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Role of multigrain based flour mixes to combat malnutrition among adolescents

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Abstract
Adolescence is a vulnerable group which lies between the age group of 10 to19 years. Micronutrient (Calcium, iron) deficiencies in the adolescents severely affect their high growth rate. Iron deficiency, which is the most common among adolescents, increase due to the consumption of junk foods (Such as snacks chocolates, snacks, soft drinks etc.) especially among school aged children possibly leading to iron deficiency anemia, obesity and diet-related diseases among them. Hypocalcemia is the calcium deficiency disease, which is happen due to low intake of calcium. Hence, to combat these deficiencies the food habits of this age group need to be modified. Incorporation of different multigrain flours in different proportions in their staple flour can help in overcoming these deficiencies. Therefore, in this review various studies related to food consumption pattern of the adolescents as well as different types of multigrain flour based foods required for them have been covered.

Keywords: adolescents, micronutrient, obesity, food consumption

Introduction
By Mishra *et al*. (2014) [9] Adolescence is considered as a period of transition from childhood to adulthood. It is characterized by rapid physical growth and significant physical, emotional, psychological and spiritual changes. According to World Health Organization adolescents are young people between the ages of 10 and 19 years. According to Gupta *et al*. (2015) Adolescents aged are between 10 and 19 years constitute 18 per cent of the world population, i.e., about 1.2 billion. Adolescent health and nutrition status has an intergenerational effect; hence it is one of the important stages of the life cycle in terms of health interventions. According to A rapid growth rate combined with a marginal nutrient intake increases the risk of nutritional deficiencies in this population. Kabir *et al*. (2010) [4] say that the nutritionally vulnerable segment of the population. Due to enhanced growth during adolescence, the requirement of some minerals is of paramount important. A rapid growth rate combined with a marginal nutrient intake increases the risk of nutritional deficiencies in this population. Micronutrients such as iron and zinc are essential trace elements involved in the high growth rates of adolescents. In Bangladesh, a large number of adolescent girls suffer from various degrees of nutritional disorders. Few studies have been done in the last couple of years to identify the extent and consequence of malnutrition in rural and urban adolescent school girls, and adolescent female workers of Bangladesh.2- 5 Results of these studies particularly confirmed the higher prevalence of anemia and iron deficiency along with some other micronutrient deficiencies. Shivgurunathan *et al*. (2015) say that Adolescents have increased nutritional requirements demanding diet rich in protein, vitamins, calcium, iodine, phosphorus and iron due to rapid growth spurt and increased physical activity. NFHS-3 data shows, in the age group 15–19 years, 47 per cent girls and 58 per cent boys were thin, 56 per cent girls and 30 per cent boys were anemic, 2.4 per cent girls and 31.7 per cent boys were overweight and 2/1000 adolescent girls and 1/1000 adolescent boys suffer from diabetes. They are also highly prone for eating disorders like anorexia nervosa or binge eating due to body dissatisfaction and depression.

Nuterient requirements for adolescents
Energy and protein
Protein is the most important macro nutrient required for maintenance of existing lean body

mass and increase of additional lean body mass during the adolescent growth spurt. The Protein requirements are highest for females between 11to 14year and for males between the 15 to 18year,. According to the National Nutrition Monitoring Bureau report (India), the intake of protein was found to be low across the adolescent age group. Thus it could be said that older children 13 years onwards fell short of RDA for their protein intake. During puberty there was a sharp decreasing trend in both boys and girls in dietary protein intakes than energy or micronutrient intakes. This may suggest that even before the time of second growth spurt, pre pubertal adolescents do not consume enough protein and calorie intakes to optimize the growth. According to Recommended Dietary Allowance (2010) energy 2190Kcal, protein 39.9 gram per day requirements for10 to 12 year Adolescents boys. Energy 2750 kcal, protein 54.3 gram, requirement for 13 to 15 year adolescents' boys and energy 3020Kcal, protein 61.5gram per day requirements for 16 to 17 year Adolescents boys. And energy 2010 Kcal, protein 39.9 gram per day requirements for 10 to 12 years Adolescents Girls. Energy 2330 kcal, protein 51.3 gm, for 13 to 15 years adolescent's girls. Energy 2440Kcal, protein 55.5 gram per day requirements for 16 to 17 year Adolescents girls.

Iron

The calculation of iron requirement must be based on the maintenance of well-defined iron status among the target groups (Hemoglobin and ferritin concentration). The factorial approach of computation of iron requirement has been adopted for Indians. The components considered were as follows: (i) obligatory or basal losses of 14 µg/kg/day which has been fixed considering the whole body excretion (skin, sweat and urine) studies which reported a daily iron loss of 0.9-1 mg in a man with a body weight of 70 kg; (ii) iron needed for growth in terms of muscle mass and hemoglobin content; (iii) iron loss due to menstrual blood of 16 µg/kg/day; (iv) iron cost of pregnancy, and (v) available evidence on breast milk output and iron content. The iron requirement during the life cycle is briefly described. The distribution of iron in the human body with respect to different compartments is assumed to be hemoglobin 70 per cent, stores 25 per cent, muscle four per cent and transport one per cent. During growth spurt (10-13 yr), body mass increases to 2.8 kg/years and the body store of iron build up and are maintained in girls until menarche. Considering iron accumulation in the body as a continuous and slow process, a conservative figure of about 50 per cent of that found in males (6 µg/kg/day) has been added to the total requirement during adolescence in girls (3 µg/kg/day). Therefore, allowances for basal loss, blood volume expansion, iron required for muscle mass and iron storage during this period are about 17 µg/kg/day. However, differences in iron requirements in girls and boys take place during 13-17 yr. The total iron requirement during this period for boys is 26 µg/kg/day and for girls 30 µg/kg/day. The RDAs of iron for Indians have been derived based on iron absorption of 15 per cent for 6-12 months, five per cent for men and children and adolescents and eight per cent for all women.

Calcium

Calcium is an element that is a fundamental part of the body and its importance is related to the functions it performs in bone mineralization, primarily related to bone health, which include formation and maintenance of the structure and rigidity of the skeleton (Maliye *et al* 2017) [8]. Calcium is the main mineral for bones strengthens and this is very important during adolescence. People reach their maximum bone density during adolescence and gradually lose bone mass the rest of their lives. When adolescents get enough calcium during the teen years, they can start out their adult lives with the strong bones and significantly reduce their risk for fractures as an adult. According to Recommended Dietary Allowance (2010) the requirement of calcium 800 mg per day for Adolescents.

Nutrient deficiency in adolescents

Kalaichelvi (2016) [5] say that Iron deficiency anemia is the most common form of malnutrition among children and adolescents. Anemia are affects the 50per cent of the population in India. The iron requirement of the body increases during this period. Iron deficiency and iron deficiency anemia among girls and boys appears to be more during the adolescent period due to growth spurt and in girls it remains during their reproductive life. Anemia is associated with lowered physical activity, poor academic performance and impaired cognitive development among adolescents. Nutritional intervention will help in improving hemoglobin level and intellectual level among adolescent girl. This study is finding out the effectiveness of nutritional intervention on iron deficiency anemia in adolescents girls. It is recommend Nutritional intervention is more effective and can be utilized in community health settings to curb the serious health problem of iron deficiency anemia among adolescent girls. According to Premalatha *et al*. (2012) [11] Objective of the study to estimate the prevalence of iron deficiency anemia among adolescent school girls in the age group of 13-17 years in Chennai and to study the associated factors. The Study are approach cross-sectional survey was executed among 400 female school students in the age group of 13-17 years in Chennai. Hemoglobin was estimated using cyan method. Statistical analysis was done using IBM SPSS (Statistical Package for the Social Sciences). Study results are shown The prevalence of anemia was found to be 78.75% among school students. In this study 42.5% of girls with BMI less than <18 were found to be anemic. Hypocalcemia, commonly known as calcium deficiency disease, which is due to happen when calcium intake are low.

Consumption pattern of Adolescents

According to Gupta *et al*. (2018) [2] conducted a study There has been an increase in the consumption of junk food among school aged children possibly leading to obesity and diet-related diseases among them. To assess the consumption of Junk Food by school-aged children in rural, Himachal Pradesh. A total of 425 children in the age group of 12–18 years studying in 30 government schools (clusters) were included. We found high prevalence 36 per cent of consumption of Junk Food among School aged children during the last 24 hours. They should be taken to reduce the consumption of Junk Food by promotion of healthy dietary habits and educating children about the ill effects of Junk food. Rathi *et al*. (2017) [12] say that found that, the adolescents reported poor dietary intakes; over one quarter (3o per cent) reported no consumption of vegetables and 70 per cent reported eating three or more servings of energy-dense snacks, on the previous day. Nearly half of the respondents (45 per cent) did not consume any servings of fruits and 47 per cent reported drinking three or more servings of energy-dense beverages. The mean consumption of food groups in serves per day varied from 0.88 (SD = 1.36) for

pulses and legumes to 6.25 (SD = 7.22) for energy-dense snacks. In general, girls had more nutritious dietary intakes than boys. The Indian adolescents reported poor food consumption patterns, and these findings highlight the need to design effective nutrition promotion strategies to encourage healthy eating in adolescence and targeting food supply and avalibility. Fast food consumption. According to Keshari and Mishra (2016) [6] High consumption of fast food has been reported in school going children and this is quite substantial in college and university students - in spite of the fact that a significant proportion of population are aware about adverse consequences of fast food consumption. Children of pregnant and lactating women eating fast foods are more prone to obesity. High fat and high sugar diet leads to change in fetal brain reward pathway altering food preferences. Fast food consumption is rising in India across all income categories and this is contributing significantly to rising trend of non-communicable diseases (NCDs) in this country. Singh and Nayak (2015) [13] reveal that adolescents frequently are consumed unhealthy and junk foods (chocolates, snacks, soft drinks, etc.). As per the adolescents' perception, the intake of foods regularly on time comes under the most important healthy eating habit. By Moreno *et al*. (2010) Lifestyle plays an important role in the development of obesity during childhood and adolescence. We provide up-to-date information about the relationship between obesity and food intake and dietary patterns in adolescents. Scientific evidence is increasing about the dietary factors associated with this relationship, specifically a low meal frequency, skipping breakfast, and a high consumption of sugar sweetened beverages.

Nutritional significance of multigrain flour

Indrani *et al*. (2010) [3] conducted the Effect of replacement of wheat flour with 5, 10, 15 and 20 per cent multigrain mix (MGM) prepared by combining soya bean, oats, fenugreek seeds, flaxseed and sesame seeds on rheological and bread-making characteristics of wheat flour was studied. Use of increasing amount of MGM from 0 to 20 per cent increased farinograph water absorption, caused disruption of protein matrix, decreased volume and increased crumb firmness value showing adverse effect of MGM on the volume and texture of bread. Addition of combination of additives to wheat flour with 15 per cent MGM brought about significant improvement in the dough strength and overall quality of the bread. The protein, fat and dietary fiber contents of bread with 15 per cent MGM was 1.5, 5.0 and 2.5 times higher than the control. The results showed that bread with improved quality characteristics and perceptible taste of multi-grains could be produced by adding 15 per cent MGM and combination of additives. According to Kocherla *et al*., (2012) [7] prepared extruded snacks using flour blends of corn, rice and egg albumin powder or Cheese powder at ratios of 35-50: 35-50: 5-30 respectively and moisture content was adjusted to 17-20 and showed that incorporation of egg albumin powder and cheese powder can be effectively used to produce RTE extruded snacks by extrusion cooking. Such ingredients naturally improved the nutrient content of the snacks. The protein content in the RTE extruded snack was found to be doubled on addition of egg albumin powder, and to a substantial extent by cheese powder. A 100 g serving would likely contribute 20 per cent – 40per cent of the RDA for protein providing an effective solution for people consuming protein deficient diets.

Conclusion

From the above reviews it can be said that skipping of meals and increased consumption of junk foods were some of the unhealthy eating habits depicted among the adolescent girls. The studies revealed that girls were consuming excess of energy, protein and fat but inadequate amounts of micronutrients like iron, calcium, and beta– carotene through junk foods which may be one of the causes of nutritional deficiency in adolescents. Therefore, it is necessary to promote healthy eating habits among adolescents and educate them about negative effects of junk food so as to prevent nutritional deficiency in adolescents. Interventions to create and promote nutritionally superior foods like pizza base, burgers etc prepared using multigrain with well balanced amount and good quality of calcium and iron.

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