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Review Article

Evaluating the Effect of Animal-Based Iron Sources on Iron Deficiency Anemia

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ABSTRACT

Iron deficiency anemia is widely spread throughout the world both in developing as well as developed countries irrespective of age and gender. There is a strong relationship between dietary intake and the nutritive status of a body. Maintaining a balanced diet having a standard iron (Fe) level and high bioavailability is challenging. Dietary source of good quality and quantity of iron is red meat from bovine, camel, goat, sheep, poultry, egg, quail, turkey, rabbit, fish, oysters, clams, prawns, shrimps, algae, and mushrooms. In the current study, animal-based iron sources were overviewed. The heme iron present in beef is the highest (1.06–2.63 mg/100 g) than in pork (0.30–0.61 mg/100 g), fish (0.46 mg/100 g), and chicken (0.17–0.49 mg/100 g). However, Iron is abundantly found in meat and poultry's liver, kidney, and heart. The liver contains the highest concentrations of iron, three to four times than meat. Camel meat contains the superabundant amount of iron 45.5 mg 100-1g in contrast to mutton 4.05mg 100-1g, beef 1.8mg 100-1g, and poultry 0.4mg 100-1g. Goat meat contains a large amount of micronutrients mainly Fe and vitamin B12 which can be utilized to prevent and cure iron deficiency anemia in a woman. Moreover, Quail egg exhibited a high amount of micronutrients especially iron and zinc (57.2 µg/g and zinc 30.5 µg/g). Meat bone paste and the raw materials of the meat industry can be utilized to form iron fortified products. Conclusively, iron from animal-based foods can be utilized to prevent and treat iron-deficiency anemia for improving human health and lifestyle.

INTRODUCTION

Nutritional Anemia is a worldwide health issue in emerging countries and developed countries having advanced health facilities. It affects people of all age groups, irrespective of gender, including babies, children, youngsters, pregnant and lactating women, and men [1]. It is conspicuous that iron-deficiency anemia (IDA) is the significant limiting factor for the growth and development of children that affects cognitive performance, immune status, physical capability, and sexual performance, particularly in developing countries encompassing middle-income populations [2, 3]. Anemia is affecting people globally; nearly a third of the world population is anemic, and it's a significant cause of morbidity worldwide in developed as well as underdeveloped countries. It occurs in all age groups (infants or adults) and both genders (males and females). In 2016, over 1.2 billion people were iron deficient, among which 89 percent were from developing countries [4-9]. Iron deficiency anemia is the record-breaking dominant type of anemia that has a point frequency of 2%–5% among postmenopausal women and adult men in the industrialized world. Almost 52 % of people in developing countries are anemic due to iron scarcity. It is highly dominant in pregnant ladies due to high physiological iron demand and higher perinatal and maternal morbidity and mortality in unindustrialized countries. Iron deficiency anemia shows various signs and symptoms, depending upon the rate of blood loss or red blood cells (RBC) count. Patients with IDA feel lethargy, weakness, tiredness inter

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alia restless legs, chest pain, shortness of breath, abnormal mental and motor development, reduced exercise tolerance, and pica. IDA causes problems in the human body, for instance, koilonychia, dermatitis, herpetiformis, cold skin, cheilitis, glossitis, hypotension (orthostatic), tachypnea, and cardiovascular diseases like tachycardia and heart failure [10-13]. Consumption of food rich in micronutrients showed a reduction in anemia in adolescents in Indonesia, especially iron and vitamin A. Therefore, there is a strong relationship between dietary intake and the nutritive status of a body [14]. Iron (Fe) is a critical component for life that shows a vital role in numerous physiological processes, namely cellular propagation and metabolic actions, such as mitochondrial catabolic and anabolic reactions (energy production), immune surveillance, and oxygen transportation [15, 16]. Female and males with ages more than 19 require 8 and 18 mg, respectively. A pregnant woman requires 27mg due to fetal growth and increased blood supply, while lactating woman requires 9 mg. Iron is crucial for the maturation and development of the brain and spinal cord growth and development during infancy, especially around age of six months, because iron stores are exhausted. Hence complementary diets are introduced for preventing iron deficiency anemia [17]. Maintaining a balanced diet with a standard iron range with good bioavailability is challenging. The quantity of iron deposited in the body and its bio accessibility in diet regulate the total iron stores of body. The problem is that foods with high iron content and good bioavailability belong to the animal origin, which is either costly or limited in supply. Besides infrequent meat consumption, vitamin C deficiency and diet-rich inhibitors are other significant aspects for determining risk of IDA in low-income countries. It is one of the most abundant micronutrient deficiencies in developed countries [18-21]. There are two kinds of iron in food, heme (animal origin such as fish, meat, and poultry) and non-heme nature (plant origin such as spices, beans, herbs, cereals, fruits, nuts, and vegetables). In developing countries where socioeconomic parameters are poor major crops is a significant fraction of the total everyday consumption of energy and micronutrients. As per surveys, chief cereals cultivated at large scale contribute more than half of entire iron consumption of the inhabitants for instance wheat, rice, and maize, along with other crops like starchy roots, tubers, green leafy and bulky vegetables, spices, legumes, and herbs. Spices and herbs consumed regularly in diets play a great role in the equilibrium of iron for example cumin seeds that contain great amount of iron 66.36 mg/100g, along with legumes and beans such as soybean contains 15.70 mg iron/100g, winged beans contain 13.44 mg iron/100g, and moth beans contains 10.85 mg iron/100g [22]. Dietary source of good quality and quantity of iron is beef liver encompass 8.2mg of iron/100g, oatmeal contains iron 4.8 mg/100g, egg holds 3.1 mg of iron/100g, lettuce 1.5 mg of iron/100g while spinach contain 2.6 mg of iron/100g [23].Fish, dairy, legumes, dark leafy vegetables, and liver are reasonable foods with high iron content. Furthermore, several foods items provide multiple nutrients; for example, dark-green leafy vegetables encompass iron, calcium, vitamin A, and folate; cattle meat is rich in protein, Fe, and Zn. Small dried fish is a worthy source of proteins, vitamin A, and vitamin B12, Ca, Fe, and Zn. In the future, healthy weaning practices and the consumption of low-cost nutritional, complementary foods should be promoted to prevent IDA in children and infants [24, 25]. Animal diet is the greatest source of iron for human everyday iron requirements due to heme-iron compounds. One of the best sources of iron, basically heme-iron, is fundamentally the red meat which is widely consumed in developed countries [26]. Animal meat contains both organic and inorganic iron, of which 40% is the heme bound iron while 60% is inorganic iron, both of them are absorbed in different ways [27]. Poultry meat and fish also deliver enough amount of heme-iron. Moreover, bigger portions of fish are recommended by dietary guidelines because they are rich in Feplusω-3 fatty acids that increases metabolism of iron [28, 29]. Animal origin food products make an important nutritional contribution to diets, especially micronutrient intake. For example, meat and its consequent products deliver a high concentration of necessary nutrients related to different foods such as cholecalciferol, iron, zinc and magnesium, and milk provides calcium and iodine [30, 31]. Animal based diet differs from plant based diet due to presence of metabolically active forms of fatty acids such as eicosapentanoic acid docosahexanoic acid (omega 3 FA) and bioavailable forms of oil soluble vitamins such as vitamin D and A along with bioavailability of heme iron. Animal based diets are consumed on large scale to avoid nutrient deficiencies such as elements Fe, Zn, Ca and I and proteins [32]. To counter iron deficiency and anemia in woman, fortification and supplementation program should be adopted in addition to food based strategies [33]. Peptides existing in meat, fish, and poultry assist with the assimilation of non-heme iron in the meal, which also influences iron absorption from vegetative diets [34]. Meat and its products that are used in daily diet contain high amount of iron especially liver of beef, chicken and veal contains 6.0–11.0mg iron/100g[35]. Heme iron in food is present in two components: hemoglobin and myoglobin, which, after digestion in the stomach, is released in the

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form of free heme. That free heme is attached to the intestine mucosal epithelial cells. It moves across the cytoplasm and basal cell membrane of the absorbing cell and finally reaches the blood circulation. Heme iron barely causes gastrointestinal irritation symptoms because of its high bioavailability and assimilation in the body. It can be used in supplements (e.g., tablets, capsules, and granules), which are more effective than traditional medicines [36-40]. Heme iron (porphyrin iron) is present in many food items of animal origin that include lean meat, liver, blood curd, shellfish, fish flesh, and blood (>40 mg heme iron/100g). After cooking, the heme iron present in beef was highest (1.06–2.63 mg/100 g) than in pork (0.30–0.61 mg/100 g), fish (0.46 mg/100 g), and chicken (0.17–0.49 mg/100 g) and the heme iron present in the meat of these products is 15-30% [36, 41-44].

CONCLUSION

Iron deficiency anemia can be cured by consuming animal-based iron sources and food products in addition to vegetables. Raw materials from the industry such as chicken liver which is rich in iron can be utilized to form iron fortified products for people with iron deficiency anemia. In addition to game animals, marine animals such as clams, prawns and fishes contains large amount of iron that can be used to prepare haem iron products. Algae and mushrooms contain a great amount of iron that when added to the regular diet can help prevent IDA. However, human-based studies are required to check the efficiency of functional foods and nutraceutical products.

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