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Development of fortified food products using spirulina combating malnutrition

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Abstract

India has a higher prevalence of child malnutrition, which manifests as stunting and underweight problems in children. India is home to about one third of all malnourished children in the world. Of the 100 worst performing districts, 40 are in Uttar Pradesh, 22 in Bihar, 15 in Jharkhand, 12 in Madhya Pradesh, 10 in Rajasthan and 5 in Orissa. Malnutrition continues to be a major public health problem throughout the developing world. Malnutrition is consequently the most important risk factor for the burden of disease in developing countries. Long term malnutrition leads to “anaemia” affecting the general masses of the developing countries and so many other diseases like goitre, hypokalemia, teeth decay, vitamins deficiency has been there since years. More than thousands of wisely conducted intervention programmes for number of times could not even improve the scenario. This study focussed on adding spirulina as a dietary supplement in cookies, pasta and noodles to fortify the food product with enriching protein, calcium, iron, vitamin B₁₂ phosphorus to enhance the foundation years of a child’s life. Spirulina is a blue green algae having very good nutritional value. It also has many therapeutic properties, in the same area the spirulina produces 20 times more protein than soya, and Spirulina typically contains about 60% protein. It is a good source of vitamin B₁₂, Copper and iron. Spirulina protein is low in calories. There are 3.9 calories per gram of protein found in spirulina, which can be compared to 65 calories per gram of protein in beef. The researcher added spirulina in specific quantity to food product recipes of cookies, pasta and noodles. These were then assessed for their nutritive value under normal condition. The results indicated significantly increased values of protein, calcium, phosphorus and iron will not much change in the taste of the food products.

Keywords: Malnutrition, Iron, Anemia, Hemoglobin

1. Introduction

“Let food be your medicine and medicine be your food” said Hippocrates 2500 years ago. The philosophy of food as medicine is more relevant today than ever before. Health and nutrition are the most important contributory factors of human index measure in any country. India is passing through the phase of economic transition while the problem of malnutrition continues to be a major problem. “Youth are the future holders of any nation.” So healthier growths of them mean better development of the nation, but in Uttar Pradesh the condition of children and females are dismal, the adolescent girls are more affected. Addition of a healthy amount of complete protein in our diet is very important. Spirulina is gaining more attention from medical scientists as a nutraceutical and source of potential pharmaceutical. Spirulina is one of the great super foods. It is approximately 65 to 71 percent complete protein in its natural state. This is higher than virtually any other unprocessed food. Spirulina is nutrient rich super food for super health. Super food can be defined as foods that have health promoting benefits and disease preventing properties over and above their nutritional value. It is the most nutritious concentrated whole food source found in nature.

Iron plays an important in physical and cognitive development of growing children and adolescents. Anemia is the most common nutritional deficiency disorder in the world. About one third of the global populations (over 2 billion) are anemic. Prevalence of anemia in all the age group is higher in Indian as compared to other developing countries. Studies indicate that iron supplementation has positive effect on hemoglobin level and growth. Since iron supplementation programmes have had little reported success in reducing anemia, interest is turning to food based approaches that have higher potential for achieving far reaching and long

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lasting benefits for the control of iron deficiency. Food based approaches aim at improving nutrition by increasing the availability and consumption of a nutritionally adequate and micro-nutrient rich diet made up from a variety of available food. Food based approaches are recognized as an essential part of an urgently needed more comprehensive strategy to combat iron and other micronutrient deficiencies. Spirulina has a special form of protein that may be helpful for anemia and many other deficiency diseases.

Hypothesis

- The fortified food products have a higher nutritional value compared to control samples.
- The fortified food products will find acceptance by people in terms of taste and appearance compared to control samples.
- The spirulina fortified food products will be rich in iron, calcium and phosphorus, thus it will be beneficial for malnourished children, and lactating mothers and other deficiency diseases.

Objectives

- To effectively develop the spirulina fortified food products.
- Nutritional analysis of all nutrients present in the biscuits, pasta and noodles.
- Comparison of the controlled sample with the spirulina fortified samples.

Materials and Method

The study was carried out in four phase

- 1) Procurement of Spirulina: Pure Spirulina powder was procured purchased from a Food Company.
- 2) Development of value added food products: Most acceptable value added addition level of Spirulina powder i.e. 10 percent was incorporated in biscuits and 5 percent was incorporated in pasta and noodles with other ingredients.
 - (A) To effectively develop the controlled sample of biscuits, pasta and noodles.
 - (B) To effectively develop the spirulina incorporated biscuits, pasta and noodles.
- 3) Organoleptic Evaluation: The develop value added biscuits, pasta and noodles was standardised using composite scoring evaluation with the help of experts. The develop value added

products along with their control samples served to the experts for organoleptic evaluation.

4) Nutritional Evaluation: - Prepared products were analyzed for moisture, protein, fat, fibre, ash, phosphorus, calcium, iron, alcoholic acidity, pH, peroxide content.

Showing the Pictures of Controlled & Fortified Samples



Controlled Biscuits & Spirulina Fortified Food Samples



Controlled Pasta & Spirulina Fortified Pasta



Controlled Noodles & Spirulina Fortified Noodles

Results of All the Food Products

| S. No. | Test Parameter | Unit | Control biscuits | 10% Spirulina fortified biscuits | Control pasta | 5% Spirulina fortified pasta | Control noodles | 5% Spirulina fortified noodles |
|--------|-------------------|-----------|------------------|----------------------------------|---------------|------------------------------|-----------------|--------------------------------|
| 1. | Moisture | % | 2.77 | 2.55 | 1.87 | 1.27 | 1.87 | 1.27 |
| 2. | Proteins | % | 4.49 | 20.43 | 2.39 | 10.28 | 2.39 | 10.28 |
| 3. | Fat | % | 17.59 | 6.25 | 9.19 | 3.85 | 9.19 | 3.85 |
| 4. | Fibre | % | 0.68 | 1.18 | 0.68 | 59.0 | 0.68 | 59.0 |
| 5. | Ash | % | 3.08 | 4.07 | 1.96 | 2.04 | 1.96 | 2.04 |
| 6. | Calcium | Mg/100 gm | 214.15 | 288.98 | 118.4 | 144.44 | 118.4 | 144.44 |
| 7. | Phosphorus | Mg/100 gm | 54.34 | 115.92 | 34.56 | 64.8 | 34.56 | 64.8 |
| 8. | Iron | Mg/100 gm | 1.87 | 3.94 | 0.98 | 1.98 | 0.98 | 1.98 |
| 9. | Alcoholic acidity | % | 0.24 | 0.30 | 0.13 | 0.17 | 0.13 | 0.17 |
| 10. | Ph | - | 7.035 | 6.035 | 7.035 | 6.085 | 7.035 | 6.085 |
| 11. | Peroxide value | Meq/Kg | 0.987 | 0.755 | 0.876 | 0.678 | 0.876 | 0.678 |

Graph showing sensory evaluation of spirulina enriched biscuits through composite scoring

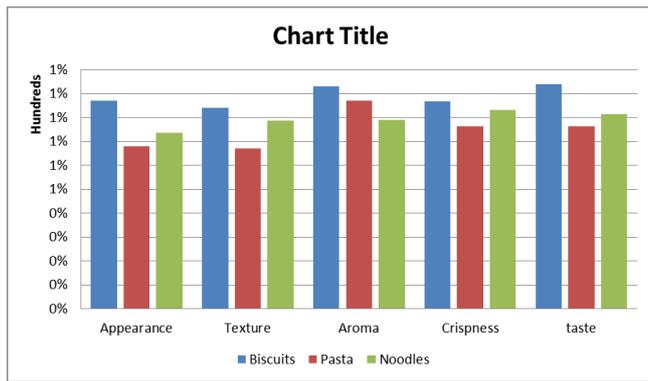


Table 2: Acceptability of Fortified Food Product

| Study of spirulina fortified food products | Fortified Biscuits | | Fortified Pasta | | Fortified Noodles | |
|--|--------------------|-----|-----------------|-----|-------------------|-----|
| | N | N% | N | N% | N | N% |
| Liked | 32 | 64% | 34 | 68% | 28 | 56% |
| Disliked | 16 | 24% | 10 | 20% | 14 | 28% |
| Neither like nor dislike | 6 | 12% | 6 | 12% | 8 | 16% |

Result and Discussion

Organoleptic Evaluation: Table 2 reveals that all the food samples were subjected to organoleptic evaluation by the experts and the results were noted. Spirulina fortified food products were falling into the liked, disliked or neither like nor dislike. Study reveals that the study of food products from a total of 50 human experts, who has judge the biscuits. The results are 64% liked the biscuits, 68% liked the pasta and 56% liked the noodles whereas 12% disliked the biscuits, 10% disliked the pasta and 14% disliked the noodles and 12%, 12% & 18% did not give a comment.

Nutritional Analysis: Nutritional analysis was judged under normal condition, carefully by the researcher. Table 1 show that the data of nutritional contents of fortified food items was much higher than control samples.

Shelf life study: Under the present study shelf life of all the products was judged on the basis of their organoleptic evaluation, during the storage period of three months, under normal condition by the researcher.

Conclusion

The present work reveals that Spirulina fortified food products prepared from Spirulina at 10% & 5% level were accepted on organoleptic parameters and the most acceptable products was found in satisfactory range during storage period. The results show that developed food products were nutritious and their nutritional value is much greater than control samples. Thus this valuable product possess great extrusion potential with higher acceptability on organoleptic parameters thus better quality of Spirulina fortified food products brings considerable advantages among the consumer.

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