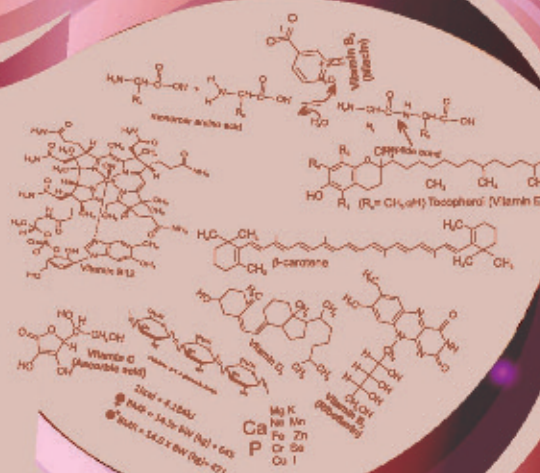


NUTRIENT REQUIREMENTS FOR INDIANS



RECOMMENDED DIETARY ALLOWANCES

ESTIMATED AVERAGE REQUIREMENTS



A REPORT OF THE EXPERT GROUP, 2020



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INDIAN COUNCIL OF
MEDICAL RESEARCH | NATIONAL INSTITUTE
OF NUTRITION

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

SUMMARY OF RECOMMENDATIONS

Recommended Dietary Allowances & Estimated Average Requirements for Indians - 2020

A SHORT REPORT

REFERENCE BODY WEIGHT

Earlier Expert Committee on RDA used data generated during 1989 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 2010 Committee has considered extensive 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 has considered the more recent, nationally representative datasets such as the National Family Health Survey - 4 (NFHS-4, 2015-16), National Nutrition Monitoring Bureau (NNMB, 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 reference height was taken as 95th centile for adult male and female, and with normal BMI range of 18.5-22.9 kg/m², a reference body weight was calculated.

The definition for reference Indian adult man and woman were modified with regard to age (19-39y instead of 20-39y) 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 infants and re-analyzed the energy requirement for infants. With the use of these values 1 kcal/kg body weight/d increment of requirement for infants aged 0-6 months is reported when compared to the previous recommendations. Otherwise the requirement for children above 6 months 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. This approach has led to a decrease in energy requirement of children. 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. The low cost Indian vegetarian diets for sedentary, moderate active man 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 for moderately active man has been improved to 3:1:2.5 as compared to the earlier 11:1:3 (ICMR 2010) within a given low cost window to meet daily protein requirements.

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 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 also emphasized. There is a realization that efforts to increase the dietary levels of total fat and n-3 PUFAs would contribute to lifelong health and well-being. Inclusion of foods which provide LCn-3 PUFAs is also recommended for the prevention of DR-NCD.

DIETARY FIBER

For the first time committee considered recommendations for fiber based on energy intake and the level of about 40 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. The EAR for CHO has been set at 100 g/day for ages 1 year and above with a RDA of 130 g/day, assuming a coefficient of variance (CV) of 15% based on variation in 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 amount 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: EAR was calculated by extrapolating the regression equation from the correlation of intakes and fecal losses and adding the average urinary losses. RDAs were calculated from EARs with 10% coefficient of variation. Requirements of other physiological groups were adjusted to age and growth factors. The EAR was thus estimated to 320 mg per day and RDA at 385 mg per day for adult males.

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 3510 mg/day is recommended for potassium. The desirable sodium:potassium ratio in mmol from the diet was fixed at 1:1.

Iron: The basis for the recommendations of iron (factorial approach) is similar to what was adopted by the previous committee. Unlike the earlier Committee which used three tier absorption for adjustment of dietary iron 3% for men, 5% for women and 8% for pregnant women, the present Committee recommends the use of only two tiers 5% (men and children) and 8% (all women), which is in conformity with the suggestion made by FAO/WHO, for developing countries and is also based on absorption data generated in India using stable isotopes. Consequently, the average requirement RDA for iron has been reduced significantly among all physiological groups. To achieve this, the committee recommended that the density of ascorbic acid in the daily diet should be at least 20 mg/1000 kcal.

Zinc: 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 intake of Iodine in the diet through food and as fortified salt, the recommendation of 150 µg/day is retained for adults. The recommendations of IOM of 250 µg/day for Iodine during pregnancy, have also been adopted.

VITAMINS

Water Soluble Vitamins

Thiamine and Riboflavin: The daily intake of these vitamins is related to the energy requirements. In the absence of direct studies, the committee recommends the requirements of thiamine (men- 0.6 mg/1000 kcal; women- 0.8 mg/1000 kcal) and riboflavin (men- 0.9 mg/1000 kcal; women- 1.1 mg/1000 kcal) based on ETK-AC (1.15) and EGR-AC cut-off values (1.2), respectively for thiamine and riboflavin.

Niacin: 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.

Vitamin B₆: Due to paucity of reference data for different age groups in Indian scenario, expert committee 2020 calculated the vitamin B₆ EAR and RDA based on EAST-AC values for adults. For this the EAST-AC cut-off of 1.8 was considered as suggested by EFSA and the requirements were calculated based on regression analysis in relation to B₆ intakes. Based on this approach the requirement (EAR) of vitamin B₆ for 1000 kcal works out to be 0.616 mg and this was used to extrapolate to other age groups based on the energy requirements. The RDA was set at 2.1 and 1.6 for moderate active men and women respectively.

Folate: 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 >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.

Vitamin B₁₂: Factorial approach was used for deriving Vitamin B₁₂ requirements 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 2.5 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 B₁₂ 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 B₁₂/d is suggested adjusting for 50% absorption. With regards to lactating women the B₁₂ requirement was arrived by considering the B₁₂ 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 to 900 µg is recommended during pregnancy. 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 adopt the IOM recommendation for all age groups. 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.

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 55 µg 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 provided by the IOM and WHO, 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 400 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.

SUMMARY OF EAR FOR INDIANS - 2020

Age Group	Category of work	Body Wt	Energy (**)	Fats/ Oils (visible) (#)	Protein	CHO	Cal cium	Magne sium	Iron	Zinc	Iodine	Thiamine	Ribo flavin	Niacin	Vit B6	Folate	Vit B12	Vit C	Vit A	Vit D
		(kg)	(Kcal/ d)	(g/d)	(g/d)	(g/d)	(mg/ 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)
Men	Sedentary	65	2110	25	42.9		800	320	11	14.0	95	1.2	1.6	12	1.6	250	2	65	460	400
	Moderate		2710	30		100						1.5	2.1	15	2.1					
	Heavy		3470	40								1.9	2.7	19	2.6					
Women	Sedentary	55	1660	20	36.3		800	270	15	11.0	95	1.1	1.6	9	1.6	180	2	55	390	400
	Moderate		2130	25		100						1.4	2.0	12	1.6					
	Heavy		2720	30								1.8	2.6	15	2.1					
	Pregnant woman	55 + 10	+ 350	30	+7.6 (2 nd trimester) +17.6 (3 rd trimester)	135	800	320	32	12.0	180	1.6	2.3	+2	1.9	480	+0.2	+10	406	400
	Lactation 0-6m		+600	30	+13.6	155	1000	270	16	12.0	200	1.7	2.5	+4	+0.22	280	+0.8	+40	720	400
	7-12m		+520		+10.6	155						1.7	2.4	+4	+0.16	280				
Infants	0-6 m*	5.8	550	-	6.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6-12m	8.5	670	25	8.8	-	-	-	2	2.0	130	-	-	-	0.5	71	1	-	170	-
Children	1-3y	11.7	1010	25	9.2	100	400	111	6	2.5	65	0.6	0.8	6	0.8	90	1	22	180	
	4-6y	18.3	1360	25	12.8	100	450	131	8	3.7	80	0.8	1.1	8	1.0	111	1	27	240	400
	7-9 y	25.3	1700	30	19.0	100	500	178	10	4.9	80	1.0	1.3	10	1.3	142	2	36	290	
Boys	10-12y	34.9	2220	35	26.2	100	650	223	12	7.0	100	1.3	1.7	12	1.7	180	2	45	360	400
Girls	10-12y	36.4	2060	45	26.6	100	650	214	16	7.1	100	1.2	1.6	12	1.6	186	2	44	370	400
Boys	13-15y	50.5	2860	50	36.4	100	800	294	15	11.9	100	1.6	2.2	16	2.2	238	2	60	430	400
Girls	13-15y	49.6	2400	35	34.7	100	800	270	17	10.7	100	1.3	1.9	13	1.8	204	2	55	420	400
Boys	16-18y	64.4	3320	40	45.1	100	850	338	18	14.7	100	1.9	2.5	19	2.5	286	2	69	480	400
Girls	16-18y	55.7	2500	35	37.3	100	850	279	18	11.8	100	1.4	1.9	14	1.9	223	2	57	400	400

*: AI; **: There is no RDA for energy. The EAR is equivalent to the Estimated Energy Requirement (EER); #: Visible fat requirement is in proportion to EER;

SUMMARY OF RDA FOR INDIANS – 2020

Age Group	Category of work	Body Wt	Protein	CHO	Cal cium	Magne sium	Iron	Zinc	Iodine	Thiamine	Ribo flavin	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	130	1000	385	19	17	150	1.4	2.0	14	1.9	300	2.5	80	1000	600
	Moderate									1.8	2.5	18	2.4					
	Heavy									2.3	3.2	23	3.1					
Women	Sedentary	55	45.7	130	1000	325	29	13.2	150	1.4	1.9	11	1.9	220	2.5	65	840	600
	Moderate									1.7	2.4	14	1.9					
	Heavy									2.2	3.1	18	2.4					
	Pregnant woman	55 + 10	+9.5 (2 nd trimester) +22.0 (3 rd trimester)	175	1000	385	40	14.5	250	2.0	2.7	+2.5	2.3	570	+0.25	+15	900	600
	Lactation 0-6m		+16.9	200	1200	325	23	14	280	2.1	3.0	+5	+0.26	330	+1.0	+50	950	600
7-12m		+13.2	200						2.1	2.9	+5	+0.17	330					
Infants	0-6 m*	5.8	8.1	55	300	30	-	-	100	0.2	0.4	2	0.1	25	1.2	20	350	400
	6-12m	8.5	10.5	95	300	75	3	2.5	130	0.4	0.6	5	0.6	85	1.2	27	350	400
Children	1-3y	11.7	11.3	130	500	135	8	3.0	90	0.7	0.9	7	0.9	110	1.2	27	390	600
	4-6y	18.3	15.9	130	550	155	11	4.5	120	0.9	1.3	9	1.2	135	1.2	32	510	
	7-9 y	25.3	23.3	130	650	215	15	5.9	120	1.1	1.6	11	1.5	170	2.5	43	630	
Boys	10-12y	34.9	31.8	130	850	270	16	8.5	150	1.5	2.1	15	2.0	220	2.5	54	770	600
Girls	10-12y	36.4	32.8	130	850	255	28	8.5	150	1.4	1.9	14	1.9	225	2.5	52	790	600
Boys	13-15y	50.5	44.9	130	1000	355	22	14.3	150	1.9	2.7	19	2.6	285	2.5	72	930	600
Girls	13-15y	49.6	43.2	130	1000	325	30	12.8	150	1.6	2.2	16	2.2	245	2.5	66	890	600
Boys	16-18y	64.4	55.4	130	1050	405	26	17.6	150	2.2	3.1	22	3.0	340	2.5	82	1000	600
Girls	16-18y	55.7	46.2	130	1050	335	32	14.2	150	1.7	2.3	17	2.3	270	2.5	68	860	600

* AI

**SUMMARY OF RECOMMENDED INTAKES FOR
OTHER MINERALS AND TRACE ELEMENTS**

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

TOLERABLE UPPER LIMIT (TUL) FOR NUTRIENTS

Age Group	Category of work	Protein	Cal cium	Magne sium	Iron	Zinc	Iodine	Niacin	Vit. B6	Folate	Vit. C	Vit. A	Vit. D
		(PE ratio)	(mg/ d)	(mg /d)	(mg/ d)	(mg /d)	(µg/ day)	(mg/d)	(mg/ d)	(µg/d)	(mg/d)	(µg/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	4000
	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 (9-17y)	1050	1700	4000
Girls	10-12y	<15%	3000	350	40	23	600	-	-	-	1300	1700	4000
Boys	13-15y	<15%	3000	350	45	34	900	-	-	-	1550	2800	4000
Girls	13-15y	<15%	3000	350	45	34	900	-	-	-	1800	2800	4000
Boys	16-18y	<15%	3000	350	45	34	1100	-	-	-	1950	2800	4000
Girls	16-18y	<15%	3000	350	45	34	1100	-	-	-	2000	2800	4000

\$: adopted from IOM