Chemical Analysis):

The iron content of jaggery can be determined through chemical analysis. One common method for measuring iron in jaggery is atomic absorption spectroscopy (AAS). AAS involves atomizing a sample of the jaggery and passing light through the resulting vapor. The absorption of light by the vapor is measured, which can be used to determinethe concentration of iron in the sample. Other methods for measuring iron in jaggery include inductively coupled plasma (ICP) spectroscopy and colorimetric methods. These methods involve different chemical reactions that produce a measurable signal that can be used to determine the iron content of the jaggery.

The chemical properties of zinc in jaggery powder:

The chemical properties of zinc in jaggery powder are similar to those of zinc in other foods and supplements. Zinc is a chemical element with the symbol Zn and atomic number 30. It is a transitional metal that is found in the Earth's crust and is essential for many biological processes in the human body, including immune function, DNA synthesis, and wound healing. Zinc is also important for the proper functioning of taste and smell receptors. Zinc in jaggery powder is present in the form of zinc ions (Zn^{2+}). These ions are released when the jaggery is dissolved in water or other liquids. Zinc ions can bind to other molecules in the body, including enzymes and proteins, to help regulate their activity. The amount of zinc in jaggery powder can vary depending on the source and processing method. The zinc content of jaggery can be determined through chemical analysis using methods such as atomic absorption spectroscopy (AAS) or inductively coupled plasma (ICP) spectroscopy. In summary, zinc in jaggery powder is present in the form of zinc ions (Zn^{2+}) and has chemical properties similar to zinc in other foods and supplements. The amount of zinc in jaggery powder can vary depending on the source and processing method, and can be determined through chemical analysis using methods such as AAS or ICP spectroscopy. Zinc is an essentialmineral that plays a crucial role in many biological processes in the human body.

Organoleptic analysis of jaggery powder:

Organoleptic analysis of jaggery powder involves the evaluation of its sensory properties, such as appearance, color, odor, flavor, and texture. These properties can impact the consumer's acceptability and preference for the product.

Appearance: The appearance of jaggery powder can be evaluated based on its color, size, and shape. The powder should be uniform in color and free of lumps.

Color: Jaggery powder can vary in color depending on the type of raw material used and the processing method. The color can range from light brown to dark brown. The color should be uniform, and any discoloration or variation should be noted.

Odor: Jaggery powder has a characteristic sweet aroma. The aroma should be pleasantand free of any off-flavors or odors.

Flavor: The flavor of jaggery powder is sweet, with a caramel-like taste. The sweetness level should be appropriate, and there should be no bitterness or other off-flavors.

Texture: The texture of jaggery powder can vary depending on the processing method. It can range from fine and powdery to coarse and grainy. The texture should be consistent, and any variation should be noted. The organoleptic analysis of jaggery powder can provide valuable information on its sensory properties, which can impact its consumer acceptability and preference. The analysis can help identify any sensory defects or issues with the product, which can be addressed through process optimizationor formulation adjustments.

Jaggery Powder and Organic Compound:

Jaggery, like most organic compounds, is made up of covalent bonds between its constituent atoms. Covalent bonds involve the sharing of electrons between atoms to form a stable molecule. The main components of jaggery, such as sucrose, glucose, and fructose, are formed through covalent bonds between carbon, oxygen, and hydrogen atoms. For example, sucrose is formed through a glycosidic bond between a glucose molecule and a fructose molecule. This bond involves the sharing of electrons between the carbon and oxygen atoms in the two sugar molecules.Jaggery also contains minerals such as iron, magnesium, and potassium. These minerals are typically present in ionic form, which means they are held together by ionic bonds. Ionic bonds involve the transfer of electrons between atoms, resulting in the formation of ions

with opposite charges that are attracted to each other. In short, the main components of jaggery are held together by covalent bonds between atoms, while the minerals in jaggery are typically present in ionic form and held together by ionic bonds.

Iron Metabolism and Jaggery:

Iron metabolism in the body involves the absorption, distribution, and storage of iron. The absorption of iron from the diet is regulated by a complex system of proteins and pathways, and the majority of dietary iron is absorbed in the duodenum and upper jejunum of the small intestine. Once absorbed, iron is transported by transferrin, a protein that binds to iron and delivers it to cells throughout the body. Iron is also storedin the liver, spleen, and bone marrow, where it is bound to a protein called ferritin. The regulation of iron metabolism in the body is primarily controlled by the hormone hepcidin. Hepcidin regulates the absorption and distribution of iron in the body by binding to ferroportin, a protein that exports iron out of cells. When hepcidin levels arehigh, ferroportin is degraded, reducing iron export and promoting iron storage. When hepcidin levels are low, ferroportin is increased, allowing for increased iron export andmobilization. While jaggery is a good source of iron, the iron it contains is in the non-heme form, which is less easily absorbed by the body than heme iron found in animal products. Nonetheless, consuming jaggery along with vitamin C-rich foods can help improve the absorption of non-heme iron in the body. Iron metabolism in the body is regulated by a complex system of proteins and pathways, and is primarily controlled bythe hormone hepcidin.

Conclusion:

Finally we can say that, the acceptability of the fortified product to the target populationis critical for the success of the fortification program. The taste, texture, and color of the fortified jaggery powder should be acceptable to consumers, and any negative perceptions or beliefs about fortified foods should be addressed through education and communication. Jaggaery powder fortified included for preparation of four traditional products namely Puranpoli, Gulpapadi, Chikki and Tamarind chutney/sauce. Iron and zinc fortification in jaggery powder presents a promising opportunity to enhance the nutritional quality of this traditional sweetener and address deficiencies in iron and zinc. The feasibility of fortification is influenced by various factors such as the availability and stability of fortificants, cost implications, quality control measures, and consumer acceptability. Comprehensive studies, including analytical testing, sensory analysis, cost-effectiveness evaluations, and health impact assessments, are necessary to ensure the successful implementation of iron and zinc fortification programs in jaggery powder. By improving the nutritional value of jaggery powder, fortification can
contribute to promoting public health and combating micronutrient deficiencies in at- risk populations.

Reference:

1. Chatterjee, U.R., S.S. Bandyopadhyay, D. Ghosh, P.K. Ghosal, and B.Ray. 2011. In vitro anti-oxidant activity, fluorescence quenching study and structural features of carbohydrate polymers from Phyllanthus emblica. International Journal of Biological Macromolecules 49 (4): 637–642.
2. Anwar, S.I., R.D. Singh, and J. Singh. 2011. Process development of production of jaggery (gur), with aonla as a natural source of vitamin C. Journal of the Institution of Engineers India 92: 33–35.
3. Ghosh, A.K., A.K. Shrivastava and V.P. Agnihotri. 1998. Production Technology of Lump Sugar-Jaggery/ Jaggery, Daya Publishing House, Delhi, India, pp. 287 (Reprinted 2017).
4. Rao, P.V., K.J. Das, and S.K. Das. 2007. Jaggery-a traditional Indian Sweetener. Indian Journal of Traditional Knowledge 6 (1): 95–102.
5. Madan, H.K., U.K. Jaiswal, J.S. Kumar, and S.K. Khanna. 2004. Improvement in gur (jaggery) making plant for rural areas. Journal of Rural Technology 1: 194–196.
6. Singh, J., R.D. Singh, S.I. Anwar, and S. Solomon. 2011. Alternative sweeteners production from sugarcane in India: Lump sugar (Jaggery). Sugar Tech 13 (4): 366–371.