

Characterization of Soya Bean and Red Kidney Bean Enriched Cookies to Combat Iron Deficiency Anemia

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ABSTRACT

Iron inadequacy anemia is a major health problem in expected women globally. Increasing iron content in diet can improve the iron bioavailability and overall health status. Mostly iron supplements used are synthetic. It primarily affects pre-school children as well as pregnant and breastfeeding women, contributing to 20% of all maternal mortality (Seghosime *et al.*, 2017). IDA the numbers of red blood cell or their oxygen-transferability decrease, which causes exhaustion, weakness, fainting, and somnolence. Kumari *et al.*, (2016) suggested that iron deficiency may be linked to a lack of folate, especially during the adolescent period Every year, IDA is linked to an estimated 11,1000 maternal fatalities in pregnant women (Wijaya-Erhardt *et al.*, 2011). Cookies, now a day's, are being used as a snack food globally. They are usually small, flat, sweet and of various types like drop cookies, meringue cookies, bar cookies and sponge cookies. Among legumes, red kidney beans provide various physical conditions due to presence of significant quantity in folic acid, protein, fiber, calcium and carbohydrate. Soya bean is the plant provenance of complete protein and good source of fat-soluble vitamins. Iron rich cookies will be made from substitution of wheat flour with red kidney beans flour blends, in ratio of 80:20% and 70:30% and also wheat flour with soya bean flour blends, in the ratio 80:20% as well as 70:30% and it labeled as T0, T1, T2, T3 and T4 as T0 will serve as control. The present study is to formulate an iron supplement biscuit for pregnant women rather than to take iron supplement pills. Products will be analyzed for compositional, physicochemical, mineral as well as sensory analysis. The results will be statistically analyzed afterwards.

Keywords: Anemia, iron enriched cookies, Pregnancy, proximate analysis, red kidney bean flour, soya-bean flour.

INTRODUCTION

Anemia from Greek Anaimia, "meaning without bloodless sense", is defined as a state in which the number of red blood cells (RBCs) decreased or their ability to transport oxygen is reduced meet normal physiological functions of the organism (Shams *et al.*, 2017)

Anemia, defined as hemoglobin levels of less than 11 g/dL by the World Health Organization (WHO), is one of the most common nutritional illnesses affecting people of all ages (Ullah *et al.*, 2018).

Iron deficiency is the most common cause of anemia, and the number of anemic people in developing nations is higher than in Europe and the United States. It is also reported that cereals and pulses provided 40% of Fe consumption (Celmeli *et al.*, 2018).

Iron is a vital nutrient for living cells and essential during pregnancy, especially for the developing foetus via maternal iron, as well as in the newborn through breastfeeding and in childhood through nutrition. Anemia also common in children, where it is linked to decreased brain function. In addition, women of childbearing age may be affected by ID due to iron loss during periods (Lepanto *et al.*, 2018).

Anemia-related morbidities:

Due to anemia, the production of oxy-hemoglobin by haem and oxygen in the blood is considerably disturbed. This complex is required for the delivery of oxygen to muscles and tissues. It also serves as a vital conduct for the body's many metabolic processes. (Shubham *et al.*, 2020).

The elements which are necessary to shoot up the degree of iron intake in body, such as haem iron. It raises the iron faster in body, while as far as non-haem iron is concerned; vitamin C and meat proteins will be work as enhancer. The hindrance to absorb of iron is such as, phytic acid (in lentils) and tannins (in beverages) and reduces iron dropping (e.g malaria intestinal bloodsucker). The total phytic acid degradation in lentils could raise iron engrossed as much as five folds (Hurrell *et al.*, 2003).

In legumes, iron is stored in ferritin, which is a most important protein to store iron. Ferritin is made up of 24 protein subunits that can store up to 4,500 Fe 3+ atoms in the form of iron oxyhydroxide-phosphate in the form of a mineral. It is found in beans, soybeans, lentils, and peas. Ferritin-bound iron concentrations in beans were lower than those previously reported by other methods, ranging from 15% to 30% of total iron. Thus, non-ferritin-bound iron accounts for 70–85 percent of the iron in beans, which may be bound to phytic acid (Petry *et al.*, 2015).

Iron Absorption:

A typical male weighing 70 kg contains roughly 4 g of iron, 2.5 g of which is contained in hemoglobin and 1 g in the liver as hemosiderin or ferritin. Iron is absorbed at a rate of 1–2 mg per day in the human body. To compensate for the losses due to menstruation, males can absorb and excrete around 0.8 mg of iron daily, while females can absorb about 1.4 mg. (Abdul *et al.*, 2021).

Symptoms of Iron Deficiency Anemia:

Following are the main causes of iron deficient anemia: (Sangeeta *et al.*, 2016).

01	IDA causes due to monotonous diet high in chemicals (phytates) that block iron absorption, preventing the body from using dietary iron.
02	Malaria is another common cause of anemia, affecting 300-500 million people worldwide and accounting for half of all severe anemia cases in endemic areas.
03	Occult blood loss due to hook worm infestation
04	Beginning menarche

Iron Fortified Foods:

Fortification is a typical procedure for raising the content of a key micronutrient in foods, such as vitamins and minerals, to improve nutritional quality and give public health advantages. The primary goal of food fortification is to boost a food's nutritional value. The target population group is a significant consideration in determining the optimal manner to supply micronutrients, whether through fortification or supplementation. (Shubham Kumar *et al.*, 2020).

Cookies:

Baked products (bread, cookies, snacks, and cakes) are popular because they are ready to eat, have good nutritional value, and are inexpensive (Olugbenga O *et al.*, 2014). Fortified bakery items are thought to be the best fortification mediums (Amin *et al.*, 2016). Cereal-based cookies, crackers, and breakfast cereals are foods that provide a significant amount of energy (Ostermann *et al.*, 2017). **Wheat:**

Wheat (*Triticum aestivum*) is one of the most essential crops, and it has long been used as a key ingredient in a variety of foods (Sun *et al.*, 2015). The endosperm, which is predominantly carbohydrates and proteins, the germ, which is mostly lipids and proteins, and the bran, which is mostly dietary fiber, make up the wheat grain (Liu *et al.*, 2015). Wheat is one of the most significant primary meals for creature (Akhtar *et al.*, 2008). Wheat flour is an excellent ingredient for a variety of food product compositions, and it is frequently utilized in the bakery and confectionery industries (Sibian *et al.*, 2020). Wheat is a national staple in various nations and contributes roughly 20% of the world's dietary calories (David *et al.*, 2015).

Iron and zinc locations in wheat grains:

Wheat flour is high in carbohydrates and however slightly low in protein content. Raw grain is a concentrated provenance of necessary dietary elements such as vitamins, minerals, protein, fat, and fiber. However, purified granules are generally composed of starch (Potter N, 2006); (Bakke and vickers, 2007)

Inyang *et al.*, (2017) found that combining cereal with legume flour improves protein content while also increasing mineral content (Abimbola A. & Olabisi A., 2020).

Soya bean:

Soybean (*Glycine max L.*) is a tropical, subtropical, and temperate legume that thrives in tropical, subtropical, and temperate regions (Alamu *et al.*, 2017). It is a member of the Fabaceae family of legumes (Alabi & Anuonye 2007).

Soya is the most nutrient-dense legume and is recognized to be a good source of the trace elements copper, zinc, and manganese, as well as containing all of the nutrients required in meals (Noorfarahzilah *et al.*, 2014). The majority of these minerals and vitamins are well-known hematinics and are required for red blood cell production (Ogbemudia *et al.*, 2018).

Soya is the only plant provenance of a complete protein. It contains all the amino-acids that are required by humans and animals and also a superior provenance of fat soluble vitamins and minerals. (Alabi O. & Anuonye C., 2007); (Hegazy A.I & Ibrahim M.I., 2009).

Red kidney bean:

Common bean dominates the cultivated species with a 90 percent growth area ratio (Celmeli *et al.*, 2018). Common dry bean, *Phaseolus vulgaris*, comes in a wide range of varieties and is the world's largest pulse crop, producing about 26 million tons annually (Nosworthy *et al.*, 2018).

Raw kidney beans should not be consumed as they contain toxic compounds known as phytohaemagglutinin (Kumar *et al.*, 2013). Raw (e.g., fresh, soaking, or sprouting form as part of a salad), flour consumption (e.g., porridge for infant food), or minimally processed (e.g., steamed) or beans (prepared in dehydrators, slow cookers, or crockpots) is frequently associated with illness (Nicipri *et al.*, 2018).

Soya bean and red kidney bean anti-nutritional factors:

ANFs are naturally occurring chemicals found in edible seeds that, when consumed, alter nutrient utilization in the human body, particularly protein, vitamin, and mineral absorption, by binding to these components and reducing absorption in the gastrointestinal tract (Nikmaram *et al.*, 2017).

Several different procedures for reducing ANF levels, such as high-pressure processing (HPP), microwave 115, and extrusion, have been launched in recent years as alternatives (Nikmaram *et al.*, 2017).

AIMS AND OBJECTIVES OF RESEARCH

The aim of our study is to form an iron enriched cookies for pregnant and lactating women so they can increase iron uptake from the cookies rather than using iron supplements pills. These cookies provide them iron content and as well as give other nutritional benefits to them.

As discussed in the literature review, the main source of iron is soya bean and red kidney beans. By the help of these sources, we will formulate iron enriched cookies to overcome IDA.

The objectives of the study are:

- 1- To develop nutraceutically rich and low-cost product by utilizing soya bean and red kidney bean composite flour.
- 2- To perform sensory evaluation and consumer survey of the cookie
- 3- To measure physiochemical characteristics of the product.

METHODOLOGY

Preparation of Composite Flour:

Flour was prepared by homogenous mixing of wheat flour with soya bean flour and red kidney bean flour in the percentage proportion 100:0, 80:20 and 70:30. First bean seeds were sorted and washed and then oven dry. After ovan dry fine milling process of bean done and flour occurs.

Treatments:

Table 1. Blending ratio of wheat flour, soya bean flour and red kidney beans flour.

S.no.	Treatment	Wheat flour	Soya-bean flour	Red kidney bean flour
01	T0	100	-----	-----
02	T1	80	20	-----
03	T2	70	30	-----
04	T3	80	-----	20
05	T4	70	-----	30

Preparation of Cookies:

The composite flours were blended with other baking ingredient like egg, margarine, flavoring essence milk powder, baking powder, baking soda, sugar and salt.

Proximate analysis of flours

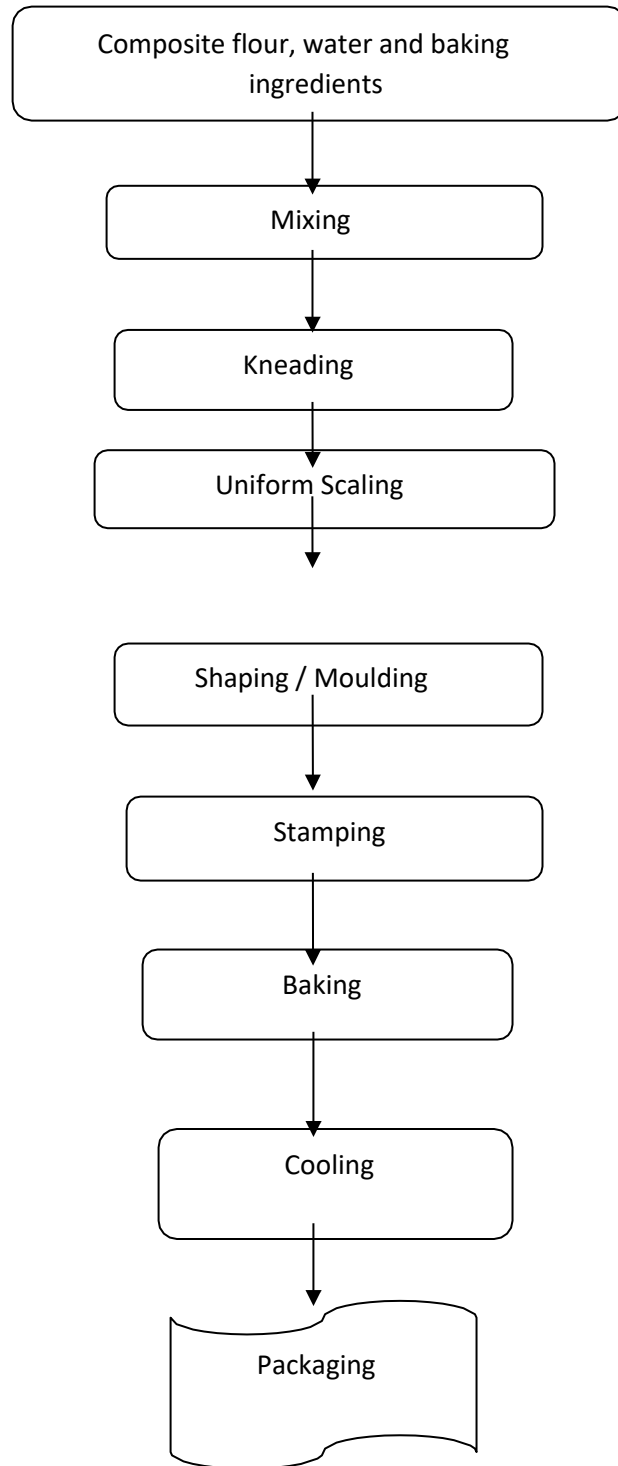


Figure 1. Process flow chart for iron rich cookies

RESULT AND DISCUSSION

Consumer Survey:

Random 20-person consumer survey should be done. Survey should be analyzed by survey questioner forms.

Sensory Evaluation:

Sensory evaluation and overall acceptability of different cookie samples. Cookies made from WWF, SBF and RKBF and their blend subjected to sensory evaluation by a sensory panel of ten persons.

S.no	Blends	Result
1	T0	7.82
2	T1	7.96
3	T2	7.92
4	T3	7.6
5	T4	7.15

Clinical Trial:

Clinical trial of iron rich cookies was conducted on rat's male and female both. The procedure was about 15 days with 1-, 7- and 15-day interval of blood test. Two groups of rats were formed one group which intake only iron rich cookies and another group cookie are given with vitamin C (ascorbic acid). The result shown as below.

Group 1 which take only iron rich cookies there least blood range was 16.17 and after intake of iron rich cookies its rises till 18.34. And in group 2 cookies were given with vitamin C supplemented the blood range level start from 10.16 and rise till 16.99.

S.no	Experiment	Results
01	Group 01	16.17-18.34
02	Group 02	10.16-16.16

Physicochemical, Compositional and Mineral analysis:

Products will be analyzed for compositional, physicochemical, mineral as well as sensory analysis. The results will be statistically analyzed afterwards.

CONCLUSION AND FUTURE PROSPECTUS

The studies on the development of composite flour are mainly aimed to substitute the flour with another legume in order to formed a new bakery product. The utilization of composite flour in new product development is due to the protein energy malnutrition and also to recover the micro nutrients in body.

The idea of making cookies with iron rich flour and wheat flour is an innovative step to form iron enriched cookies for enhancing the nutritive cookies as well as medicinal cookies. The study is aimed to develop iron rich cookies which will surely provide nutrients, high sensory acceptability and as well are cost effectiveness. However, in future studies anti-nutritional substance in legumes can be studied.

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