A Brief Note on
Nutrient Requirements for Indians, the Recommended Dietary Allowances (RDA) and the Estimated Average Requirements (EAR),
ICMR - NIN, 2020

The Nutrient requirements book defines nutrient distribution and requirements for normal individuals of all age groups, physiological groups and different physical activity groups of Indian population. Nutrient requirement is not the same in all people and can vary considerably (distributed) even among normal, healthy individuals. In order to derive a single value for the requirement, two features of the distribution of requirements are used. First, the median of this distribution is called the estimated average requirement (EAR), second, the 97.5th percentile of the distribution is called the Recommended Daily Allowance.

The first Nutrient Recommendations was developed in 1944, and was revised by the NAC of the ICMR in 1958 in the wake of reports by the Food and Agriculture Organization (FAO) on energy and protein. Subsequently, in 1968 and 1978 the ICMR committee revised the requirements for all nutrients except energy. The ICMR 2010 committee RDA recommendations further revised and upgraded the RDAs for Indians based on the international data provided by FAO/WHO/UNU 2004 expert committee, but derived only one value that is RDA (EAR was not derived).

The present (2020) committee used recent data on energy expenditure, protein metabolism; and available data on minerals and vitamins losses and absorption to estimate nutrient requirements for Indians. Latest statistical approaches were applied to derive the requirements through definitions of their distributions, such that the estimated average requirement (EAR) could be defined for population requirements and adequacies, and the upper 95th percentile of the distribution- the recommended dietary allowances (RDA) could be used to address deficiencies. In addition, since several foods are now being fortified with nutrients, the tolerable upper limits of intake of nutrients were also defined in the Nutrient requirements 2020 book.

RDA had been the recognized standard globally, but from 1990s four sets of nutrient values (EAR, RDA, AI-adequate intake and TUL-tolerable upper limits) are expressed as part of the dietary reference intakes. The RDAs are not recommended for use in menu planning for groups or individuals and are not used for calculation of nutrient inadequacies. Usually the EARs are approximately 80% of the RDA. And, in healthy population the distribution of nutrient requirement and dietary intake is expected to superimpose. Also, when we consider RDA as the reference the distribution shifts to the right with RDA as the mean and the entire population will shift beyond and above the requirements and a significant proportion may be at TUL. Hence, the present committee recommended EAR for population requirement/ adequacy estimations and menu or diet planning for individuals, which is in alignment with global recommendations.

Recommendation on energy requirement

The total energy requirement or the total energy expenditure (TEE) is calculated based on a multiplication of basal metabolic rate (BMR) to physical activity level (PAL): TEE = BMR X PAL.

Physical activity level (PAL): In the earlier report (ICMR-NIN, 2010), the energy cost of each activity was taken from FAO/WHO/UNU, 2004. However, the physical activity ratio (PAR) values used by FAO/WHO/UNU were obtained from the studies conducted in Western populations. Studies

carried out in India indicate that energy spent for different physical activity are lower. This could be because energy expended for a given activity (physical activity ratio- PAR) is not constant across the range of body weight and extrapolation from a heavy weight individual can overestimate energy spent for lower weight individual. Energy spent for each physical activity is lower for Indians, therefore a recalculation was performed using the PAR values reported for Indian population and this showed that the PAR was lower from 1.53 that was used in the previous recommendation (RDA-2010) to 1.40 for sedentary population and was relatively lower for other physical activities as well.

BMR: The Basal Metabolic Rate (BMR) is either measured directly (using DLW or HRM methods), or predicted from body weight, gender and age specific equations that were derived from a large international dataset by the FAO/WHO/UNU. However, the comparison of BMR derived from FAO/WHO/UNU equations and BMR observed among Indians suggest that the equation can overestimate the BMR by 10-12%, because the FAO/WHO/UNU data set included young and muscular subjects. The body composition among Indians includes relatively more fat and hence would result in a lower BMR as observed in studies conducted in India (*refer- ICMR-NIN Expert Group on Nutrient Requirement for Indians, Recommended Dietary Allowances (RDA) and Estimated Average Requirements (EAR) - 2020*). The earlier ICMR-NIN committee used 5% reduction in BMR calculation from FAO/WHO/UNU equations for deriving energy requirements for Indian adults, while the present committee reviewed the literature on BMR and based on the evidence, further reduced the BMR by another 5 % for adults.

Hence, the recommended energy requirement is lower by 3 to 8 kcal/kg/day for adults compared to the previous recommendation (RDA-2010) (Tables 1a & 1b). However, for children, since there is no recent evidence to show that the BMR of Indian children is lower than that of their Western counterparts, the present committee retained the BMR derived from the FAO/WHO/UNU 2004.

Recommendation on protein requirement

The human protein requirement should satisfy the currently established indispensable amino acid requirements as recommended by FAO/WHO/UNU Consultation of 2007.

The present Expert Group (ICMR-NIN 2020) adopted the FAO/WHO/UNU(2007) approaches to define the protein requirements for Indians of different age groups. A median obligatory nitrogen loss (WHO, 2007) has been used to compute mean (0.66 g/kg/day-EAR) and safe protein requirements (0.83 g/kg/day-RDA) for healthy Indian adults. Considering high quality protein sources as the premise for defining requirements, a newer protein quality index, digestible indispensable amino acid score (DIAAS), which is based on true ileal digestibility (instead of PDCAAS) of individual amino acids has been introduced in the current document.

In addition, the cereal-legume-milk composition of the diet has been improved to 3:1:2.5 (ICMR-NIN, 2020) as compared to the earlier 11:1:3 (ICMR-NIN, 2010).

Hence in the 2020 recommendation the RDA for protein is 0.83g/kg/day instead of 1g/kg/day (RDA 2010) and the EAR is 0.66 g/kg/day (Table 2a & 2b). A foot note is mentioned under the Table 2a- that for people consuming cereal-based diet with low quality protein, the protein requirements are 1 g/kg per day.

Recommendation on fats and oil requirement

There are three types of fatty acids (FA) in our diets, saturated fatty acids (SFA), mono unsaturated fatty acids (MUFA) and poly unsaturated fatty acids (PUFA). Our body can synthesize

SFAs, MUFAs besides obtaining them from the diet, while the PUFAs, namely, linoleic acid (also known as n-6 or omega 6 or LA) and alpha linolenic (also known as n-3 or omega 3 or ALA) cannot be synthesized. Hence, n-6 and n-3 are termed essential fatty acids (EFAs). Our body depends on dietary sources for n-3 and n-6 FA as they are not made in our body. Hence, one should take adequate amounts of nuts, oilseeds along with recommended levels of diverse foods (My Plate for the Day), to meet the required amounts of 6.6 grams of n-6 PUFA and 2.2 grams of n-3 PUFA for all the essential functions in the body. The visible fat (cooking oil) must be limited to 20-50g (4 to 10 teaspoon full) per person/ day depending on the level of energy (calorie) requirement, which is based on physical activity and physiological status. (For example, not more than 27g visible fat/ cooking oil is recommended for a 2000 kcal diet/ day).

Recommendation on vitamins and mineral requirement

For vitamins and minerals, the EAR and RDA are determined among normal individuals by using approaches such as (1) Factorial: calculate losses in feces, urine, sweat and estimate the bioavailability, then add the requirement for growth in children or milk output in lactating women (2) balance studies: minimum required to maintain homeostasis; intake – losses = 0, (3) or calculate from maintenance of optimal function, such as BP and sodium, calcium and bone density etc. The present committee has done extensive deliberations on recommendations for minerals like iron, calcium, phosphorus, zinc, selenium and iodine, and vitamins such as B vitamins and vitamin A. Data available on dietary intakes, balance studies, fecal loss- urinary loss in different geographical states, absorption studies, turnover studies were considered. For some nutrients (B1, B2, B6) enzyme activity coefficient studies were considered. As can be seen from the Tables 3 (males) and 4 (females) the RDA for all the vitamins and minerals are higher in the ICMR-NIN 2020 recommendation compared to the 2010. However, as the distribution of nutrient requirement and dietary intake is expected to superimpose among healthy population groups, considering RDA as the reference the distribution shifts to the right with RDA as the mean and the entire population will shift beyond and above the requirements and a significant proportion may be at TUL. Hence, the present committee recommended EAR for population requirement/ adequacy estimations, menu or diet planning for individuals, which is in alignment with global recommendation.

Table 1a. Summary of recommended energy requirement for Indians

Age group	Category	ICMR 2020	ICMR 2010	Difference
		Kcal/d		
Adult Men	Sedentary work	2110	2320	**-210**
	Moderate work	2710	2730	**-20**
	Heavy work	3470	3490	**-20**
Adult Women	Sedentary work	1660	1900	**-240**
	Moderate work	2130	2230	**-100**
	Heavy work	2720	2850	**-130**
	Pregnant	+ 350	+ 350	**--**
	Lactating (0-6m)	+600	+600	**--**
	Lactating (7-12m)	+520	+520	**--**
Infants	0-6 months	530	520	**+10**
	6-12 months	660	670	**-10**
Children*	1-3 y	1070	1060	**+10**
	4-6 y	1360	1350	**+10**
	7-9 y	1700	1690	**+10**
Boys	10-12 y	2220	2190	**+30**
Girls	10-12 y	2060	2010	**+50**
Boys	13-15 y	2860	2750	**+110**
Girls	13-15 y	2400	2330	**+70**
Boys	16-18 y	3320	3020	**+300**
Girls	16-18 y	2500	2440	**+60**

*For children 1% increase over the previous recommendations.

Table 1b. Energy Requirement*

Age Group	Category	Body weights	(kcal/d)[a]	(kcal/kg/day)
Men	Sedentary work	65.0	2110	**32**
	Moderate work	65.0	2710	**42**
	Heavy work	65.0	3470	**53**
Women	Sedentary work	55.0	1660	**30**
	Moderate work	55.0	2130	**39**
	Heavy work	55.0	2720	**49**
	Pregnant	55.0 + GWG[b]	+ 350	
	Lactating	55.0+	+600 +520	
Infants	0-6 m	5.8	530	**90**
	6-12m	8.5	660	**80**
Children[c]	1-3y 4-6y 7-9 y	12.9 18.3 25.3	1110 1360 1700	**83** **74** **67**
Boys	10-12y	34.9	2220	**64**
Girls	10-12y	36.4	2060	**57**
Boys	13-15y	50.5	2860	**57**
Girls	13-15y	49.6	2400	**49**
Boys	16-18y	64.4	3320	**52**
Girls	16-18y	55.7	2500	**45**

[a] Rounded off to the nearest 10 kcal/d

[b] GWG: Energy need in pregnancy should be adjusted for actual bodyweight, observed weight gain and activity pattern for the population

[c] Energy needs of children and adolescents have been computed for reference children and adolescents; with a moderate daily physical activity level.

*The actual requirement in specific population groups should be adjusted for the actual weight and physical activity of that population

Table 2a. Summary of recommended protein requirements for Indians 2020

		Body weight (kg)	EAR (g/kg/d)	RDA (g/kg/d)	EAR (g/d)	RDA (g/d)	
Adult Men	Sedentary	65	**0.66**	**0.83**	**42.9**	**54.0**	
	Moderate						
	Heavy Work						
Adult Women	Sedentary	55	**0.66**	**0.83**	**36.3**	**45.7**	
	Moderate						
	Heavy Work						
Pregnant Women	2nd Trimester				**+7.6**	+9.5	
	3rd Trimester				**+17.6**	+22.0	
Lactating Women	0-6 months				+13.6	+16.9	
	6-12 months				+10.6	+13.2	
Infants	0-6 months	5.8	1.16	1.40	6.7	8.1	
	6-12 months	8.5	1.04	1.23	8.8	10.5	
Children	1-3y	12.9	0.79	0.97	10.2	12.5	
	4-6y	18.3	0.70	0.87	12.8	15.9	
	7-9y	25.3	0.75	0.92	19.0	23.3	
Boys	10-12y	34.9	0.75	0.91	26.2	31.8	
Girls	10-12y	36.4	0.73	0.90	26.6	32.8	
Boys	13-15y	50.5	0.72	0.89	36.4	44.9	
Girls	13-15y	49.6	0.70	0.87	34.7	43.2	
Boys	16-18y	64.4	0.70	0.86	45.1	55.4	
Girls	16-18y	55.7	0.67	0.83	37.3	46.2	

For people consuming cereal-based diet with low quality protein, the protein requirements are 1 g/kg per day
Note: The cereal-legume-milk composition of the diet should be 3:1:2.5 for good protein quality.

Table 2b. Recommended protein for vegetarians

Protein recommendation: RDA 2010	Body weight kg	Protein g/kg/d	Total daily Requirement (g)
Males	60	1.0	60
Females	55	1.0	55

Note: The cereal-legume-milk composition of the diet should be 3:1:2.5 for good protein quality.

Table 3. (Males) Nutrient values comparison ICMR-2010/2020 and IOM

Nutrients	ICMR-NIN			IOM
	RDA 2010	RDA 2020	EAR 2020	
Calcium (mg)	600	1000	800	1000
Magnesium (mg)	340	440	370	400
Iron (mg)	17	19	11	8
Zinc (mg)	12	17	14	11
Iodine (µg)	150	150	95	150
Thiamine (mg)	1.4	1.8	1.5	1.2
Riboflavin (mg)	1.6	2.5	2.1	1.3
Niacin (mg)	18	18	15	16
Vitamin B6 (mg)	2	2.4	2.1	1.3
Folate (µg) DFE	200	300	250	400
Vitamin B12 (µg)	1	2.2	2	2.4
Vitamin C (mg)	40	80	65	90
Vitamin A (µg)	600	1000	460	900
Vitamin D (IU)	400	600	400	600

Table 4. (Females) Nutrient values comparison ICMR-2010/2020 and IOM

Nutrients	ICMR			IOM
	RDA 2010	RDA 2020	EAR 2020	
Calcium (mg)	600	1000	800	1000
Magnesium (mg)	310	370	310	310
Iron (mg)	21	29	15	18
Zinc (mg)	10	13.0	11	8
Iodine (µg)	150	150	95	150
Thiamine (mg)	1.1	1.7	1.4	1.2
Riboflavin (mg)	1.3	2.4	2.0	1.3
Niacin (mg)	14	14	12	16
Vitamin B6 (mg)	2	1.9	1.6	1.3
Folate (µg) DFE	200	220	180	400
Vitamin B12 (µg)	1	2.2	2	2.4
Vitamin C (mg)	40	65	55	75
Vitamin A (µg)	600	840	390	700
Vitamin D (IU)	400	600	400	600