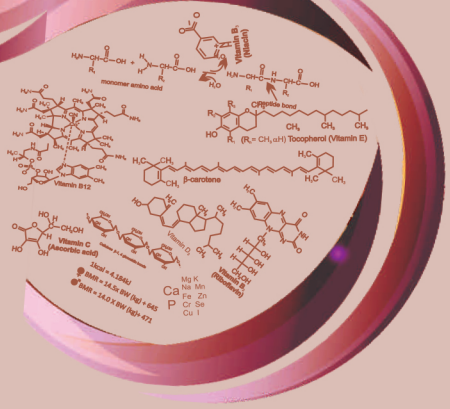
Short Report of NUTRIENT REQUIREMENTS FOR INDIANS

RECOMMENDED DIETARY ALLOWANCES



ESTIMATED AVERAGE REQUIREMENTS

A REPORT OF THE EXPERT GROUP, 2020

ICMR-National Institute of Nutrition
Indian Council of Medical Research
Department of Health Research
Ministry of Health and Family Welfare
Government of India

Short Report of

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Indian Council of Medical Research
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ICMR-National Institute of Nutrition
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This RDA book short report defines nutrient distribution and requirements for normal individuals of all age groups of Indian population. A fundamental part of defining nutrient requirements is that the requirement is not the same in all people. It can vary considerably in healthy individuals. In order to derive a single value for the requirement, two features of this distribution of requirements are used. First, the median of this distribution is called the estimated average requirement (EAR). The EAR is the nutrient requirement used in public health nutrition, to evaluate the nutrient intakes of a population. Second, the 97.5th percentile of the distribution is called the Recommended Daily Allowance. The RDA is for healthy individuals and may be prescribed to satisfy the nutritional needs of specific nutrients in a specific life stage and gender group and ensures that there is a very small risk of the nutrient intake being inadequate. With the RDA, there is also the risk of excess intake, since each individual may not actually require that much. There is no need to consume higher doses on regular basis or for prolonged period without supervision. Therefore, readers of this book will note that there has been a shift from the previous edition, and two distinct nutrient requirements are now presented: the EAR and RDA. In addition, nutrients are also toxic when ingested at very high doses. This has resulted in the definition of the Tolerable Upper Limit of Intake (TUL). Intake of nutrients more than the TUL invites the risk of toxicity. It cannot be overstated that when assessing the health and nutritional status of the population, EAR is recommended as the unit of requirement.

Diet planning for populations

The diet for a population should be planned based on the EAR, and not the RDA of the nutrients. In a healthy population, with EAR, it is expected that prevalence of risk of inadequacy of nutrient intake would be 50% to match the intake distribution with the requirement distribution. The target of 50% risk of inadequacy is not prescriptive. It is sometimes desirable to bring in an element of safety, to account for any uncertainties around the EAR value (for example, due to factors that might increase the EAR, like an adverse environment or specific reasons for increased nutrient losses). Some consideration should be given to inflating the EAR for specific populations, and in doing so, it is likely that a nominal prevalence of risk of inadequacy of 30 or 40% could be targeted.

Diet planning for an individual

The diet planning for an individual aims to minimize the risk of inadequate intake of nutrient. One way to achieve this with a high level of certainty is to use the RDA as a guide. If meeting the RDA for a particular nutrient is difficult, the recommendation should ensure that the intake of that nutrient is between EAR and RDA. However, careful monitoring and follow-up are required for an individual whose intake is at or close to the RDA, such that symptoms of excess intake are assessed, and nutrient intake modified accordingly.

Assessing the risk of excess intake

The proportion of individuals at risk of excess nutrient intake in a population is assessed with the help of the TUL. Here, adverse health effects are possible from excess nutrient intake. The method to assess the risk of excess intake is similar to the cut-point approach, except that the TUL value is used, and the proportion to the right side of the TUL is considered as those at risk of an excess intake.

Humans need a wide range of nutrients to lead a healthy and active life. The required nutrients for different physiological groups can only be derived from a well-balanced diet and the nutrients are also absorbed more efficiently. Components of the diet must be chosen judiciously to provide all the nutrients to meet the requirements in proper proportions for the different physiological activities. The amount of each nutrient needed for an individual based on age, gender, body weight and physiological status is given in this short version. The frame work followed, the details of methodologies used to arrive at requirements of each nutrient are given in the full version of the book "Nutrient requirements for Indians-RDA, EAR book 2020".

REFERENCE BODY WEIGHT

Earlier Expert Committee on RDA (1989) used data generated on body weights and heights of well-to-do Indian children and adolescents, which was based only on a segment of Indian population and did not have an all India character. The reference weights for man and woman were 60 kg and 50 kg respectively.

The previous committee (2010) has considered data on anthropometry collected by NNMB/ India nutrition profile from 10 states of India for computing reference body weights. Since the data collected was from rural India, the committee decided to use the 95th centile values of heights and weights for a given age and gender which will be representative of well-nourished population of India. For computing RDA for children (0-3y), WHO growth standards for infants and preschool children were considered.

The present committee (2020) has considered the more recent, nationally representative datasets such as the National Nutrition Monitoring Bureau (NNMB, 2015-16), National Family Health Survey - 4 (NFHS-4, 2015-16), the World Health Organization (WHO, 2006-07) and the Indian Academy of Paediatrics (IAP 2015) to derive acceptable reference body weight values through the lifespan. The 95th centile of height was taken, for adult male and female, as it represents full growth potential. The reference body weight for male and female were derived from the median weight of male and female population whose height and BMI (18.5-22.9kg/m^2) were in the proposed range.

The definition for reference Indian adult man and woman were modified with regard to age (19-39y instead of 18-29y), and a body weight of 65 kg and 55 kg respectively were fixed for a normal BMI.

ENERGY

The factorial approach used for adults in computation of energy requirement by the earlier committee is retained. Additionally, the current committee has used Doubly Labelled Water (DLW) and heart rate monitoring methods for computation of total energy expenditure for deriving requirements as done in the previous recommendations.

The earlier committee used 5% reduction in BMR from FAO/WHO/ UNU equations and higher PAL values for deriving energy requirements for adults. While the present committee reviewed the literature on BMR and PAL based on the evidence, a reduction in the BMR to 10% and 9% for males and females respectively with simultaneous reduction in PAL values is proposed. The current committee uses the lower ranges of PAL reported by

FAO/WHO/UNU, 2004 report. The energy requirement for the population >60y of age has been provided as requirements decrease due to a reduction in BMR. Because of change in body weight, a proportionate increase in requirement has been suggested in pregnancy. As data on pregnant Indian women is unavailable the present committee has retained the additional energy requirement proposed by ICMR 2010. In the case of lactation, the average energy utilization for milk production based on actual observation is taken into consideration and an increase has been suggested. No changes from the previous recommendations have been made in the additional requirements of lactating women.

The earlier committee had adopted the FAO/WHO/UNU, 2004 equations for deriving the energy requirement of infants and children since there was an absence of Indian data and also used the body weights reported in the above-mentioned document. However, the present committee has used the WHO child growth standard data for body weight of children and re-analyzed the energy requirement for infants and children. With the use of these values, a minor difference in the requirements of infants and children up to 6y of age, of 1-2 kcal/kg body weight/d is reported when compared to the previous recommendations. Otherwise the requirement for children above 6 years of age remains the same as suggested by the previous committee. Both the previous and the present committee, have emphasized the importance of physical activity among children. It is recommended that children should be engaged in moderate physical activity. Among children of 13-17 years, there was an increase in requirements on account of using same quadratic equation generated from FAO/ WHO/ UNU 2004 to which a higher PAL value was used based on a higher physical activity level of Indian children of that age group in ICMR, 2010. The same has been retained by the present committee.

PROTEIN

The present Expert Group of the ICMR adopted the following approaches to define the protein requirements for Indians of different age groups. A median obligatory nitrogen loss of 48 mg/kg (WHO, 2007) has been used to compute mean (0.66 g/kg/day) and safe protein requirements (0.83 g/kg/day) for healthy Indian adults. Considering high quality protein sources as the premise for defining requirements, the present committee has removed the protein digestibility corrections (PDCAAS) applied on safe intakes for all age groups.

A newer protein quality index, digestible indispensable amino acid score (DIAAS), which is based on true ileal digestibility of individual amino acids has been introduced in the current document. Data on true ileal amino acid digestibility values of both high and low quality proteins in Indian adults and

children, obtained using dual tracer method has been included in the present document.

Diets for sedentary and moderate active man and woman, and pregnant woman have been modified based on the revised energy requirements. The nutritive values of each food are taken from recently published food composition tables (IFCT, 2017). In addition, the protein contents of each food group have been corrected for true fecal digestibility values (WHO, 2007) to ensure safe protein intakes. The cereal-legume-milk composition of the diet has been improved to 3:1:2.5 as compared to the earlier 11:1:3 (ICMR 2010).

FATS AND OILS

The FAO/WHO recommendations on fat were taken into account for (i) total fat, individual fatty acids and health promoting non-glyceride components (ii) sources of dietary fats in Indians (iii) availability of fat and (iv) energy requirements set on the basis of age, physiological status and physical activity. The recommendations are directed towards meeting the requirements for optimal foetal and infant growth and development, maternal health and combating chronic energy deficiency (children and adults) and Diet Related Non-Communicable Diseases (DR-NCD) in adults. There was a conscious effort to provide physical activity-based recommendations. Consequently, the upper limit of visible fat intake for sedentary, moderate and heavy activity has been set at 25, 30 and 40 g/d for adult man and 20, 25 and 30 g/d for adult women as against the single level recommended earlier. To achieve intakes of individual fatty acids in Indians that are consistent with FAO/WHO 2008 recommendations the types of visible fats and correct combination of vegetable oils to be used for different food applications has been emphasized.

DIETARY FIBER

For the first time committee considered recommendations for fiber based on energy intake and the level of about 30 g/2000 kcal has been considered as safe intake.

CARBOHYDRATES

The quantity and quality of CHO are important to maintain good health and have been indicated substantially to impact nutrition related chronic disorders/non-communicable diseases (NCDs). For the first time recommendations have been made for the dietary intakes of carbohydrates. A minimum intake of 100 - 130g of carbohydrates/day should be ensured for ages 1 year and above. This level is the minimum required for brain glucose utilization.

MINERALS

The present committee has done extensive deliberations on recommendations for minerals like calcium, phosphorus, zinc, selenium and iodine and have been included as separate chapters in the new document.

***Calcium and Phosphorus*:** Calcium requirement proposed as RDA for adult man and adult woman is 1000 mg/d and is 1.5 times the value proposed by earlier expert group i.e., 600 mg/d for adult man and woman. For pregnant women, the calcium values proposed is similar to the value proposed for adult woman i.e., 1000 mg/d. For lactating woman, an additional allowance of 200 mg is added to EAR of 800 mg and a total of 1000 mg has been set as EAR and adding 10% CV, the RDA is set at 1200 mg. For post-menopausal women the recommendation is 1200 mg/d.

The recommended values for phosphorus for all age groups except for infants are 1:1 ratio with calcium. For infants, it is 1.5 times the value recommended for calcium.

Magnesium: Data were available on intakes, faecal loss, urinary loss and balance (intake – faecal loss- urinary loss) in different geographical states. There was a biphasic relationship between intake and urinary excretion, where it appears that the urinary loss is more or less constant around 135 mg/day in the range of intakes below 600 mg/day, which steadily increases to a mean of 191 mg in intakes above 800 mg/day. To remove the impact of variable absorption in these studies, the intake that was actually absorbed (intake - faecal loss) was used in a regression against the balance (intake – faecal loss- urinary loss); the intercept of this relation gave the absorbed intake at which a zero Mg balance was obtained. This equation was 'absorbed intake (mg/day)' = 0.67 * 'balance (mg/day)' + 147; therefore, the absorbed Mg intake required for a zero balance was 147 mg/day. This value was then adjusted for intestinal absorption, which was calculated to be about 36% from various studies and was rounded off to 40%. Thus the dietary intake of Mg for a zero balance after accounting for absorption was calculated to be 147/0.4 = 368 mg/day. This was rounded to 370 mg/day and was considered to be the average requirement (EAR) for adult males and was extrapolated, based on body weight, to other physiological groups.

Sodium and Potassium: Specific recommendations have been made on adequate intakes for sodium and potassium for adult man and woman based on WHO (2012) recommendation. With regard to sodium due to emerging concerns on prevalence of hypertension a safe intake of 2000 mg/day which amounts to 5 g/day of salt is recommended; while an intake of 3500 mg/day is recommended for potassium. The desirable sodium:potassium ratio in mmol from the diet was fixed at 1:1.

***Iron*:** The daily physiological requirement for iron was calculated by summing up all the iron losses from the body, which was then adjusted to iron bioavailability to obtain the EAR. For women of reproductive age group, the distribution of iron requirements was obtained by convolution of the probability distribution of daily basal and menstrual iron losses. The present committee considered 8% absorption for men, women and adolescents, and 6% for children. And based on the available data, increased absorption of 12% was considered for calculating EAR and RDA for pregnant women, which is in conformity with the absorption data generated in India. The committee recommended that the density of ascorbic acid in the daily diet should be at least 20 mg/ 1000 kcal for improved iron absorption.

***Zinc*:** The EAR and RDA were derived by factorial approach that considered losses in 1. Sweat 2. Urine 3. Seminal fluid 4. Menstrual losses 5. Endogenous intestinal zinc excretion 6. Additional requirements during pregnancy, lactation and growth, all of which are summed and adjusted for bioavailability to derive estimated average requirements. Based on studies conducted in India and elsewhere 23% bioavailability was assumed across the all age/ gender groups. And, considering the high phytic acid content of cereal/pulse/millet based diets in India, a conservative estimate of 25% and 30% bioavailability were considered for pregnant and lactating women, respectively. Computation of zinc requirements was done considering all the average losses of zinc through bodily fluids and additional requirements due to growth (tissue and blood volume expansion), lactation, pregnancy needs. The absolute requirements were then adjusted for bioavailability to derive EAR. From the EAR, RDA for adult man and woman is set at 17 and 13 mg/day respectively and specific recommendations for all physiological groups are included in this report.

Copper, Chromium and Manganese: The RDA for Cu, Cr and Mn have been considered separately in view of their importance and a brief account of relevant information on the nutritional significance and suggested adequate dietary intakes for adults are provided in this report.

***Selenium*:** The present Committee recommended 40 µg/day as adequate intake of selenium.

***Iodine*:** Based on accumulation of radioiodine in the thyroid gland in turnover studies observed in euthyroid individuals, and positive iodine balance studies in adults with normal thyroid function[23], the requirements of iodine were estimated and considering a CV of 20% due to variations in experimental design, the RDA was calculated. Accordingly, the EAR for Indian Adults ≥19y (Men and Women) is set at 95µg/day and the RDA at 133µg/day, which is rounded off to 140µg/day, considering a CV of 20%.

VITAMINS

Water Soluble Vitamins

Thiamine B_1: The requirement of thiamine was estimated by plotting erythrocyte transketolase activity coefficient (ETK-AC) values versus dietary thiamine intake data obtained from healthy human adult population studies. Average requirement (EAR) was calculated from regression analysis. The acceptable cut-off used for ETK-AC is 1.15. The EAR of thiamine is estimated as 1.2 based on the ETK-AC cut-off and with assumed normal distribution for adult men the corresponding RDA is set at 1.4. Similarly, EAR of thiamine is 1.1 and corresponding RDA is 1.4 for adult women. Additional allowances of thiamine was made for pregnant and lactating women based on the additional calorie allowances of current recommendations.

Riboflavin B_2: The requirement of riboflavin was estimated by plotting erythrocyte glutathione reductase activity coefficient (EGR-AC) values versus dietary riboflavin intake data obtained from human studies. Average requirement (EAR) was calculated from regression analysis. The acceptable cut off used for EGR-AC is 1.2. Based on the cut off and intake data, the EAR for riboflavin is arrived at 1.6 and corresponding RDA is 2.0 for adult men. Similarly, EAR of riboflavin is 1.6 and corresponding RDA is 1.9 for adult women. Additional allowances of riboflavin was made for pregnant and lactating women based on the additional calorie allowances of current recommendations.

Niacin B_3: Diet surveys from India show that the average intake of niacin is around 10 mg daily. Based on the EAR of 5.6 mg/1000 Kcals for adults, which was derived by urinary metabolite studies of niacin, 10% CV (20% 2SD) was added to EAR to derive the RDA. Individual requirements were computed based on energy requirements. The EAR (RDA) was set at 12 mg/day (14 mg/day) and 9 mg/day (11 mg/day) for sedentary men and women respectively.

Pantothenic acid B_5: Based on intakes of apparently healthy people an AI of 5 mg per day for adults and pregnant women is proposed, with an additional allowance of 2 mg/day for lactating women accounting for losses through breast milk. The AI for children and adolescents is set at 4 & 5 mg/ day.

Pyridoxine B_6: The functional activity of erythrocyte aspartate aminotransferase (EAST) which requires PLP as a cofactor, was used for estimating the estimated average requirement (EAR) of Vitamin B6, and regression analysis was performed by plotting EAST-AC values versus dietary vitamin B_6 intake data obtained from human studies for both men and women. The required

dietary intake of B_6 was 1.6 mg/day with an EAST-AC cut off 1.8. Considering 1.6 mg as the requirement (EAR) of B_6/day, the RDA was calculated by considering CV of 10%, and RDA of 1.9 mg/day was arrived for adult men and women. The EAR and RDA thus derived for adults based on EAST-AC calculation was extrapolated for other physiological and age groups based on the energy requirements.

Biotin B_7: For adults and pregnant women an AI of 40 µg/day is proposed; with an additional allowance of 5 µg/day for lactating women to compensate for losses through breast milk. The recommended AIs for age groups 1–3, 4–10 and adolescents the AI proposed are 20, 25 and 35µg/day, respectively.

Folate B_9: The present committee revised the requirements of folate based on some recent Indian data, which includes dietary intakes, and plasma folate and homocysteine levels as functional marker. Based on the available data on serum/plasma folate and the dietary folate intake among healthy Indian adults, the EAR was derived. The requirement to maintain normal plasma folate levels of $\geq$10 nmol/L was considered and the RDA was calculated as 300 µg for adult men and 220 µg for adult women. Additional requirements of 300 µg/day and 100 µg/day were added respectively during pregnancy and lactation for meeting the factorial extra needs.

***Cyanocobalamin B_{12}*:** Factorial approach was used for deriving Vitamin B_{12} require-ments and the mean daily excretion used in the previous ICMR 2010 recommendation, of 1 µg/d, was considered. Using mean bioavailability of 50% based on stable isotope kinetic studies done at St. John's Research Institute, an EAR of 2 µg/d for adults is recommended. Distribution of the requirement was calculated based on distribution of bioavailability, and the 97.5th percentile of this distribution was used to define RDA of 2.2 µg/d. For young children, as no specific data is available, an intake of 1 µg/day is suggested keeping in view of low prevalence of vitamin B_{12} deficiency observed in 1-4y old children in the Comprehensive National Nutrition Survey (CNNS); and for school children and adolescents the adult requirement is suggested. For pregnant women, since studies have shown that the human foetus accumulates 0.1 µg/d and is required for maintaining adequate foetal growth, an additional EAR of 0.2 µg B_{12}/d is suggested adjusting for 50% absorption. With regards to lactating women the B_{12} requirement was arrived by considering the B_{12} content of milk and the output in first 6 months, which is around 0.4 µg/d. Adjusting for absorption an additional EAR of 0.8 µg/d is suggested.

***Ascorbic acid (Vitamin C)**:* The committee has evaluated all the available evidence on this subject and estimated the EAR and RDA based on replacement levels of body pool saturation of 900 mg, for a metabolic loss of

2.9% per day, compensated for the urinary loss (25% per day), taking absorption efficiency in Indian foods also into consideration. The EAR was set at 65mg per day and RDA at 80 mg per day for adult males. Due importance of ascorbic acid in a meal to improve iron absorption among Indians on a vegetarian diet is also emphasized while making the recommendations.

Fat Soluble Vitamins

***Vitamin A*:** The present Committee revised the carotene conversion ratio to account for tissue conversion, based on recent knowledge, and a general conversion factor of 6:1 is recommended for all carotenoids except β-cryptoxanthine and α-carotene where a CF of 12:1 is recommended. Vitamin A requirements (RDA) for all groups were also revised upwards using factorial computation method.

Considering the recent studies on vitamin A status carried out in India, an upward revision of retinol has been recommended. To ensure adequacy at least in vulnerable groups like pregnant and lactating women, the Committee has recommended that a minimum of 50% RE be drawn from animal sources.

***Vitamin D*:** The Committee after considering the available evidence of vitamin D status decided to increase recommended intakes for vitamin D compared to earlier revision of 2010. Accordingly, an EAR of 400 IU and an RDA of 600 IU is recommended while emphasizing the importance of outdoor physical activity as a means of achieving adequate vitamin D status in a tropical country like India. The increased requirement is attributed to progressive decrease in sunlight exposure necessitating dietary sources to meet the requirement.

***Vitamin E & K*:** The requirement of alpha tocopherol suggested is 0.8 mg/g of dietary essential fatty acids. This roughly works out to 7.5 - 10 mg tocopherol per day, similar to FAO/ WHO recommendations depending on the edible oil used. The recommendation for vitamin K is 55µg for adults and is in tune with recommendations of FAO/WHO.

WATER

The requirement of water was estimated based on a factorial approach, utilising the existing literature of the fluid guidelines, with corrections made for body mass and energy requirement to suit the Indian context. The water required from beverages for adult man ranges from 32-58 ml per kg body mass and for woman, it ranges from 27-52 ml per kg body mass, with sedentary working group at lower end and the heavy working group at higher end of the range. For children, the requirement is greater than 60 ml per kg

body mass and for adolescent boys it ranges from 47-60 ml per kg body mass, while, for girls it is 39-49 ml per kg body mass. For pregnant woman, based on the working intensity, the water required from beverages ranges from 2.1 to 3.2 litres per day. For old-age, irrespective of gender, the present consensus for water requirement from beverages is 33 ml per kg body mass for sedentary activity and 38 ml per kg body mass for moderate activity.

ANTIOXIDANTS

Realising the importance of dietary antioxidants, the committee deliberated on the information on consumption of antioxidants and recommended a minimum of 500 g/day of fruits and vegetables to obtain sufficient amounts of antioxidant nutrients such as beta-carotene, vitamin C and certain non-nutrients like polyphenols and flavonoids which may protect against chronic diseases. This should be complemented with sufficient amount of vegetable oil so as to obtain vitamin E.

RDA FOR ELDERLY

The recommended estimated energy requirements (EER) based on BMR and physical activity levels, for the sedentary elderly man and woman weighing 65kg and 55kg are 1700 Kcal and 1500 Kcal respectively. The energy requirements at various body weights are given in chapter 4 on energy requirements. Although energy is decreased, recommendations for other nutrients except vitamin D and calcium are maintained similar to adults to ensure nutrient density. Hence the elderly are encouraged to consume nutrient-dense foods such as nuts, oilseed, fruits, vegetables, legumes and flesh foods to meet the daily requirements of vitamins and minerals to prevent multiple micronutrient malnutrition, and are encouraged to maintain physical activity.

SUMMARY OF EAR FOR INDIANS -ICMR- NIN, 2020

Age Group	Category of work	Body Wt (kg)	Energy (**) (Kcal/ d)	Protein (g/d)	Cal cium (mg/ d)	Magnes ium (mg /d)	Iron (mg/ d)	Zinc (mg/ d)	Iodine (µg/ day)	Thiamine (mg/ d)	Ribo flavin (mg/ d)	Niacin (mg/d)	Vit B6 (mg/ d)	Folate (µg /d)	Vit B12 (µg/ d)	Vit C (mg/ d)	Vit A (µg/ d)	Vit D (IU/d)
Men	Sedentary	65	2110	43.0	800	370	11	14.1	95	1.2	1.6	12	1.6	250	2	65	460	400
	Moderate		2710							1.5	2.1	15	2.1					
	Heavy		3470							1.9	2.7	19	2.6					
Women	Sedentary	55	1660	36.0	800	310	15	11.0	95	1.1	1.6	9	1.6	180	2	55	390	400
	Moderate		2130							1.4	2.0	12	1.6					
	Heavy		2720							1.8	2.6	15	2.1					
	Pregnant woman	55 + 10	+ 350	+7.6 (2^{nd} trimester) +17.6 (3^{rd} trimester)	800	370	21	12.0	160	1.6	2.3	+2	1.9	480	+0.2	+10	406	400
	Lactation 0-6m	-	+600	+13.6	1000	335	16	11.8	200	1.7	2.5	+4	+0.22	280	+0.8	+40	720	400
	7-12m		+520	+10.6							2.4		+0.16					
Infants	0-6 m*	5.8	530	7.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6-12m	8.5	680	9.0	-	-	2	2.1	-	-	-	-	0.5	71	1	-	170	-
Children	1-3y	12.9	1110	10.0	400	73	6	2.8	65	0.6	0.8	6	0.8	97	1	24	180	400
	4-6y	18.3	1360	13.0	450	104	8	3.7	65	0.8	1.1	8	1.0	111	2	27	240	
	7-9 y	25.3	1700	19.0	500	144	10	4.9	65	1.0	1.3	10	1.3	142	2	36	290	
Boys	10-12y	34.9	2220	27.0	650	199	12	7.0	70	1.3	1.7	12	1.7	180	2	45	360	400
Girls	10-12y	36.4	2060	27.0	650	207	16	7.1	70	1.2	1.6	12	1.6	186	2	44	370	400
Boys	13-15y	50.5	2860	36.0	800	287	15	11.9	100	1.6	2.2	16	2.2	238	2	60	430	400
Girls	13-15y	49.6	2400	35.0	800	282	17	10.7	100	1.3	1.9	13	1.8	204	2	55	420	400
Boys	16-18y	64.4	3320	45.0	850	367	18	14.7	100	1.9	2.5	19	2.5	286	2	70	480	400
Girls	16-18y	55.7	2500	37.0	850	317	18	11.8	100	1.4	1.9	14	1.9	223	2	57	400	400

* Adequate Intake (AI)

** There is no RDA for energy, the EAR for energy is equivalent to the Estimated Energy Requirement (EER)
Note: For adequate intake of Biotin and Pantothenic acid, refer to the text on summary of recommendations.

SUMMARY OF RDA FOR INDIANS - ICMR- NIN, 2020

Age Group	Category of work	Body Wt	Protein	Dietary Fiber*	Calcium	Magnesium	Iron	Zinc	Iodine	Thiamine	Riboflavin	Niacin	Vit B6	Folate	Vit B12	Vit C	Vit A	Vit D
		(kg)	(g/d)	(g/d)	(mg/d)	(mg/d)	(mg/ d)	(mg/d)	(µg/day)	(mg/d)	(mg/d)	(mg/d)	(mg/d)	(µg/d)	(µg/d)	(mg/d)	(µg/d)	(IU/ d)
Men	Sedentary	65	54.0	30	1000	440	19	17	140	1.4	2.0	14	1.9	300	2.2	80	1000	600
	Moderate			40						1.8	2.5	18	2.4					
	Heavy			50						2.3	3.2	23	3.1					
Women	Sedentary	55	46.0	25	1000	370	29	13.2	140	1.4	1.9	11	1.9	220	2.2	65	840	600
	Moderate			30						1.7	2.4	14	1.9					
	Heavy			40						2.2	3.1	18	2.4					
	Pregnant woman	55 + 10	+9.5 (2nd trimester) +22.0 (3rd trimester)	-	1000	440	27	14.5	220	2.0	2.7	+2	2.3	570	+0.25	+15	900	600
	Lactation 0-6m		+17.0	-	1200	400	23	14.1	280	2.1	3.0	+5	+0.26	330	+1.0	+50	950	600
	7-12m		+13.0								2.9		+0.17					
Infants	0-6 m*	5.8	8.0	-	300	30	-	-	100	0.2	0.4	2	0.1	25	1.2	20	350	400
	6-12m	8.5	10.5	-	300	75	3	2.5	130	0.4	0.6	5	0.6	85	1.2	30	350	400
Children	1-3y	12.9	12.5	15	500	90	8	3.3	90	0.7	1.1	7	0.9	120	1.2	30	390	600
	4-6y	18.3	16.0	20	550	125	11	4.5	90	0.9	1.3	9	1.2	135	2.2	35	510	
	7-9 y	25.3	23.0	26	650	175	15	5.9	90	1.1	1.6	11	1.5	170	2.2	45	630	
Boys	10-12y	34.9	32.0	33	850	240	16	8.5	100	1.5	2.1	15	2.0	220	2.2	55	770	600
Girls	10-12y	36.4	33.0	30	850	250	28	8.5	100	1.4	1.9	14	1.9	225	2.2	50	790	600
Boys	13-15y	50.5	45.0	43	1000	345	22	14.3	140	1.9	2.7	19	2.6	285	2.2	70	930	600
Girls	13-15y	49.6	43.0	36	1000	340	30	12.8	140	1.6	2.2	16	2.2	245	2.2	65	890	600
Boys	16-18y	64.4	55.0	50	1050	440	26	17.6	140	2.2	3.1	22	3.0	340	2.2	85	1000	600
Girls	16-18y	55.7	46.0	38	1050	380	32	14.2	140	1.7	2.3	17	2.3	270	2.2	70	860	600

* Adequate Intake (AI)

Note: For adequate intake of Biotin and Pantothenic acid, refer to the text on summary of recommendations.

RECOMMENDATIONS FOR DIETARY FAT INTAKE IN INDIANS

Age/Gender/ physiological groups	Physical activity	Minimum level of Total fat (% E)	Minimum level* of Fat from foods other than visible fats % E	Visible fat	
				%E	g/day
Adult Men	Sedentary	20	10	10	25
	Moderate				30
	Heavy				40
Adult Women	Sedentary	20	10	10	20
	Moderate				25
	Heavy				30
	Pregnant women	20	10	10	30
	Lactating women				30
Infants	0 – 6 m	40-60	Human milk		
	6 - 24 m	35	10[c]	25	25
Children	3-6 y	25	10	15	25
	7-9 y				30
Boys	10 – 12 y				35
	13 – 15 y				45
	16 – 18 y				50
Girls	10 – 12 y				35
	13 – 15 y				40
	16 – 18 y				35

* if higher than 10%E, visible fat requirement proportionately reduces

DAILY NUTRIENT RECOMMENDATIONS FOR THE ELDERLY IN INDIA ICMR- NIN, 2020

Nutrients		Energy (Kcal)	Dietary Fibre	Protein (g)	Vit-A (µg)	Thiamin B_1 (mg)	Riboflavin B_2 (mg)	Niacin (mg)	Vit-C (mg)	Vit-B_6 (mg)	Folate (µg)	Vit-B_{12} (µg)	Vit-D (IU)	Calcium (mg)	Magnesium (mg)	Iron (mg)	Zinc (mg)	Iodine (µg)
Men ≥60 Yrs	EAR	1700	-	43.0	460	1.2	1.6	12	65	1.6	250	2.0	400	1000	370	11	14	95
	RDA	-	30	54.0	1000	1.4	2.0	14	80	1.9	300	2.2	800	1200	440	19	17	140
Women ≥60 Yrs	EAR	1500	-	36.3	390	1.1	1.6	9	55	1.6	180	2.0	400	1000	310	11	11	95
	RDA	-	25	46.0	840	1.4	1.9	11	65	1.9	200	2.2	800	1200	370	19	13.2	140

ACCEPTABLE MACRONUTRIENT DISTRIBUTION RANGE (AMDR) BY AGE AND PHYSIOLOGICAL GROUPS AS PERCENT OF ENERGY (%E)

Age group / Nutrients	1-2 years	3-18 years	Adults	Pregnant and lactating women
Protein (PE ratio)*	5-15	5-15	5-15	5-15
Total Fat	30-40	25-35	15-35	20-35
n-6 PUFA#	4-10	4-10	4-10	4-10
n-3-PUFA	0.5-1	0.5-1	0.5-1	0.5-1
Carbohydrate	40-60	45-65	45-65	45-65

*Depends on protein quality and total energy intake

n-6 to n-3 ratio should be between 5-10:1

Note: For good health, adults should consume minimum of 100 to 130g of carbohydrates and atleast 20g fats (food sources)

SUMMARY OF RECOMMENDED INTAKES FOR OTHER MINERALS AND TRACE ELEMENTS IN ADULTS

SNo.	Minerals/ Trace Element	Recommended intake (per day)
1	Phosphorous	1000 mg
2	Sodium	2000 mg
3	Potassium	3500 mg
4	Copper	1.7 mg
5	Manganese	4 mg
6	Chromium	50 µg
7	Selenium	40 µg

TOLERABLE UPPER LIMIT (TUL) FOR NUTRIENTS- ICMR- NIN, 2020

Age Group	Category of work	Protein (PE ratio)	Calcium (mg/d)	Magnesium* (mg/d)	Iron (mg/d)	Zinc (mg/d)	Iodine (µg/day)	Niacin (mg/d)	Vit. B6 (mg/d)	Folate (µg/d)	Vit. C (mg/d)	Vit. A (µg/d)	Vit. D (IU/d)
Men	Sedentary	<40%	2500	350	45	40	1100	35	100	1000	2000	3000	4000
	Moderate												
	Heavy												
Women	Sedentary	<40%	2500	350	45	40	1100			1000	2000	3000	
	Moderate												
	Heavy												
	Pregnant woman	<30%	2500	350	45	40	1100	-	-	1000	2000	3000	4000
	Lactation 0-6m 7-12m	<40%	2500	350	45	40	1100	-	-	1000	2000	3000	4000
Infants	0-6 m	<15%	–	-	40	4	-	-	-	-	-	600	1000
	6-12m	<15%	–	-	40	5	-	-	-	-	-	600	1500
Children	1-3y	<15%	1500	65	40	7	200	-	-	-	350	600	2500
	4-6y	<15%	2500	110	40	12	300			-	550	900	3000
	7-9 y	<15%	2500	110	40	12	400			300	800	900	3000
Boys	10-12y	<15%	3000	350	40	23	600	-	-	600-800	1050	1700	4000
Girls	10-12y	<15%	3000	350	40	23	600	-	-	600-800	1300	1700	4000
Boys	13-15y	<15%	3000	350	45	34	900	-	-	600-800	1550	2800	4000
Girls	13-15y	<15%	3000	350	45	34	900	-	-	600-800	1800	2800	4000
Boys	16-18y	<15%	3000	350	45	34	1100	-	-	600-800	1950	2800	4000
Girls	16-18y	<15%	3000	350	45	34	1100	-	-	600-800	2000	2800	4000

The TUL is the maximum level of habitual intake from all sources of a nutrient or related substance judged to be unlikely to lead to adverse health effects in humans
*Note: For Magnesium the TUL values are only for non-dietary pharmacological doses.

Balanced diet for moderate active man with nutrient content values

Food Composition	Amount (g /day)	Nutrient	Vegetarian diet	Non-vegetarian diet	EAR	RDA
Cereals & Millets	360	Energy (kcal)	2690	2650	2710	-
		Protein (g)	87.5	81.7	43	54
Pulses (Legumes)/ flesh foods[1]	120	Visible fat (g)	35	35	30	30
Green leafy vegetables	100	Calcium (mg)	1084	1054	800	1000
Other Vegetables	200	Iron (mg)	33.3	31.1	11	19.0
Roots & Tubers (excluding potatoes)	100	Zinc (mg)	16.3	15.9	14.1	17
Fruits	150	Magnesium (mg)	968	891	370	440
Milk	300	Vitamin A (µg)*	1802	1796	460	1000
Fats & Oils	30	β carotene	9842	9779	2760	6000
Oil seeds & Nuts (gingely seeds & Pea nuts)	30	Thiamine (mg)	2.0	1.9	1.5	1.8
		Riboflavin (mg)	1.9	1.9	2.1	2.5
		Niacin (mg)	19	20.0	15	18
		Vitamin B_6 (mg)	2.4	2.4	2.1	2.4
		Vitamin C (mg)	209	209	65	80
		Total Folates (µg)	559	491	250	300
		Vitamin B_{12} (µg)	1.5	2.4	2.0	2.2

Note: Total protein from the above diet = 88g, Digestible protein = 71g, PDCAAS = 84%
[1]Pulses can be replaced with animal foods (egg, meat, fish and chicken) for non-vegetarians.
* Retinol derived from β carotene from diet was also added to the total Vitamin A.
For cereals and millets, it is recommended to consume 50% as whole grains.

Balanced diet for sedentary man with nutrient content values

Food Composition	Amount (g /day)	Nutrient	Vegetarian diet	Non-vegetarian diet	EAR	RDA
Cereals & Millets	275	Energy (kcal)	2130	2084	2110	-
		Protein (g)	67.2	69.1	43	54
Pulses (Legumes)/ flesh foods [1]	80	Visible fat (g)	25	25	25	25
Green leafy vegetables	100	Calcium (mg)	968	958	800	1000
Other Vegetables	200	Iron (mg)	27.4	26.3	11.0	19.0
Roots & Tubers (excluding potatoes)	100	Zinc (mg)	13.5	13.2	14.1	17.0
Fruits	150	Magnesium (mg)	798	762	370	440
Milk	300	Vitamin A (µg)*	1768	1765	460	1000
Fats & Oils	25	B-carotene (µg)	9638	9605	2760	6000
Oil seeds& Nuts (gingely seeds & Pea nuts)	30	Thiamine (mg)	1.7	1.6	1.2	1.4
Spices	10	Riboflavin (mg)	1.6	1.6	1.6	2.0
		Niacin (mg)	15.6	16.0	12	14
		Vitamin B_6 (mg)	2.0	2.0	1.6	1.9
		Vitamin C (mg)			65	80
		Total Folates (µg)	483	450	250	300
		Vitamin B_{12} (µg)	1.5	2.0	2.0	2.2

Note: Total protein from the above diet = 71g, Digestible protein = 58g, PDCAAS = 85%
[1]Pulses can be replaced with animal foods (egg, meat, fish and chicken) for non-vegetarians.
* Retinol derived from β carotene from diet was also added to the total Vitamin A.
For cereals and millets, it is recommended to consume 50% as whole grains.

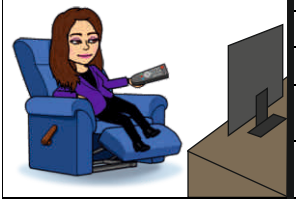
Balanced diet for moderate active woman with nutrient content values

Food Composition	Amount (g /day)	Nutrient	Vegetarian diet	Non-vegetarian diet	EAR	RDA
Cereals & Millets	300	Energy (kcal)	2135	2084	2130	-
		Protein (g)	74.2	73.3	36.0	46.0
Pulses (Legumes)/ flesh foods [1]	90	Visible fat (g)	20	20	25	20
Green leafy vegetables	100	Calcium (mg)	999	989	800	1000
Other Vegetables	200	Iron (mg)	29.0	27.9	15.0	29.0
Roots & Tubers (excluding potatoes)	100	Zinc (mg)	14.0	13.6	11.0	13.2
Fruits	150	Magnesium (mg)	841	806	310	370
Milk	300	Vitamin A (µg) *	1804	1741	390	840
Fats & Oils	20	B-carotene (µg)	9489	9457	-	-
Oil seeds& Nuts (gingely seeds & Pea nuts)	30	Thiamine (mg)	1.75	1.70	1.4	1.7
spices	10	Riboflavin (mg)	1.65	1.64	2.0	2.4
		Niacin (mg)	16.3	16.8	12	14
		Vitamin B_6 (mg)	1.96	1.97	1.6	1.9
		Vitamin C (mg)	187	187	55	65
		Total Folates (µg)	191	459	180	220
		Vitamin B_{12} (µg)	1.5	2.0	2	2.2

Note: Total protein from the above diet = 76g, Digestible protein = 62g, PDCAAS = 85%

[1]Pulses can be replaced with animal foods (egg, meat, fish and chicken) for non-vegetarians.
* Retinol derived from β carotene from diet was also added to the total Vitamin A.
For cereals and millets, it is recommended to consume 50% as whole grains.

Balanced diet for sedentary woman with nutrient content values

Food Composition	Amount (g /day)	Nutrient	Vegetarian diet	Non-vegetarian diet	EAR	RDA
Cereals & Millets	200	Energy (kcal)	1690	1650	1660	-
		Protein (g)	58.2	57.4	36.0	46.0
Pulses (Legumes)[1]	60	Visible fat (g)	15	15	20	20
Green leafy vegetables	100	Calcium (mg)	905	895	800	1000
Other Vegeta bles	200	Iron (mg)	23.8	22.8	15.0	29.0
Roots & Tubers (excluding potatoes)	100	Zinc (mg)	11.0	10.5	11.0	13.2
Fruits	150	Magnesium (mg)	684	649	310	370
Milk	300	Vitamin A (µg) *	1730	1727	390	840
Fats & Oils	15	B-carotene (µg)	9412	9380	-	-
Oil seeds& Nuts (gingely seeds & Pea nuts)	30	Thiamine (mg)	1.36	1.30	1.1	1.4
spices	10	Riboflavin (mg)	1.5	1.48	1.6	1.9
		Niacin (mg)	13.0	13.5	9.0	11
		Vitamin B_6 (mg)	1.7	1.7	1.6	1.9
		Vitamin C (mg)	187	187	55	65
		Total Folates (µg)	426	395	180	220
		Vitamin B_{12} (µg)	1.5	2.0	2	2.2

Note: Total protein from the above diet = 60g, Digestible protein = 50g, PDCAAS = 87%
[1]Pulses can be replaced with animal foods (egg, meat, fish and chicken) for non-vegetarians.
* Retinol derived from β carotene from diet was also added to the total Vitamin A.
For cereals and millets, it is recommended to consume 50% as whole grains.

Balanced diet for pregnant woman with nutrient content values

Food Composition	Amount (g /day)	Nutrient	Vegetarian diet	Non-vegetarian diet	EAR	RDA
Cereals & Millets	325	Energy (kcal)	2060	2040	2480	-
		Protein (g)	71.7	71.6	54	68
Pulses (Legumes)[1]	90	Visible fat (g)	15	15	30	30
Green leafy vegetables	100	Calcium (mg)	980	970	800	1000
Other Vegetables	200	Iron (mg)	27.2	26.0	21	27
Roots & Tubers (excluding potatoes)	100	Zinc (mg)	13.1	12.8	12.0	14.5
Fruits	150	Magnesium (mg)	786	747	370	440
Milk	400	Vitamin A (µg) *	1821	1818	406	900
Fats & Oils	25	B-carotene (µg)	9634	9597	-	-
Oil seeds& Nuts (gingely seeds & Pea nuts)	40	Thiamine (mg)	1.64	1.60	1.6	2.0
Spices	10	Riboflavin (mg)	1.8	1.84	2.3	2.7
		Niacin (mg)	16.0	16.7	14	16
		Vitamin B_6 (mg)	2.0	2.0	1.9	2.3
		Vitamin C (mg)	210	210	65	80
		Total Folates (µg)	484	447	480	570
		Vitamin B_{12} (µg)	2.0	2.4	2.2	2.5

Note: Total protein from the above diet = 78.8g, Digestible protein = 70g, PDCAAS = 88%
[1]Pulses can be replaced with animal foods (egg, meat, fish and chicken) for non-vegetarians.
* Retinol derived from β carotene from diet was also added to the total Vitamin A.
For cereals and millets, it is recommended to consume 50% as whole grains.

Key micronutrients in different food groups

(All values are for 100g edible portion)

Micro-nutrients	Cereals[a]	Pulses[b]	Leafy Vegetables[c]	Other vegetables	Roots & Tubers[d]	Fruits[e]	Milk (Buffalo)[f]	Milk (Cow)[f]	Egg	Chicken	Mutton	Beef	Fish	Liver (Sheep, Goat, Lamb)
Iron (mg)	3.00	5	8.5	2.12	0.6	0.56	0.2	0.2	1.82	1.5	1.3	2.2	0.6	6.3
Zinc (mg)	2.16	2.1	0.2	0.3	0.3	0.11	0.4	0.3	1.2	1.7	3	4.6	0.6	3.6
Vitamin A (µg)	2.43	8.6	259.1	22.4	70.0	32.36	49.8	58.3	198	21.4	9	15.5	5.6	6690
Riboflavin (mg)	0.15	0.14	0.1	0.07	0.0	0.01	0.13	0.11	0.2	0.09	0.16	0.12	0.03	0.36
Dietary folate (µg)	24.03	127.7	16.7	24.4	31.3	17.61	8.6	7	49.3	9.3	6.4	8.1	15.4	92
Vitamin B_{12} (µg)	Nil	Nil	Nil	Nil	Nil	Nil	1.5	1.5	1.8	NA	2.8	1.7	1.4	91.9

[a] Mean values of nutrients from commonly consumed cereals (67% weightage) such as rice and wheat were taken and 33% weightage was also given to millets such as Bajra, Jowar, Maiz and Ragi.

[b] Mean values of nutrients from Lentils, Tur dhal, Bengal gram, Black gram, Cowpea, Green gram, Peas, Rajmah, Red gram and Soyabean were considered.

[c] Carotenoid conversion to retinol equivalents.

[d] Mean values of nutrients from Beetroot, Carrot, Colocasia, Onion, Radish, Tapioca and Yam were considered.

[e] Mean values of nutrients from Amla, Apple, Banana, Cherries, Grapes, Guava, Jack fruit, Lemon, Lichi, Mango, Melon, Orange, Papaya, Pine apple, Pomegranate, Sapota, Custard apple, Strawberry were considered.

[f] Good source of bioavailable calcium.

NA= Not available; NR=Not reported

- Low absorption of non heme iron can be improved by consuming more vitamin C rich foods (Amla, Lemon, Oranges, Guava, etc.) in raw form as much as possible.
- Meat, poultry and liver contains high bio-available heme iron and also increases absorption (meat factor) of non-heme iron (including fish).

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