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What's **INSIDE**

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An Eye Opener

Protein deficiency in Indians

A survey reported that 9 out of 10 Indians have diet deficient in protein. 91% of vegetarian and 85% of non vegeterian have a diet deficient in protein. Protein deficiency was reported irrespective of gender and socioeconomic group. [1]

Role of Proteins in Adults

Proteins in diet

Dietary proteins should supply the nine dietary indispensable amino acids (IAA) in proper proportions and in adequate quantity to allow synthesis of the tissue proteins in the body (Table 1).

- The Estimated Average Requirement (EAR) for protein in the adult is 0.66 g/kg/day and the safe requirement is 0.83 g/kg/day.[2]

Table 1: Dietary indispensable amino acid (IAA) requirements of adult humans[2]

	2007 FAO/WHO/UNU*		1985 FAO/WHO/UNU*	
Amino acid	mg/kg/d	mg/g protein	mg/kg/d	mg/g protein
Isoleucine	20	30	10	15
Leucine	39	59	14	21
Valine	26	39	10	15
Lysine	30	45	12	18
Methionine + Cysteine	15	22	13	20
Phenylalanine + Tyrosine	25	38	14	21
Threonine	15	23	7	11
Tryptophan	4	6	3.5	5
Histidine	10	15	8-12	15
Total IAA	184	277	93.5	141

IAA: Dietary indispensable amino acid

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Protein deficiency: a growing burden

Protein deficiency indicates a lack of body protein or a relative deficiency of one or several essential amino acids. Thus, protein deficiency is synonymous with a negative nitrogen balance. The deficiency can result from a protein-deficient diet or other events, such as diseases.[3]

Protein can be found in relatively high concentrations in the following foods:[5]

- Meats, poultry, and fish
- Legumes (dry beans and peas)
- Tofu
- Eggs
- Nuts and seeds
- Milk and milk products (cheese and yogurt)
- Grains, some vegetables and some fruits (provide only small amounts of protein relative to other sources)

Protein-energy malnutrition (PEM) is a problem affecting children and adults throughout the world. Indian diets derive almost 60 % of their protein from cereals with relatively low digestibility and quality.[2] Protein deficiency affects the transport of many essential nutrients that are normally bound to protein carriers in the plasma. An imbalance between dietary protein and energy intake is associated with relatively high insulin and low plasma cortisol levels, which impede mobilization of muscle protein from the peripheral to the visceral compartments.[1,4]

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Recommendations for protein intake

It is recommended that 10-35% of daily energy intake should come from protein. The Academy of Nutrition and Dietetics recommends that **the average individual should consume 0.8 grams of protein per kilogram or 0.35 grams per pound of body weight per day for general health.**[5]

Role of proteins in adolescence

Nutrient requirements including those for energy, protein, and others increase in adolescence to support adequate growth and development.[6] The rapid physical changes of adolescence have a direct influence on a person's nutritional needs. Demand for nutrients is relatively high during adolescence years as compared to adults due to rapid growth and development.[7] The need for essential amino acids is critical during adolescence to support the pubertal growth spurt.[6] Protein plays important role during adolescence:[8]

- **Muscle mass gain,**
- **Provides better athletic performance,**
- **Improve physical performance of the body**
- **Immunity improvement**

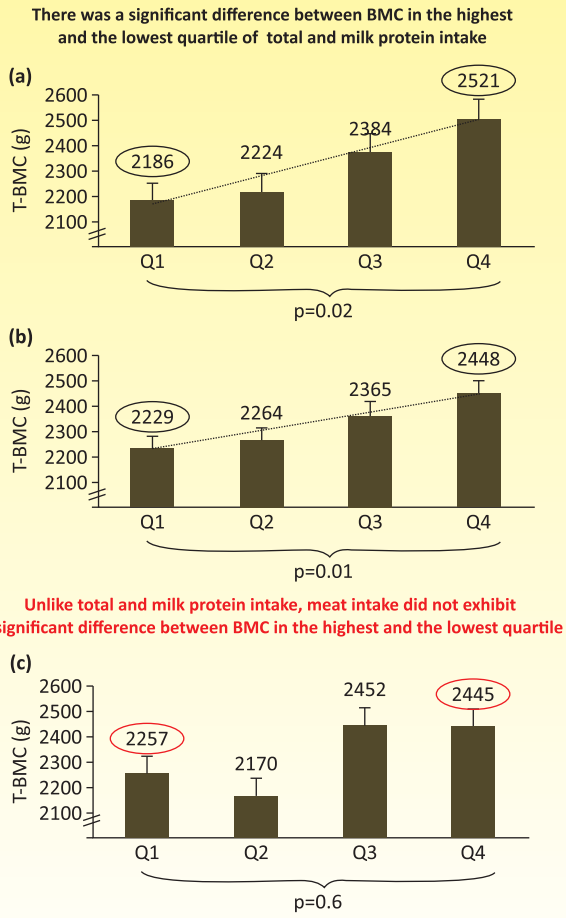
Table 2: Recommended daily allowances (RDA) for protein in adolescence[9]

Groups	Protein (g/day) 13 - 15 Years	Protein (g/day) 16 - 17 Years
Boys	54.3	61.5
Girls	51.9	55.5

Budek AZ et al (2007)[10], conducted a study in adolescence girls and boys to evaluate hypothesis that total protein intake is positively associated with bone mass, and that milk and meat protein intake is differently associated with bone mass in adolescents.

- In this cross-sectional study, 17-year-old girls (n=63) and boys (n=46) participated. Dietary intake (7-day food record), bone mineral content (BMC) and bone

Figure 1: Distribution of whole-body bone mineral content (T-BMC) between quartiles (Q) of total (a), milk (b) and meat (c) protein intake.



*Q1 and Q4 represents the lowest and the highest protein intake, respectively.

area (BA), serum markers for bone turnover and serum IGF-I were measured.

- Results of the study concluded that the mean total protein intake (~1.2 g/kg) was modestly higher than recommended.
- Total and milk (~0.3 g/kg) protein intake was positively associated with size-adjusted BMC (P≤0.05), but meat protein intake (~0.4 g/kg) was not positively associated with BMC (P=0.6)
- There was significant and positive association between milk protein intake and size-adjusted BMC (P≤0.01)

The study concludes that protein intake i.e. milk-derived protein may be beneficial for bone mineralisation during adolescence.[10]

Role of protein in weight loss and obesity management

Diet high in protein improves satiety compared to other macronutrients. The satiety effect of protein is partly mediated by a synergistic effect of the satiety hormones GLP-1 and PYY released from the small intestine. During weight loss, higher protein diets preserve lean body tissue, the major determinant of resting and 24-h energy expenditure, which in turn prevents an excessive reduction in energy expenditure.[11]

The DioGenes study, a pan-European, randomized, controlled multicenter trial that investigated dietary means of preventing weight (re)gain following weight loss in free-living conditions, examined the importance of a slight increase in dietary protein content, reduction in carbohydrate and the importance of choosing low (LGI) vs. high GI (HGI) carbohydrates for weight control in 932 obese families.

Results

The mean 8-week weight loss with the Low-calorie diet (LCD) was 11.0 kg.

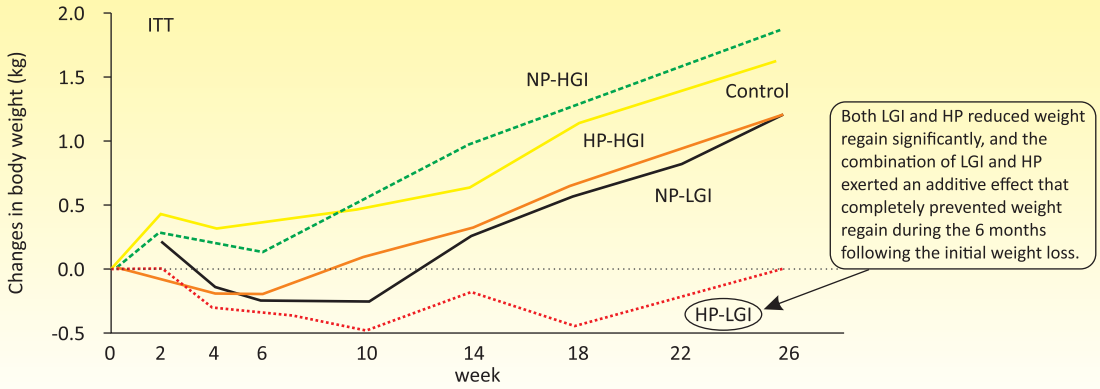
- Higher protein diets were more acceptable than the normal protein diets, whereas no differences were found between the HGI vs LGI diets (Table 3).

Table 3: Mean acceptability scores of different subsets of intervention diets (ITT analysis)

	Normal Protein (n=253)	Higher Protein (n=275)	p-value
Satisfied	62.7 (60.4, 65.1)	65.7 (63.4, 67.9)	0.09
Convenient	58.7 (56.4, 61.0)	63.3 (61.1, 65.5)	0.004
Easy	49.9 (47.4, 52.5)	55.4 (53.0, 57.8)	0.002
Motivated	69.6 (67.3, 71.8)	72.6 (70.5, 74.8)	0.05
Enjoyable	56.9 (54.5, 59.3)	62.0 (59.7, 64.3)	0.002

- Weight regain was 0.93 kg less in the HP groups than in the NP group (P = 0.003), and 0.95 kg less in the LGI

Figure 2: Change in body weight with different dietary interventions



groups than in the HGI groups (P = 0.003, Figure 2).

- The HP diets were more likely to produce an additional 5% weight loss after randomisation than were the NP diets (OR, 1.92; P = 0.03), and the LGI diets were more likely to result in an additional 5% weight loss than were the HGI diets (OR, 2.54; P = 0.003).
- The weight loss reduced high-sensitivity C-reactive protein by nearly 40% (−1.15 mg/l; P<0.001); significant reduction were also observed in prevalence of MS (33.9% vs. 15.9%; P<0.001) and MS score (−1.48 vs. − 4.45; P<0.001).

An additive effect was observed on body weight regulation, without any weight regain by slight increase in dietary protein and corresponding decrease in carbohydrate with lowering of the glycemic index of the diet by 8 units.[11]

Role of protein in Pregnancy

The nutritional status of women prior to and during pregnancy plays a key role in fetal growth and development.[12,13] Undernourished pregnant women may be at increased risk for adverse pregnancy outcomes, including giving birth to low-birth-weight and small for gestational age infants.[13]

It is important to maintain optimum protein levels in pregnancy.

- **Balanced protein energy supplementation (containing up to 20% of energy as protein) given to pregnant women with energy or protein deficit appears to improve fetal growth, increase birth weight (by 95-324 g) and height (by 4.6-6.1mm), and decrease the percentage of low birth weight (by 6%).**
- Supplements with excess protein (>20% of energy as protein) provided to women with a diet already containing adequate protein might conversely impair fetal growth.[12]

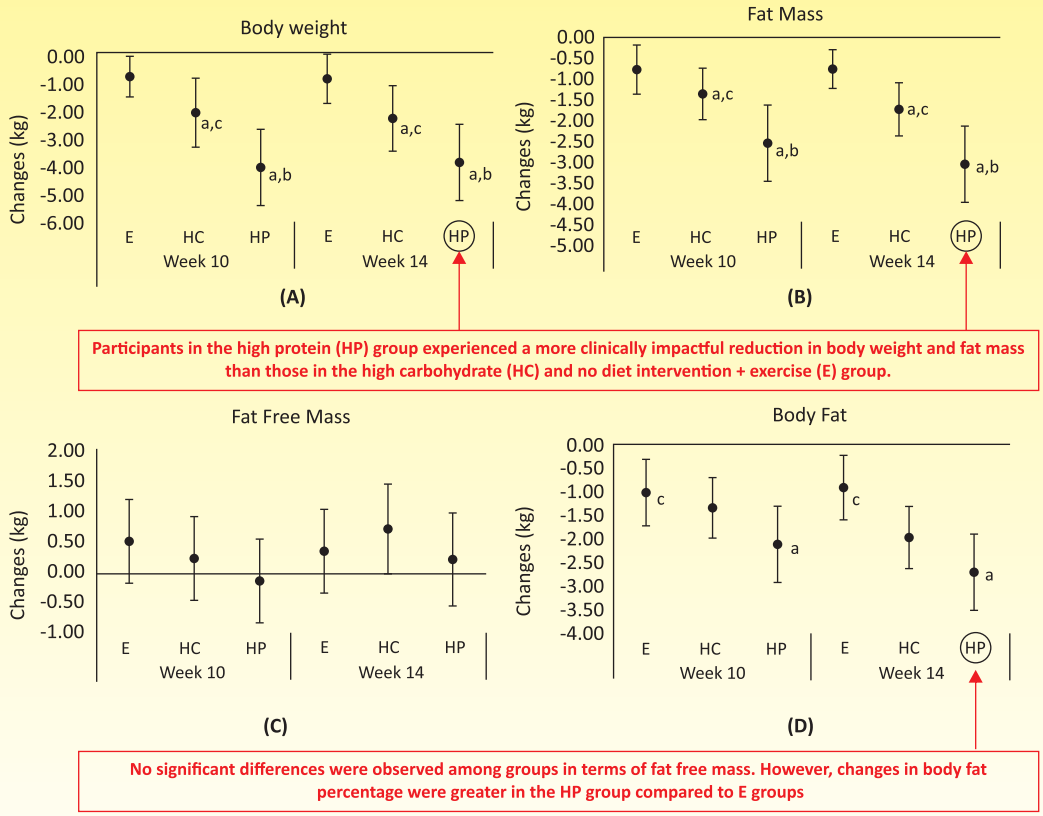
Role of protein in elderly

Weight gain and obesity can cause a range of medical co-morbidities including diabetes, arthritis, pulmonary abnormalities, urinary incontinence, cataracts, and certain types of cancer. Moreover, obesity is also known to complicate the aging process, especially when associated with sarcopenic obesity.[14]

A study examining whether adherence to a higher protein diet while participating in a resistance-based exercise program promoted more favorable changes in body composition, markers of health, and/or functional capacity in older females in comparison to following a traditional higher carbohydrate diet or exercise training alone with no diet intervention found that:

- After 14 weeks, **participants in the HP group experienced significantly greater reductions in weight (p = 0.003), fat mass (p < 0.001), and body fat percentage** (p = 0.002; Figure 3).
- Significant differences were observed in leptin (p = 0.001) and adiponectin (p = 0.001) levels.
- All groups experienced significant improvements in muscular strength, muscular endurance, aerobic capacity, markers of balance and functional capacity, and several markers of health.

Figure 3: Changes in (A) Body weight, (B) fat mass, (C) fat-free mass, (D) body fat after intervention



Mean changes with 95% confidence intervals (CIs) from baseline in body composition variables for the exercise only (E), higher carbohydrate (HC), and higher protein (HP) groups. Means and 95% CIs completely below baseline represent a significant change over time. a = p < 0.05 difference from E; b = p < 0.05 difference from HC; c = p < 0.05 difference from HP.

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