

Nutrient Adequacy of Adult Males Belonging to Rural Areas of Ludhiana District (Punjab)

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Abstract

A total of 147 rural adult males from two villages of Ludhiana district, Punjab belonging to low (LIG), medium (MIG) and high income groups (HIG) were surveyed for their nutrient adequacy. The daily intake of cereals, pulses, green leafy vegetables, roots and tubers, other vegetables, fruits, sugars and fats and oils was less than suggested intake, while that of milk and milk products was higher. Diets of the individuals were deficient in energy, α -carotene, riboflavin, niacin and vitamin B₁₂ but contained higher amount of thiamine and calcium compared to ICMR's recommendation. Intake of protein, fat, folic acid and iron was higher in MIG and HIG than RDA as compared to LIG. Income significantly ($P < 0.05$) affected fat, α -carotene, folic acid, calcium and iron consumption, whereas energy, protein, carbohydrate, thiamine, riboflavin, ascorbic acid intake of individuals was significantly ($P < 0.05$) more in HIG as compared to LIG.

Keywords: Adult Males; Income Groups; Nutrient Adequacy.

Introduction

India, especially the state of Punjab, is also passing through a transitional phase of socio-economic development which has the potential of altering the nutritional status of population groups [13]. Majority (70%) of people lives in rural areas and depends directly or indirectly on agriculture for their living. Usually, there are limited number of markets and less diversity and availability of food items in rural areas that affect food security of rural households. Low and stagnating incomes among the poor lead to low purchasing power which remains a serious constraint to household food and nutritional security, even if food production picks up as a result of interventions in agriculture and creation of rural infrastructure [2].

Punjab being a rich state of India should be at an advantage of higher food intake by individuals. The green revolution in Punjab has improved the economic status of farming families. Males in Indian

society are thought to be an advantageous group. Males being earning members of the family are given special share during food distribution. Surveys conducted by National Nutrition monitoring Bureau do not include the data for the state of Punjab. Hence, the present survey was carried to find nutrient adequacy of adult males belonging to various socio-economic groups in rural areas of Ludhiana district of Punjab.

Materials and Methods

Two villages namely Bharonwal Kalan and Bhatha Dhua of central plain zone of Punjab in Ludhiana district were selected for the present investigation. Before collecting actual data, ten families were pre-surveyed, which were excluded from a total of 90 families which were selected randomly. Based on various social and economic factors, the screening of families was done in three categories with a mean socio economic scores of d" 30 (low-), 31-50 (middle) and e" 50 (high), respectively. The social scores comprised of caste, family structure, family education and organizational membership, whereas economic scores included farm and household assets, ownership of media, transport, electricity, household items and distinctive features.

All the adult males above 18 years of age were surveyed for their food intake. The data regarding food intake was recorded during the months of June-

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August using 24 hour recall method for 3 consecutive days using standardized containers. The dietary nutrient intake was calculated from food intake using Dietcal software given by [8]. The average nutrient intakes were compared with recommended dietary allowances (RDA) for Indians [6] and per cent adequacy of various foods and nutrients were calculated. Mean and standard deviation for various parameters were computed. Analysis of variance was applied to assess the difference in food and nutrient intake of rural adult males belonging to three income groups i.e. low (LIG), middle (MIG) and high (HIG) income groups.

Food Intake

The data in Table 1 shows the food intake of the subjects of LIG, MIG and HIG. Main cereal consumed was wheat and maize as *chapattis*. The intake of cereals in three income groups ranged between 150-515, 177-475 and 133-540 g/d with the mean values of 288, 334 and 300 g/d, respectively. The cereal intake of MIG was significantly ($p < 0.05$) higher than LIG and HIG. The cereal intake was inadequate in all groups, the percent adequacy being 64, 74 and 67 per cent among LIG, MIG and HIG, respectively. Intake of pulses and legumes in three income groups ranged between 5-72, 0-123 and 0-150 g with the mean values of 27, 49 and 65 g/d respectively. The percent adequacy of pulses and legumes in three income groups was 30, 54 and 72 per cent, respectively indicating a statistically significant ($P < 0.05$) difference among the three income groups. However, the intake of cereals and pulses in all the income groups were below than the suggested intake of 450 and 90 g, respectively [7].

The mean daily consumption of green leafy vegetables in three income groups was 0.3, 26 and 83 g, respectively indicating a severe inadequate intake of green leafy vegetables. The intake of roots and tubers by the subjects in three income groups ranged between 10-63, 17-158 and 20-168 g with the mean values of 35, 46 and 59 g, respectively with the per cent adequacy of 17, 23 and 29. The intake of leafy vegetables and roots and tubers increased with income and the consumption was statistically significant ($P < 0.05$) different in all the three income groups.

The mean daily intake of other vegetables by the subjects was 79, 74 and 58 g in LIG, MIG and HIG, respectively, the per cent adequacy being 39, 37 and 29 per cent. A non-significant difference regarding consumption of other vegetables was observed among the three income groups. The mean daily intake of fruits by LIG, MIG and HIG adult males was 12, 18 and 18 g, respectively. Consumption of all vegetables and fruits was found to be inadequate in the target population of three income groups when compared to suggested intake [7]. However, statistically significant ($P < 0.05$) difference was found in LIG vs MIG and LIG vs HIG among the intake of fruits. Diet was grossly inadequate in roots and tubers, other vegetables and fruits which were similar to present study [12]. Lower intake of all the vegetables among males of Northern Sweden was compared to the present study [11].

The daily consumption of milk and milk products in three income groups ranged between 116-850, 150-1117 and 400-1300 g with the mean values of 314, 601 and 876 g and with percent adequacy of 105, 200 and 292 per cent, respectively. The consumption of milk products significantly ($P < 0.05$) increased with an increase in income. Average milk consumption by all individuals in all groups was significantly higher than ICMR's suggested intake. Similar findings were reported [5]. Contradiction to the present study, the intake of milk was less among lower income group [14].

The sugar consumption was found to be highest among HIG (21g) followed by MIG (20 g) and LIG (11 g), the per cent adequacy being 38, 67 and 71 per cent, respectively. A statistically significant ($P < 0.05$) difference was found in the sugar intake among LIG vs MIG and LIG vs HIG. A statistically significant ($P < 0.05$) difference was found in fats and oils consumption among all the three income groups. The mean consumption being was 9, 18 and 22 g with a per cent adequacy being was 29, 60 and 72 %, respectively.

The mean daily intake of cereals, pulses, green leafy vegetables, root and tubers, other vegetables, fruits, milk and milk products, fats and oils and sugars was 332.0, 40.5, 34.4, 93.7, 193.6, 107.3, 573.2, 27.9 and 24.7 g, among rural males of Punjab, India respectively [1].

Table 1: Average daily food intake (g) of the subjects (Mean±SE)

| Food groups | LIG (n=44) | MIG (n=46) | HIG (n=57) | Suggested intake* |
|------------------------|------------------------|------------------------|-------------------------|-------------------|
| Cereals | 288 ^c ±11.2 | 334 ^a ±12.2 | 300 ^{bc} ±13.0 | 450 |
| Pulses and legumes | 27 ^c ±2.6 | 49 ^b ±4.0 | 65 ^a ±5.2 | 90 |
| Leafy vegetables | 0.3 ^c ±0.3 | 26 ^b ±7.0 | 83 ^a ±11.0 | 100 |
| Roots and tubers | 35 ^c ±2.3 | 46 ^b ±3.7 | 59 ^a ±4.3 | 200 |
| Other vegetables | 79 ^a ±9.6 | 74 ^a ±13.1 | 58 ^a ±6.2 | 200 |
| Fruits | 12 ^b ±2.4 | 18 ^a ±1.5 | 18 ^a ±1.7 | 100 |
| Milk and milk products | 314 ^c ±26.0 | 601 ^b ±41.0 | 876 ^a ±39.0 | 300 |
| Sugars | 11 ^b ±0.6 | 20 ^a ±1.2 | 21 ^a ±1.0 | 30 |
| Fats and oils | 9 ^c ±0.6 | 18 ^b ±1.3 | 22 ^a ±1.0 | 30 |

DMRT test has been applied

Figures followed with different superscripts are significantly different (P<0.05) *[7]

Table 2: Per cent adequacy of food intake of the subjects

| Food groups | LIG (n=44) | MIG (n=46) | HIG (n=57) |
|----------------------------|------------|------------|------------|
| Cereals (g) | 64.0 | 74.0 | 67.0 |
| Pulses and legumes (g) | 30.0 | 54.0 | 72.0 |
| Leafy vegetables (g) | 0.3 | 26.0 | 83.0 |
| Roots and tubers (g) | 17.0 | 23.0 | 29.0 |
| Other vegetables (g) | 39.0 | 37.0 | 29.0 |
| Fruits (g) | 12.0 | 18.0 | 18.0 |
| Milk and milk products (g) | 105.0 | 200.0 | 292.0 |
| Sugars (g) | 38.0 | 67.0 | 71.0 |
| Fats and oils (g) | 29.0 | 60.0 | 72.0 |

Nutrient Intake

The data regarding daily nutrient intake of the subjects has been presented in Table 3. A statistically significant (P<0.05) difference was observed in daily energy and protein consumption among the males of LIG, MIG and HIG. All the groups had lower energy intake than the recommended dietary allowances, the per cent adequacy being 55, 74 and 76 in LIG, MIG and HIG, respectively. The per cent adequacy of protein intake was slightly lower (89) among men belonging to LIG, whereas it was higher in men belonging to MIG and HIG (129 and 134 respectively). Average daily consumption of fat was 29 g with an adequacy of 95 per cent among the men of LIG families. However, the values were quite high being 53 and 59 g with a per cent adequacy of 176 and 198 among men belonging to MIG and HIG, respectively. A statistically non-significant difference was observed in carbohydrate intake among the subjects of MIG and HIG, whereas the difference was significant when intake by men of LIG was compared to MIG and HIG. Mean energy intakes of male respectively were 1916.0 ± 368.5 k cal. 50.3 ± 8.2 g protein, 32.4 ± 6.0 g fat which was comparable to the subjects of LIG in present study [10].

A highly significant lower intake of β -carotene was observed in LIG, MIG and HIG men, the values being 103, 863 and 2008 μ g, respectively against the ICMR recommendations of 4800 mcg [6]. It might be due to a significantly lower intake of leafy vegetables and fruits among all the three income groups. The intake of thiamine among the subjects of all the income groups was higher and that of riboflavin and niacin was lower as compared to RDA [6]. The higher intake of thiamine might be due to the reason that consumption of whole grain cereals and unrefined flour was more than 50% among families, the adequacy being 121, 143 and 143 per cent in LIG, MIG and HIG, respectively (Table 4). The average daily intake of Vitamin B₁₂ was found to be less among all the three income groups as compared to RDA's of 1.0 μ g [6], the values being 0.3, 0.6 and 0.7 μ g among LIG, MIG and HIG, respectively which might be due to non inclusion of non-vegetarian foods in their daily diets. The data revealed that the mean daily intake of folic acid in LIG was 160 μ g which was less than recommendations of 200 μ g [6]. It might be due to inadequate intake of whole grain cereals, pulses, green leafy vegetables and roots & tubers among men belonging to LIG, whereas the intake was found to be higher than RDA's among MIG and HIG men (210

and 260, respectively). The data regarding mean daily intake of vitamin C (Table 3) by the subjects of all the three income groups revealed that intake increased with an increase in the income. The values are 27, 33 and 57 mg in LIG, MIG and HIG men, respectively. When compared to RDA's (40 mg), the intake was found to be inadequate among LIG and MIG; which might be due to inadequate intake of citrus fruits and green leafy vegetables but intake was higher among men of HIG families. The per cent adequacy in three income groups was 67, 82 and 144 per cent, respectively. A statistically significant ($P<0.05$) difference in consumption of ascorbic acid, vitamin B₁₂ and folic acid was observed in all the three income groups. The deficient intake of fruits and vegetables among men resulted in deficient intake of B-carotene, ascorbic acid and folic acid [9].

Due to significantly lower intake of green leafy vegetables, very low intake of iron was observed among men belonging to LIG (7 mg) and MIG (12 mg)

when compared to recommended value of 17 mg per day [6], whereas an intake of 17 mg was observed among the men of HIG which was comparable to the recommended intake. The per cent adequacies are 39, 71 and 101, respectively (Table 4) among the three income groups. A statistically significant ($P<0.05$) difference was observed regarding the consumption of calcium among men in all the three income groups. The mean calcium intake was found to be adequate in LIG (600 mg), whereas intake was higher among MIG (1081 mg) and HIG (1278 mg) as compared to recommended intake of 600 mg [6]. The per cent adequacy of calcium in LIG, MIG and HIG men was 100, 180 and 213, respectively.

Similar to present findings, the average daily intake of energy, niacin and iron was inadequate while protein, riboflavin and calcium intake was adequate among men of rural areas of Punjab [1]. More than half of the participants did not meet RDA's for energy, vitamin C, thiamine, riboflavin and calcium [4].

Table 3: Average daily nutrient intake of the subjects (Mean±SE)

| Food groups | LIG (n=44) | MIG (n=46) | HIG (n=57) | RDA* |
|------------------------------|--------------------------|-------------------------|--------------------------|------|
| Energy (Kcal) | 1430 ^b ±50.2 | 2013 ^a ±57.6 | 2082 ^a ±59.4 | 2730 |
| Protein (g) | 54 ^b ±2.0 | 77 ^a ±2.1 | 81 ^a ±2.0 | 60 |
| Fats (g) | 29 ^c ±1.1 | 53 ^b ±2.2 | 59 ^a ±1.4 | 30 |
| Carbohydrates (g) | 239 ^b ±9.0 | 307 ^a ±9.0 | 306 ^a ±10.0 | - |
| B-carotene (µg) | 103 ^c ±31.6 | 863 ^b ±170.3 | 2008 ^a ±286.0 | 4800 |
| Thiamine (mg) | 1.7 ^b ±0.1 | 2.0 ^a ±0.1 | 2.0 ^a ±0.1 | 1.4 |
| Folic acid (µg) | 160 ^c ±6.1 | 210 ^b ±8.1 | 260 ^a ±12.2 | 200 |
| Vitamin B ₁₂ (µg) | 0.3 ^c ±0.02 | 0.6 ^b ±0.03 | 0.7 ^a ±0.03 | 1.0 |
| Ascorbic acid (mg) | 27.0 ^b ±4.3 | 33 ^b ±3.5 | 57 ^a ±4.4 | 40 |
| Iron (mg) | 7 ^c ±0.6 | 12 ^b ±1.0 | 17 ^a ±1.0 | 17 |
| Calcium (mg) | 600.0 ^c ±29.0 | 1081 ^b ±57.4 | 1278 ^a ±39.4 | 600 |

DMRT test has been applied

Figures followed with different superscripts are significantly different ($P<0.05$) * [6]

Table 4: Per cent adequacy of nutrient intake of the subjects

| Food groups | LIG (n=44) | MIG (n=46) | HIG (n=57) |
|------------------------------|------------|------------|------------|
| Energy (Kcal) | 55.0 | 74.0 | 76.0 |
| Protein (g) | 89.0 | 129.0 | 134.0 |
| Fats (g) | 95.0 | 176.0 | 198.0 |
| B-carotene (µg) | 2.0 | 18.0 | 42.0 |
| Thiamine (mg) | 121.0 | 143.0 | 143.0 |
| Folic acid (µg) | 80.0 | 105.0 | 130.0 |
| Vitamin B ₁₂ (µg) | 30.0 | 60.0 | 70.0 |
| Ascorbic acid (mg) | 67.0 | 82.0 | 144.0 |
| Iron (mg) | 39.0 | 71.0 | 101.0 |
| Calcium (mg) | 100.0 | 180.0 | 213.0 |

Per cent contribution to total energy intake

The data regarding per cent contribution of energy by various nutrients has been presented in Table 5. Carbohydrate contributed 67, 61 and 59 per cent of total energy intake in the subjects of LIG and MIG men and HIG, respectively, which was within the range of 65-70 per cent as given by ICMR indicating that as the income increased, the per cent contribution to total energy intake by the carbohydrate decreased.

However, no difference was observed regarding per cent contribution of protein to total energy intake. An increase in income resulted in the increase in per cent contribution of energy from fat. Percent contribution of fats to total daily energy was 32.5%, which was undesirable and higher as compared to present study [1]. Total fat intake (74 g/day) by urban men of Ludhiana District was significantly more than that of men in rural areas [3].

Table 5: Per cent contribution of carbohydrates, protein and fats to the total energy intake

| Nutrient | LIG (n=44) | MIG (n=46) | HIG (n=57) |
|--------------|------------|------------|------------|
| Carbohydrate | 67.0 | 61.0 | 59.0 |
| Protein | 15.0 | 15.4 | 15.5 |
| Total fat | 18.0 | 24.0 | 26.0 |

Conclusion

It was concluded from the present study that diet consumed by male subjects was higher in milk and milk products and was inadequate in cereals, pulses, leafy vegetables, roots and tubers, other vegetables, fruits, sugars and fats and oils. However, intake of green leafy vegetables, fruits and other vegetables was inadequate leading to deficiency of vitamins and minerals like iron and vitamin B₁₂. So there is an urgent need to educate about the importance of balanced diet and promote the consumption of foods like cereals, pulses, green leafy vegetables, roots and tubers, sugar and fruits etc. in their diet to improve their nutritional status.

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