Take-Home Ration

Requirements across age group

Table1:

Nutrients	6m-1yr child / 1-3yr child	Pregnant women's / Lactation mothers	6m-1yr child	1-3yr child
Energy (Kcal)	500	600	250	250
Protein (g)	12	18	5	9
Fat (g)*	19.44	23.33	10	10
Iron (mg)	4	-	1.5	-
Zinc (mg)	1.65	-	1.25	-
Folate (µg)	60	-	42.5	-

*Fat is 35% of Energy and it can be maximum of 40% of Energy

The nutrient composition in **Table1** is the recommendation as per the guidelines from ICDS for take home rations [1]**.** For children the micronutrients are also optimized to meet 50% RDA [2].

Fat is minimum of 35% of Energy and maximum of 40% Energy

Fat energy ratio is calculated as:

$$\text{Fat (g)} \geq \text{Energy(kcal)} / 9 * 0.35 \quad | \quad \text{Fat (g)} \leq \text{Energy(kcal)} / 9 * 0.40$$

Protein Energy ratio is calculated as:

$$\text{Protein (g)} \geq \text{Energy(kcal)} / 4 * 0.10 \quad | \quad \text{Protein (g)} \leq \text{Energy(kcal)} / 4 * 0.15$$

Protein digestibility factors are considered while optimizing for protein requirement [3]**.**

Cost limit across age group

As per the guidelines of ICDS we are optimizing for the cost of 8 RS. for children's and 9.5 RS for pregnant and lactation women.

Whole Milk Powder:

Other scheme – In this approach we are considering the Nutrition composition of the milk powder from the intake quantity, and we are optimizing for the remaining supplementary nutrition requirement i.e., (supplementary nutrition requirement of ICDS – Nutrition composition of intake quantity of milk powder)

ICDS- Addition to the above, we also consider the cost of milk powder in the unit cost of ICDS while optimizing. i.e., maximum cost limit for optimization = Cost norm from ICDS – Cost of intake quantity of milk powder.

Model explanation

Method:

The method we used here is the **Linear programming problem**. It is an optimization method for a linear objective function and a system of linear inequalities or equations. The linear inequalities or equations are known as **constraints**. The quantity which needs to be maximized or minimized (optimized) is reflected by the **objective function**. The fundamental objective of the linear programming model is to look for the values of the variables that optimize (maximize or minimize) the objective function.

We know that in linear programming, we subject linear functions to multiple constraints. These constraints can be written in the form of linear inequality or linear equations. This method plays a fundamental role in finding optimal resource utilization. The word "linear" in linear programming depicts the relationship between different variables. It means that the variables have a linear relationship between them. The word "programming" in linear programming shows that the optimal solution is selected from different alternatives.

Objective function: This function is expressed as a linear function, and it describes the quantity that needs optimization. Our objective is to minimize the cost of the diet which is written as below

Minimize (Cost of the diet) = Quantity of food1*Cost of food1 + Quantity of food2*Cost of food2 + …. n

Constraints: These are the limitations set on the main objective function. These limitations must be represented in the mathematical form. For example, as below

Egg <= 45gm (maximum one egg per day)

Cereals=2*Pulse (proportion of cereals and pulse in the diet)

Using the linear programming method, we can get the optimal cost diet plan which meets the nutrition requirements by satisfying all the constraints.

REFERENCES

1.

2. https://www.nin.res.in/RDA_Full_Report_2020.html

3.

Data reference

Price of foods - https://www.indiamart.com/

Nutrition composition of foods - IFCT

IFCT Food code:

Food Group	Food code	Food Name
Cereals and Millets	A005	Jowar
Cereals and Millets	A006	Maize
Cereals and Millets	A010	Ragi
Cereals and Millets	A015	Rice
Cereals and Millets	A019	Wheat Flour Atta
Cereals and Millets	A020	Wheat
Cereals and Millets	A021	Wheat Broken
Cereals and Millets	A022	Wheat Rava
Pulses	B002	Bengal Gram (Channa dal)
Pulses	B004	Black Gram (Urad dal)
Pulses	B010	Green Gram (Moong dal)
Pulses	B013	Red Lentil (Masoor dal)
Pulses	B015	Yellow Lentil (Mung dal)
Pulses	B017	Peas
Pulses	B020	Rajma Red (Kidney beans)
Pulses	B021	Red Gram (Toor dal) (Arhar dal)
Pulses	B024	Soya bean (Brown)
Pulses	B025	Soya bean (White)
Fruits	E012	Banana
Nuts	H012	Ground nut
Sugar	I001	Jaggery
Oil	T013	Ghee

Hot-Cooked Meal

Requirements across age group

Table1:

Nutrition's	4-6 years child			Pregnant women's	Lactation mothers
	Meal**	Meal	Snack		
Energy (Kcal)	500	333	167	1350	1640
Protein (g)	12	8	4	41	37
Fat (g)*	19.5	13	6.5	52.5	63.78

*Fat is 35% of Energy and it can be maximum of 40% of Energy

** Meal will cover the 100% ICDS Supplementary Nutrition Recommendation

The nutrient composition in **Table1** is the recommendation as per the guidelines from ICDS for hot cooked meals [1]. For children the supplementary nutrition composition can be split into snacks (33%) and meal (67%) of the ICDS supplementary requirements.

Fat is minimum of 35% of Energy and maximum of 40% Energy

Fat energy ratio is calculated as:

$$\text{Fat (g)} \geq \text{Energy(kcal)} / 9 * 0.35 \quad | \quad \text{Fat (g)} \leq \text{Energy(kcal)} / 9 * 0.40$$

Protein Energy ratio is calculated as:

$$\text{Protein (g)} \geq \text{Energy(kcal)} / 4 * 0.10 \quad | \quad \text{Protein (g)} \leq \text{Energy(kcal)} / 4 * 0.15$$

Protein digestibility factors are considered while optimizing for protein requirement **[2].**

Cost limit across age group

As per the guidelines of ICDS we are optimizing for the cost of 8 RS. for children's and 21 RS for pregnant and lactation women.

Whole Milk Powder:

Other scheme – In this approach we are considering the Nutrition composition of the milk powder from the intake quantity, and we are optimizing for the remaining supplementary nutrition requirement i.e., (supplementary nutrition requirement of ICDS – Nutrition composition of intake quantity of milk powder)

ICDS- Addition to the above, we also consider the cost of milk powder in the unit cost of ICDS while optimizing. i.e., maximum cost limit for optimization = Cost norm from ICDS – Cost of intake quantity of milk powder.

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The method we used here is Linear programming problem. It is an optimization method for a linear objective function and a system of linear inequalities or equations. The linear inequalities or equations are known as **constraints**. The quantity which needs to be maximized or minimized (optimized) is reflected by the **objective function**. The fundamental objective of the linear programming model is to look for the values of the variables that optimize (maximize or minimize) the objective function.

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Objective function: This function is expressed as a linear function, and it describes the quantity that needs optimization. Our objective is to minimize the cost of the diet which is written as below

Minimize (Cost of the diet) = Quantity of food1*Cost of food1 + Quantity of food2*Cost of food2 + …. n

Constraints: These are the limitations set on the main objective function. These limitations must be represented in the mathematical form. For example, as below

Egg <= 45gm (maximum one egg per day)

Cereals=2*Pulse (proportion of cereals and pulse in the diet)

Using the linear programming method, we can get the optimal cost diet plan which meets the nutrition requirements by satisfying all the constraints.

REFERENCES

1.

2.

Data's we used

Price of foods - https://www.indiamart.com/

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IFCT Food code:

Food Group	Food code	Food Name
Cereals and Millets	A005	Jowar
Cereals and Millets	A006	Maize
Cereals and Millets	A010	Ragi
Cereals and Millets	A015	Rice
Cereals and Millets	A019	Wheat Flour Atta
Cereals and Millets	A020	Wheat
Cereals and Millets	A021	Wheat Broken
Cereals and Millets	A022	Wheat Rava
Pulses	B002	Bengal Gram (Channa dal)
Pulses	B004	Black Gram (Urad dal)
Pulses	B010	Green Gram (Moong dal)
Pulses	B013	Red Lentil (Masoor dal)
Pulses	B015	Yellow Lentil (Mung dal)
Pulses	B017	Peas
Pulses	B020	Rajma Red (Kidney beans)
Pulses	B021	Red Gram (Toor dal) (Arhar dal)
Pulses	B024	Soya bean (Brown)
Pulses	B025	Soya bean (White)
Fruits	E012	Banana
Nuts	H012	Ground nut
Sugar	I001	Jaggery
Oil	T013	Ghee