

Human Nutrition (DTC – 211)

**CONCEPT OF BALANCED DIET AND
NUTRIENT REQUIREMENTS
OF
DIFFERENT AGE GROUPS**

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When diet is wrong, medicine is of no use.
When diet is correct, medicine is of no
need.

-Ancient Ayurvedhic Proverb-

- ❖ Humans → wide range of nutrients → healthy and active life.
- ❖ required nutrients for different physiological groups → derived from a well-balanced diet and nutrients are also absorbed more efficiently.
- ❖ Components of the diet → chosen judiciously → all the nutrients → requirements in proper proportions for the different physiological activities.



A diet which contains different types of food possessing the nutrients:

carbohydrate,

protein,

fats,

vitamins,

minerals and

water – in a proportion to meet the requirement of the body

❖ **Nutrients** → chemical substances needed for

- growth and
- maintenance

❖ **Clinical nutrition** → medical specialty dealing with the relationship between **disease and nutrition**.

❖ Acute and chronic illnesses are caused by

- **deficiencies** of dietary components and
- others by their **excesses**.

Malnutrition

- ❖ **inappropriate quality,**
- ❖ **quantity,**
- ❖ **digestion,**
- ❖ **absorption or**
- ❖ **utilization of ingested nutrients.**

- ❖ It includes:
- ❖ **Undernutrition** - low food intake (calorie deficiency) leading to **growth suppression** or other **deficiency signs**, and
- ❖ **overnutrition** - consume too much food and/or single nutrients leading to **specific toxicities**.
- ❖ Some **45-50 chemical entities** - **required** by humans, either preformed in food or added as an appropriate chemical substitute.

❖ These can be divided into :

- **carbohydrates,**
- **fats,**
- **proteins,**
- **vitamins and**
- **inorganic elements**

❖ **important in maintaining good health.**

❖ **essential** or **dietary essential** - obtain the nutrient from our diet

Recommended Dietary Allowances (RDA)

- ❖ developed by the **Food and Nutrition Board** of the National Academy of Sciences.
- ❖ defined as “levels of intake of essential nutrients considered, in the judgment of Committee of Dietary Allowances of Food and Nutrition Board, on the basis of available scientific knowledge to be adequate to meet the known nutritional needs of practically all healthy persons.”
- ❖ RDAs → **healthy population**
- ❖ met from - a wide variety of readily available foods.

- ❖ RDAs should not be confused with **nutrient requirements of individuals** because these are too variable.
- ❖ **average level of daily intake of a nutrient** which over time approximates the RDA → *nutritional inadequacy will be rare* in that population.
- ❖ **do not provide the needs** that have been **altered** as a result of **disease states**, chronic usage of **certain drugs**, or **other factors** that require specific individual attention.

- ❖ Earlier Expert Committee on RDA (1989) used data → body weights and heights of well-to-do Indian children and adolescents based only on a segment of Indian population and did not have an all India character.
- ❖ reference weights for man and woman were **60 kg** and **50 kg** respectively.
- ❖ 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**.
- ❖ reference body weight for male and female were derived from the median weight of 2 male and female population whose height and **BMI (18.5-22.9kg/m)** were in the proposed range.
- ❖ 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**.


SUMMARY OF RDA FOR INDIANS - ICMR- NIN, 2020

Age Group	Category of work	Body Wt (kg)	Protein (g/d)	Dietary Fiber* (g/d)	Calcium (mg/d)	Magnesium (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	54.0	30	1000	440	19	17	140	1.4	2.0	14	1.9	300	2.2	80	1000	600																	
	Moderate			1.8						2.5	18	2.4																							
	Heavy			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			1.7						2.4	14	1.9																							
	Heavy			2.2						3.1	18	2.4																							
Infants	Pregnant woman	55 + 10	+9.5 (2 nd trimester) +2.0 (3 rd trimester)	-	1000	440	27	14.5	220	2.0	2.7	+2	2.3	570	+0.25	+15	900	600																	
																			6-12m	8.0	300	30	3	2.5	130	0.4	0.6	5	0.6	85	1.2	20	350	400	
Children	Lactation	5.8	+17.0	-	1200	400	23	14.1	280	2.1	3.0	+5	+0.26	330	+10	+50	950	600																	
																			0-6m	8.0	300	30	3	2.5	130	0.4	0.6	5	0.6	85	1.2	20	350	400	
																			7-12m	10.5	300	75	3	2.5	130	0.4	0.6	5	0.6	85	1.2	20	350	400	
Boys	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	16.0	20	550	125	11	4.5	90	0.9	1.3	9	1.2	135	2.2	35	510	600
																			7-9 y	23.0	26	650	175	15	5.9	90	1.1	1.6	11	1.5	170	2.2	45	630	600
Girls	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																	
																			10-12y	33.0	30	850	250	28	8.5	100	1.4	1.9	14	1.9	235	2.2	50	790	600
																			13-15y	50.5	43	1000	345	22	14.3	140	1.9	2.7	19	2.6	285	2.2	70	930	600
Boys	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																	
																			16-18y	64.4	50	1050	440	26	17.6	140	2.2	3.1	22	3.0	340	2.2	85	1000	600
																			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

* Adequate Intake (AI)

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

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 Foliates (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%

¹Pulses 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 Foliates (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%

¹Pulses 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.

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

Nutrients	Men		Women	
	EAR	RDA	EAR	RDA
Energy (Kcal)	1700	•	1500	•
Dietary Fibre	•	30	•	25
Protein (g)	43.0	54.0	36.3	46.0
Vit-A (µg)	460	1000	390	840
Thiamin B ₁ (mg)	1.2	1.4	1.1	1.4
Riboflavin B ₂ (mg)	1.6	2.0	1.6	1.9
Niacin (mg)	12	14	9	11
Vit-C (mg)	65	80	55	65
Vit-B ₆ (mg)	1.6	1.9	1.6	1.9
Folate (µg)	250	300	180	200
Vit-B ₁₂ (µg)	2.0	2.2	2.0	2.2
Vit-D (IU)	400	800	400	800
Calcium (mg)	1000	1200	1000	1200
Magnesium (mg)	370	440	310	370
Iron (mg)	11	19	11	19
Zinc (mg)	14	17	11	13.2
Iodine (µg)	95	140	95	140

- ❖ **Energy RDA** - *food energy intake* must **equal** the *energy expended* - maintain their body weight.
- ❖ **Protein RDA** - based on the individuals **body weight**.
- ❖ High - to cover most person's needs.
- ❖ **average requirement** - **0.6 grams per kilogram** of body weight; the **RDA is 0.8 grams** to meet **97.5%** of the population's needs.

❖ No RDA - Carbohydrate and Fat

- ❖ amount of protein recommended represents a small percentage of a person's energy allowance
- ❖ remainder acquired from carbohydrates and fats.

- ❖ general guideline for carbohydrate and fat :
 - ❖ **more than half of daily energy** ← carbohydrates
 - ❖ not more than **one-third** ← fat.

Minimal Daily Requirement (MDR)

- ❖ **minimum amount of a nutrient from exogenous sources**
→ **sustain normality.**
- ❖ consume food more for **satiation of energy** needs than for individual nutrients.
- ❖ quality of any food in relation to its content of specific nutrient → **nutrient density**
- ❖ defined as the **concentration of a nutrient per unit of energy** (e.g., 1,000 calories) in a specific food.

- ❖ For any nutrient **higher the nutrient density → better the food source**
- ❖ one whole green pepper → 20 mg of vitamin C and provides 4 calories
- ❖ one medium sweet potato → 20 mg of vitamin C but provides 100 calories.
- ❖ green pepper is a much better source of vitamin C than sweet potato.

Metabolism

- ❖ cells have in common *two major general functions*:
 - **energy generation** and
 - **energy utilization** for **growth** and / or **maintenance**.
- ❖ termed metabolic reactions or simply **metabolism**.
- ❖ **Anabolism** → processes → **large molecules** - proteins are **biosynthesized** from small nutrient materials - **amino acids**.
- ❖ reactions require **energy** - available in cells in the form of stored chemical energy in **high energy phosphate compounds**.

- ❖ **Catabolism** → **degradation** of large molecules to smaller ones.
- ❖ reactions serve to **capture chemical energy** (in the form of adenosine triphosphate, **ATP**) from the degradation of energy-rich molecules.
- ❖ allows nutrients (in the diet or stored in cells) to be converted into **building blocks** needed for the **synthesis of complex molecules**.

- ❖ **Intermediary metabolism** → changes that occur in a food substance beginning with **absorption** and **ending with excretion**.
- ❖ **adult** → there is a **delicate regulated balance** between anabolic (synthetic) and catabolic (degradative) processes.
- ❖ **growing child** → input of nutrients and anabolism exceed catabolism → growth of tissues.
- ❖ **aging** process or in wasting diseases → catabolic processes exceed anabolic ones.

Bio-availability:

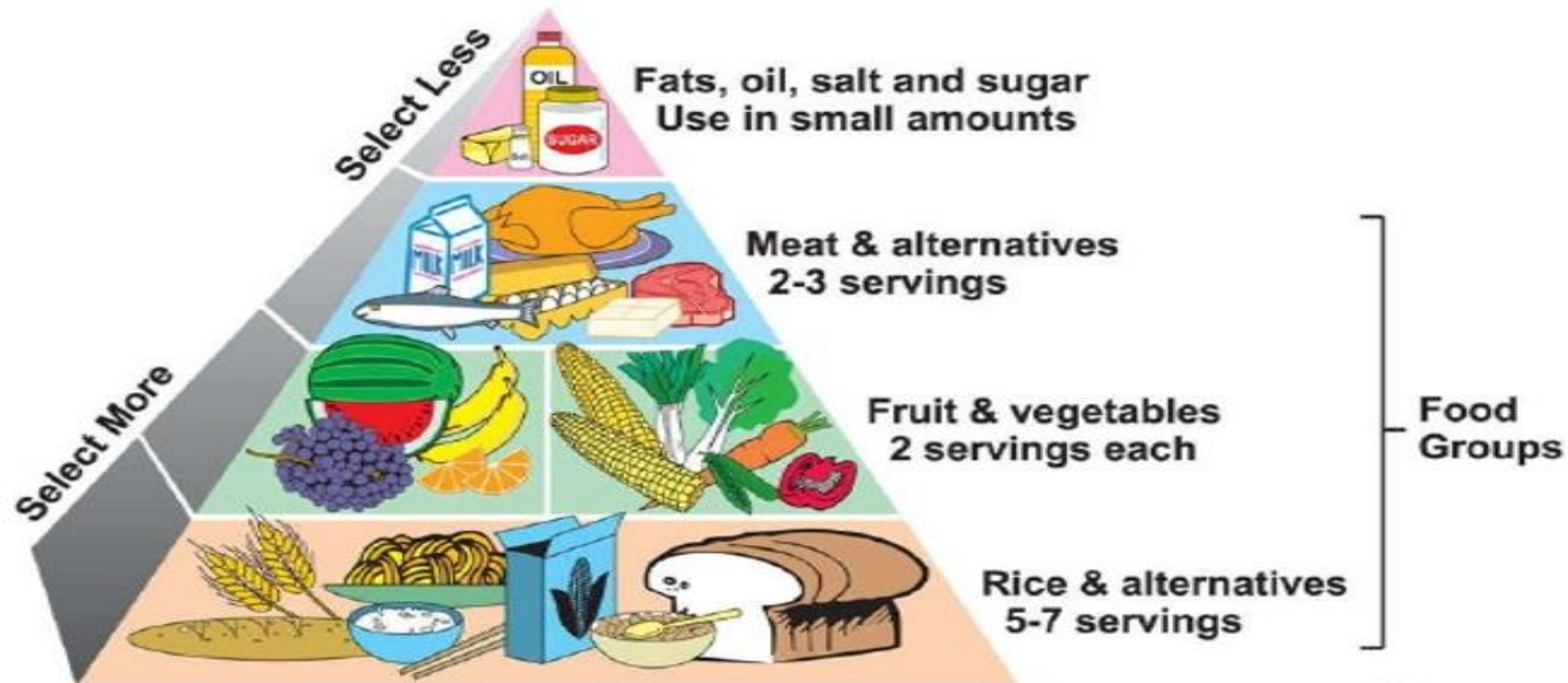
- ❖ release of the nutrient from the food, its absorption in the intestine and bioresponse have to be taken into account.
- ❖ level of nutrient that should be present in diet to meet the requirement.
- ❖ **bio-availability factor** is quite important in case of **calcium** , **protein** and **trace elements** like **iron** and **zinc**.
- ❖ **Iron** → amount to be present in the diet is **20-30 times higher** than actual iron requirement → **low bio-availability of iron** from a given diet.

Basic four food groups

Group	Food	Major nutrients
Milk	Milk and other dairy products	Calcium, protein riboflavin
Meat	Meat, poultry, fish, eggs Beans, peas, nuts, seeds (meat substitutes)	Protein, fat, iron, other minerals
Fruits and vegetable	All varieties of fruits and vegetables, green yellow vegetables	Vitamin C, vitamin A precursors
Bread and cereal	Bread, cooked cereal, dry cereal, rice, pasta	B vitamins, iron, carbohydrate

Healthy diet pyramid

General guide that lets you choose a healthful diet that's right for you.



The Need for Energy

- ❖ human body needs a **continuous regulated supply of nutrients.**
- ❖ **Energy** is required for all body processes, growth, and physical activity.
- ❖ **Even at rest** *body requires energy* - muscle contraction, active transport of molecules and ions, and synthesis of macromolecules and other biomolecules from simple precursors.

- ❖ *heart* pumps approximately 8,000 L/day of blood in about 80,000 pulsations.
- ❖ daily energy required for this heart function alone → equivalent to lifting a weight of 1,000 kg to a height of 10 meters.
- ❖ In most processes *energy is supplied by adenosine triphosphate (ATP)*.
- ❖ Energy is liberated when ATP is hydrolysed to **adenosine diphosphate (ADP)** and **inorganic phosphate**.

- ❖ resting human → 40 kg of ATP in 24 hours.
- ❖ amount of ATP in the body tissues is limited but is generated continuously from the fuel stores to supply the required energy.
- ❖ These fuel stores must be replenished via food intake.



**Health
is
Wealth**

**Thanks for
Your Attention!**