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Nutritionally Enhanced Protein - Rich and Gluten - Free Snacks Prepared From Admixtures of Different Flours

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ABSTRACT

Based on the various socio economic status and diverse populations of Rajasthan, and their food habits selection of various food items have been adopted to develop an admixture which will enhance the nutritive value of final products along with cost-effectiveness, so that it can be availed by various target groups and vulnerable population groups. With this nutritional transition, many developing countries face a phenomenon known as the 'triple burden' of malnutrition-undernourishment, micronutrient deficiencies, and obesity. In addition to this these crops will help in alleviating the problem of protein energy malnutrition by developing weaning formulations. The development of low cost, high protein and micronutrient dense food supplements for infants is a constant challenge for developing countries. To address these nutritional problems in consideration of more and more people allergic to wheat and wheat based products these nutritious complementary foods were formulated with admixtures of different flours namely Quality Protein Maize, Moth bean flour, moringa leaves and sesame seeds in form of sweet and salty cookies and Nachos in form of Ready –to- Eat foods while improving physical well-being of consumers and a healthy society.

Key words: *Ready -to- Eat, Obesity, Malnutrition, Children*

INTRODUCTION

Developing countries are moving from traditional or minimally processed foods to highly processed, energy – dense, micronutrient–poor foods and drinks, which lead to obesity and diet related chronic diseases. With this nutritional transition, many developing countries face a phenomenon known as the 'triple burden' of malnutrition-undernourishment, micronutrient deficiencies, and obesity. Malnutrition in women and men can result in reduced productivity, slow recovery from illnesses, increased susceptibility to infections, and a heightened risk of adverse pregnancy outcomes. A woman's nutritional status has important implications for her health as well as the health of her children. Good nutrition is essential for attainment of normal growth and development of children.

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Food is taken daily in piece meals called diet. Any deviation from a balanced diet may lead towards long and short-term consequences such as malnutrition, micronutrient deficiency and various degrees of deficiency diseases. Nutritional deprivation is the most widespread problem among preschoolers in all the developing countries of the world. According to Kul C. Gautam, former deputy executive director of UNICEF "The 'hidden hunger' due to micronutrient deficiency does not produce hunger as we know it. You might not feel it in the belly, but it strikes at the core of your health and vitality". Vitamin A and zinc deficiencies adversely affect child health and survival by weakening the immune system. Lack of zinc impairs growth and can lead to stunting in children. Iodine and iron deficits prevent children from reaching their physical and intellectual potential. Insufficient folate or folic acid in the diet of pregnant mothers leads to Neural Tube Defects (NTD) in infants. Women and children have greater needs for micronutrients. The nutritional status of women around the time of conception and during pregnancy has long-term effects for fetal growth and development. The most commonly recognized micronutrient deficiencies across all ages, in order of prevalence, are caused by a lack of iodine, iron, zinc and folic acid or dietary folate.

Several steps like bio-fortification, value-added products and product development have been suggested to get rid of all these consequences. 'Bio-fortification' of micronutrient-enriched staple plant foods/crops through breeding approaches have been adopted worldwide to alleviate micronutrient deficiencies and cost-effective food-based solutions to combat malnutrition[1].

Nutrition related diseases have been prevented using Biofortification as a tool to overcome hunger and malnutrition where mixing flours made from various sources like plant crops such as Maize, soybean, cassava, flaxseeds, ragi along with pulses like beans, peas, to provide with vitamins and amino-acids required by our vulnerable sections of society and country as a whole. Product development by admixing may prove useful in alleviation of this problem. Nowadays, more and more people are having allergies from wheat and wheat products. Replacement of wheat as a staple by gluten-free maize is a substitute for celiac patients providing essential nutrients and preventing nutrition related diseases while improving physical well being of consumers. Developing traditional as well as local recipes which are suitable for all ages, addressing undernutrition at the community level in developing countries and eradicating micronutrient malnutrition which is largely hidden public health problem is the key to a better and healthy society.

Value-added products are defined by as having a change in the physical state or form of the product (such as milling wheat into flour or making strawberries into jam) or the production of a product in a manner that enhances its value[2]. Product development refers to nutritional improvement approaches i.e. mixing of weaning foods or food items of diverse sources in optimal quantities, which can provide nutritional needs of specific target groups, like, preschool children, malnourished individuals, pregnant and lactating women and population suffering from micronutrient deficiencies. It aims towards their survival, as well as better health conditions besides, it gives an opportunity for availability of specially formulated foods all round the year[3]. Based on the various socio economic status and diverse populations of Rajasthan, and their food habits selection of various food items have been adopted to develop an admixture which will enhance the nutritive value of final products along with cost-effectiveness, so that it can be availed by various target groups and vulnerable population groups.

The aim of the study was to develop value added products from various combinations of plant materials viz. Quality Protein Maize (QPM), Moth Bean (MB), Moringa Leaves (ML), Sesame Seeds (SS) and Jaggery (J) enhancing their nutritional qualities following various methods to nourish undernourished or deprived and vulnerable sections of the society. WHO has recommended the major criteria for a good-

quality complementary food, to be adequate in protein content with high energy value per unit of food volume, soft texture, high fiber content, adequate vitamins and minerals, and absence of anti-nutritional factors. To this effect, the formulation and development of nutritious complementary foods from local and readily available foods have received considerable attention in many developing countries[4]. The development of low cost, high protein and micronutrient dense food supplements for infants is a constant challenge for developing countries[5]. This is particularly important in countries like India where malnutrition has been a prevalent issue for a very long time.

Although much work has been done to address protein-energy malnutrition, still there are gaps to the micronutrient deficiency problem. To address these nutritional problems, nutritious complementary foods could be formulated from locally available foods. A significant section of human population relies upon legumes as staple foods for subsistence, as a source of protein and essential amino acids particularly, in combination with cereals. The research findings described that the composite flour technology plays a vital role to complement the deficiency of essential nutrients[6].

There were differences in some of the functional properties such as viscosity, pasting time and temperature of quality protein maize and common maize. In addition, certain amino acids of the quality protein maize were significantly higher than those of common maize especially lysine, tryptophan, isoleucine, phenylalanine and methionine[7]. In view of these results, QPM can be integrated into the family food where maize is used as a staple and especially in the formulation of weaning foods as this will help in alleviating the problem of protein energy malnutrition.

Moth bean is considered as a multi-purpose crop and legume of great economic use in semi-arid and arid areas. Being a pulse, the principal and the most common use is a rich and cheap source of vegetable protein in form of papad, mangodi, bhujia, roti, vada, kheech, rabri, sprouts and also as a soil binder. The influence of soaking and sprouting of horse gram (*Dolichos biflorus*) and moth bean (*Phaseolus aconitifolius*), for 8 and 16 h reduced the levels of tannins and phytates[8]. Degradation of phytates and tannins was more pronounced after 24 h of germination. In vitro iron availability significantly increased after soaking as well as after germination of these legumes.

The nutritional and anti-nutritional factors in moth bean (*Vigna aconitifolia*) and sorghum (*Sorghum bicolour* (L.) Moench) seeds with their product development by different household processing, followed by their addition to diets would help improve the nutritional profile at low cost[9].

Moringa oleifera is an important tree which has had enormous attention as the 'natural nutrition of the tropics'. Its leaves, fruit, flowers and immature pods are used as a highly nutritive vegetable in many countries, particularly in India, Pakistan, Philippines, Hawaii and many parts of Africa. It is reported to be a rich source of β-carotene, protein, vitamin C, calcium and potassium and acts as a good source of natural antioxidants such as ascorbic acid, flavonoids, phenolics and carotenoids[10], and thus enhances the shelf-life of fat-containing foods.

Sesame seed is rich in lipids (54-65%), proteins (17-27%), carbohydrates (6.4-21.0%) and dietary fiber (9.3%) and contains important minerals and vitamins such as Ca, P, Fe, niacin, and thiamin[11]. It also has some potential of nutraceutical compounds such as lignan type phenolics and tocopherols with antioxidant activity that have significant effect on reducing blood pressure, lipid profile and degeneration of vessels which may thereby reduce chronic diseases. The physico-chemical properties of sesame varieties should be processed into different products and blended with concentrated fruits to be utilized as a functional food for human nutrition.

However, in the recent past, with the increase in urbanization, changing lifestyle of common man and health awareness, the demand for the newer and improved processed

products has increased. A nutritious variety of combinations and recipes made or developed of QPM *(Zea mays)*, Moth bean (*Vigna aconitifolia*), *Moringa oleifera* leaves and *Sesamum indicum* seeds were identified further .

Jaggery (pounded finely) or common salt was added in constant proportions in all proposed products to provide sweetness or saltiness and nutritive value.

Although a lot of work has been done to address protein-energy malnutrition, there are gaps to the micronutrient deficiency problem. To address these nutritional problems, nutritious complementary foods were formulated:

1) QPM - Moth Bean flour with combination of Sesame Seeds Cookies (Sweet& Salty)
2) QPM - Moth Bean flour with combination of Moringa leaves Cookies (Sweet& Salty)
3) QPMF+ MBF+(ML+ SS) Salty Nachos

QPM - Moth Bean flour Cookies (Sweet & Salty)

QPMF+ MBF (ML+ SS) Salty Nachos

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