# NUTRIOPTIMIZER USER MANUAL

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**Nutrioptimizer**

## 1. Introduction

Numerous nutrients and food components are needed for normal growth, development, and body functioning. Essential nutrients those that the body cannot produce itself in adequate amounts must be obtained from foods. Nutrients function in many ways to build, maintain, and protect body structures and systems and to promote health. Many nutrients are necessary for the production and functioning of compounds necessary for health. In addition to preventing classic nutrient deficiency diseases, prospective epidemiologic studies suggest that a healthy Pyramid Food Group one that provides recommended intakes of essential nutrients within recommended energy levels reduces the risk of some common chronic diseases, including obesity, cardiovascular disease, and some cancers. Nutrioptimizer helps in arriving a Diet plan that meets Pyramid Food Group's and Nutrient recommendation by optimization using Linear Programming.

Nutrioptimizer has following options:

A) Optimization to arrive the Balanced Diet with minimal departure from Observed/Average Diet

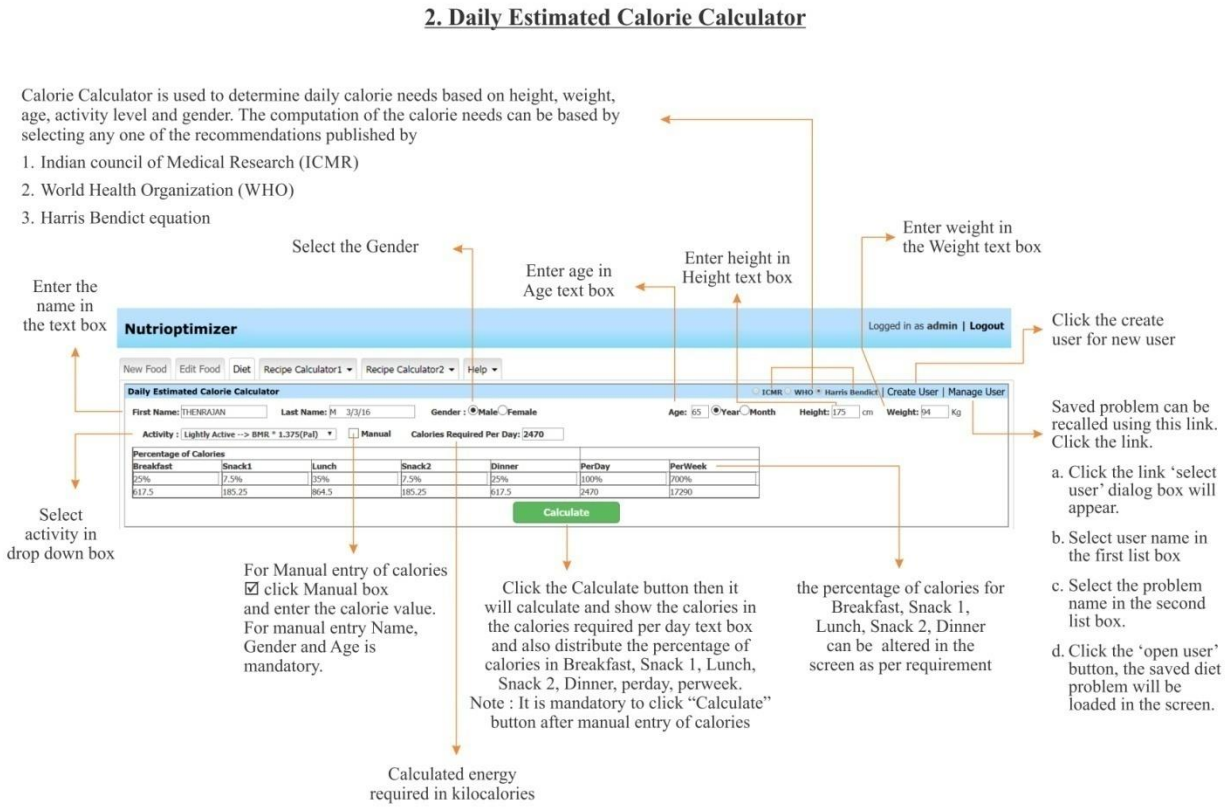
based on

1. Pyramid Food Groups recommendation
   or
2. Nutrient RDA + Pyramid Food Groups recommendation
   or
3. Nutrient RDA

B) Nutrient/ Food Group analysis by the NutriAdder software to arrive at Food Names, Serving Quantities, Nutrient Values and Pyramid Food Group Values.( without optimization, just addition of nutrient values like other nutrition software ; the special feature is arriving of Pyramid Food Group values for the diet along with nutrient values).

C) Recipe calculator based on the ingredient list (Calculating nutrient values and Food Group values for Recipe/ multi-ingredient foods.
   1) Computes the total value of each nutrient in the recipe
   2) Classifies the ingredients into Pyramid Food Groups and computes the total quantity of each Pyramid food group in 100 gms. of the recipe

## 2. Daily Estimated Calorie Calculator




Introduction:

Calorie calculator is used to determine daily calorie needs based on height, weight, age, activity level and gender. The computation of the calorie needs can be based on by selecting any one of the recommendations published by

2.1 Indian Council Of Medical Research (ICMR),
2.2 World Health Organization (WHO) or
2.3 Harris Benedict Equation

The procedure for using the Calorie Calculator for each recommendation is detailed below:

### 2.1 ICMR based Calorie Calculator

1.Select "ICMR" radio button

2. Enter "First Name" and "Last Name" in the respective text boxes.

3. Select the Gender in the "Gender" box

In case of female, if relevant select “Pregnant Woman” or “ Lactating Woman” in the drop down box next to “***Female***”

4. Enter Age in “Age” text box

5. Enter height in “Height” text box

6. For age 0 – 12 month & 1 – 18 year system will display the weight automatically in Weight Text Box.

For the age above 18 years enter weight

7. Select activity level in the “Activity” dropdown box

7.1.1.If Age is selected between 0 to 12 month

No activity will be displayed in “Activity” dropdown box. (i.e. there is no need to select the activity level)

7.1.2.For Age 1- 5 years –only “Moderate Activity” is displayed in activity drop down box.

7.1.3. Select “Moderate Activity”

7.1.4. For age 6 – 18 years three activity levels are displayed i.e.

a) Sedentary Activity

b) Moderate Activity

c) Heavy Activity

For age above 18 three activity levels are displayed i.e.

a) Sedentary work

b) Moderate work

c) Heavy work

Select the appropriate activity level

8. Click the “Calculate” button then user can see the “Calorie value” in the “Calories required per day” text box.

The “Percentage of Calories” table appears displaying the default values in the respective column for “Breakfast”, “Snack 1”, “Lunch”, “Snack2”, “Dinner”, “Per day”, and “Per week”.

The percentage of calories displayed on the screen for “Breakfast”, “Snack 1”, “Lunch”, “Snack2”, “Dinner” can be altered by the user as per the requirement.

**2.2 WHO based Calorie Calculator**

1. Select “WHO” radio button
2. Enter first name and last name in respective text boxes “First Name” and “Last Name”
3. Select the “Gender”
   In the dropdown box next to “Female” if relevant select “Pregnant Woman” or Lactating Woman”
4. Enter Age in “Age” text Box
5. Enter “Height”
6. For age 0 – 12 month & 1 – 18 year ; system will display the weight automatically in Weight Text Box.
   For the age above 18 enter weight

7. Select activity level in the “Activity” dropdown box

7.1.1. If Age is selected between 0 to 12 month

No activity will be displayed in “Activity” dropdown box. (i.e. there is no need to select the activity level)

7.1.2. For Age 1- 5 years –only “Moderate Activity” is displayed in activity drop down box.

7.1.3. Select “Moderate Activity”

7.1.4. For age 6 – 18 years three activity levels are displayed i.e.

a) Light Activity

b) Moderate Activity

c) Heavy Activity

7.1.5. For age above 18 years six activity levels are displayed i.e.

a) Sedentary

b) Lightly Active

C) Active

d) Moderately Active

e) Vigorous Active

f) Vigorously Active

Select the appropriate activity level

8. Click the “Calculate” button then user can see the “Calorie value” in the “Calories required per day” text box.

The “Percentage of Calories” table appears displaying the default values in the respective column for “ Breakfast”, “Snack 1” , “Lunch” , “Snack2”, “Dinner” , “Per day” , and “Per week”

The percentage of calories displayed on the screen for “ Breakfast”, “Snack 1” , “Lunch” , “Snack2”, “Dinner” can be altered by the user as per the requirement.

**2.3 Harris Benedict Equation based Calorie Calculator**

1. Select “Harris Benedict” radio button
2. Enter first name and last name in respective text boxes “First Name” and “Last Name”
3. Select the “Gender”
4. In the dropdown box next to “Female” if relevant select “Pregnant Woman” or Lactating Woman”
5. Enter Age in “Age” text Box

   For Age 0-3 years, normally Harris Benedict Equation is not used.

   For 3 to 70 years only Harris Benedict Equation used..

6. Enter “Height”

7. Enter the “Weight”.

8. Select Activity level in the activity dropdown box.

   1. Sedentary

   2. Lightly Active

   3. Moderately Active

   4. Very Active

   5. Extremely Active

Click the “Calculate” button then user can see the “Calorie value” in the “Calories required per day” text box.

The “Percentage of Calories” table appears displaying the default values in the respective column for “Breakfast”, “Snack 1” , “Lunch” , “Snack2”, “Dinner” , “Per day” , and “Per week”

The percentage of calories displayed on the screen for “Breakfast”, “Snack 1”, “Lunch”, “Snack2”, “Dinner” can be altered by the user as per the requirement.

### 2.4 Manual setting of calories

Click the check box “Manual”, then enter the required calorie values in the “Calories required Per day” text box. It is mandatory to click “Calculate” button after the manual entry of calories.

Note: For using the “Manual” mode, data entry in text boxes of “Age, Gender, First Name and Last Name” and selection of any one of “ICMR, WHO, Harris Benedict” are mandatory for appropriate display of nutrient values in RDA Table.

**3 Selecting the parameter to be optimized**

From the RDA table user can see the tab for "Breakfast,Snack1,Lunch,Snack2,Dinner, Per Day, Per Week".

Decide which is to be optimized by selecting anyone of "Breakfast/Lunch/Dinner/Per Day/Per Week". If per day is selected for optimization click on 'Per Day'. According to the selection by default the calorie values and nutrient values will be displayed in the RDA table.

**4. Cost constraint**

Above the RDA table user can see the cost constraint selection option. By default “Cost” is not selected, if cost is to be included as a constraint, click on check box and enter the cost range and also enter the price for the selected foods.

**5. Weight constraints**

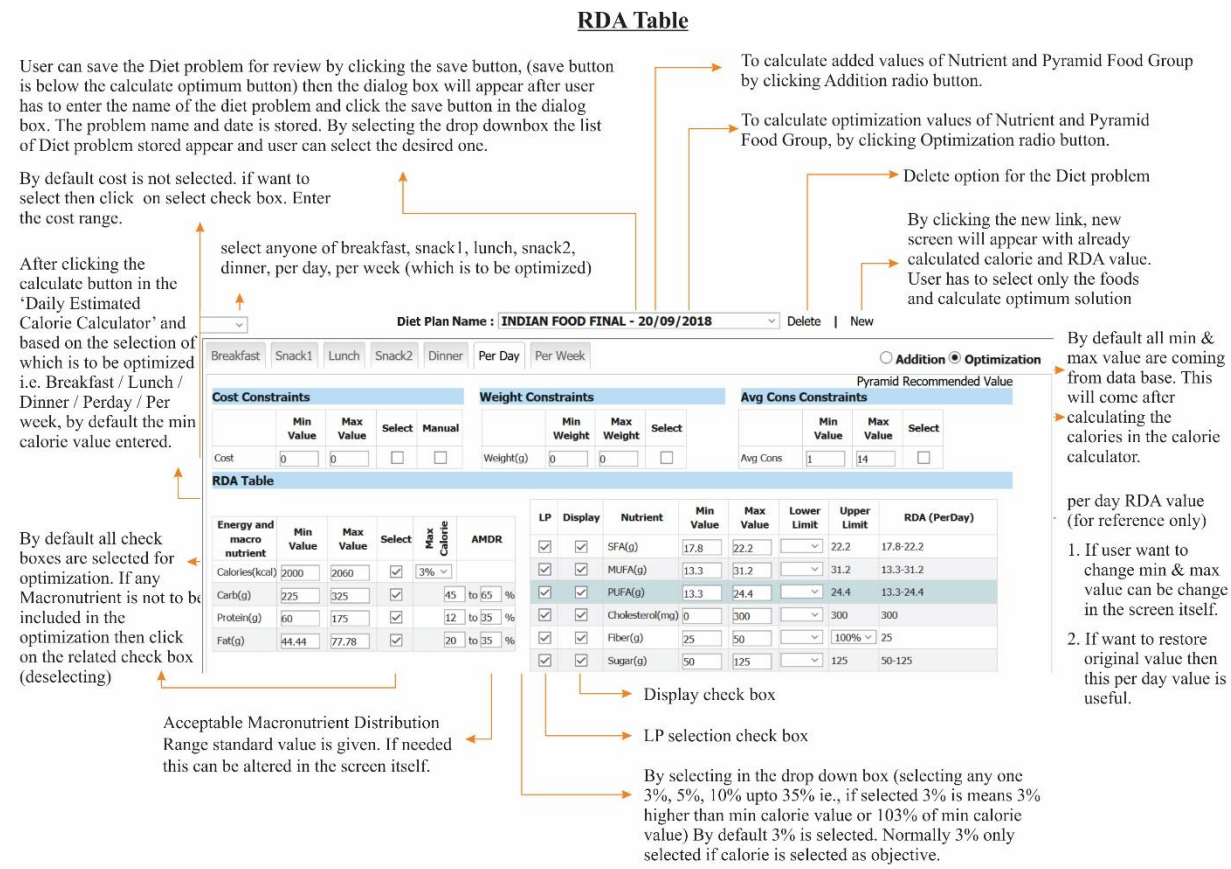
Above the RDA table user can see the Weight Constraint option. For design of Food Based Formulation weight constraints i.e. total weight of all ingredients in the formulations is one of the constraints.

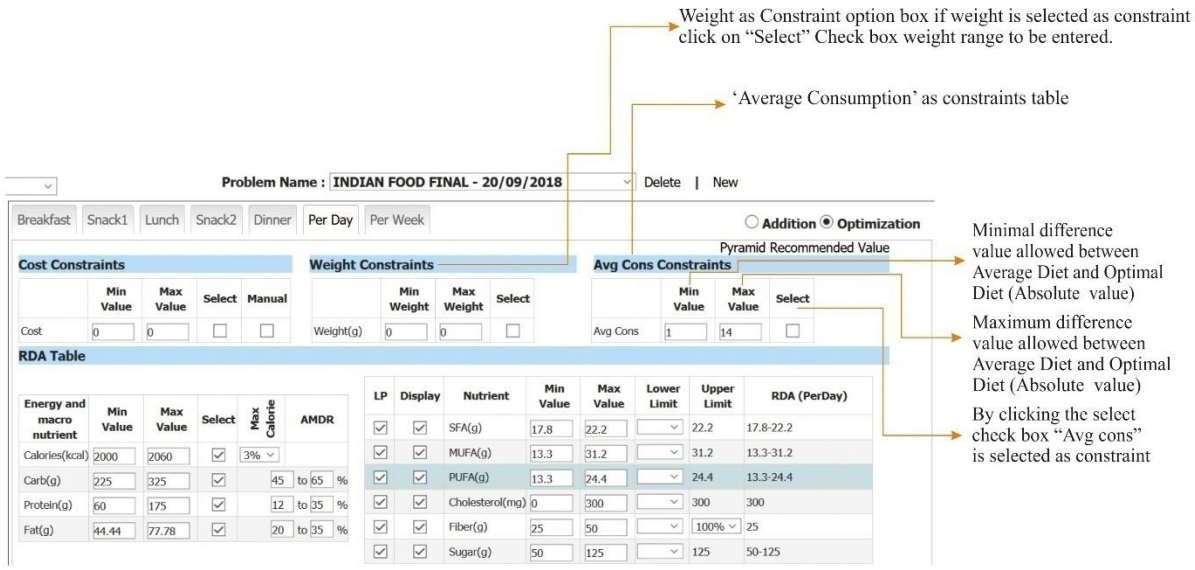
If weight is to be included as constraint click on ‘Select’ check box and enter the Min weight & Max weight in the text boxes.

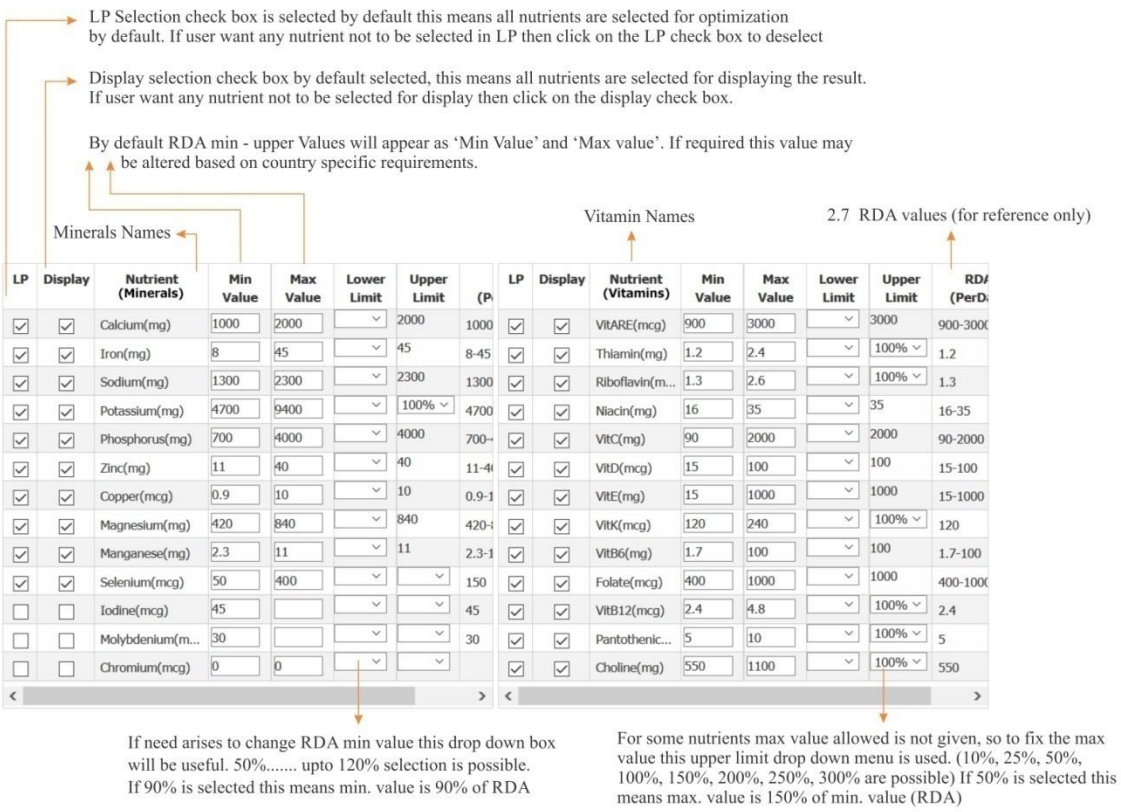
**6. Average Consumption Constraint**

Above the RDA table user can see the “Avg cons” (Average Consumption Constraint) box. If Calorie or any one of the Macro and Micro Nutrients is to be selected as the objective then user can select “Avg Cons” as constraint. Click on the “Select” checkbox to include “Avg Cons” as constraint and enter the Min & Max sum of the difference between Observed/Average Diet and Optimum Diet.

# 7. RDA table


RDA Table
User can save the Diet problem for review by clicking the save button, (save button is below the calculate optimum button) then the dialog box will appear after user has to enter the name of the diet problem and click the save button in the dialog box. The problem name and date is stored. By selecting the drop downbox the list of Diet problem stored appear and user can select the desired one.
To calculate added values of Nutrient and Pyramid Food Group by clicking Addition radio button.
To calculate optimization values of Nutrient and Pyramid Food Group, by clicking Optimization radio button.
Delete option for the Diet problem
By default cost is not selected. if want to select then click on select check box. Enter the cost range.
By clicking the new link, new screen will appear with already calculated calorie and RDA value. User has to select only the foods and calculate optimum solution
select anyone of breakfast, snack1, lunch, snack2, dinner, per day, per week (which is to be optimized)
After clicking the calculate button in the 'Daily Estimated Calorie Calculator' and based on the selection of which is to be optimized i.e. Breakfast / Lunch / Dinner / Perday / Per week, by default the min calorie value entered.
Diet Plan Name : INDIAN FOOD FINAL - 20/09/2018
Delete | New
Breakfast Snack1 Lunch Snack2 Dinner Per Day Per Week
Addition Optimization
Pyramid Recommended Value
Cost Constraints
Weight Constraints
Avg Cons Constraints
RDA Table
By default all min & max value are coming from data base. This will come after calculating the calories in the calorie calculator.
per day RDA value (for reference only)
1. If user want to change min & max value can be change in the screen itself.
2. If want to restore original value then this per day value is useful.
By default all check boxes are selected for optimization. If any Macronutrient is not to be included in the optimization then click on the related check box (deselecting)
Acceptable Macronutrient Distribution Range standard value is given. If needed this can be altered in the screen itself.
Display check box
LP selection check box
By selecting in the drop down box (selecting any one 3%, 5%, 10% upto 35% ie., if selected 3% is means 3% higher than min calorie value or 103% of min calorie value) By default 3% is selected. Normally 3% only selected if calorie is selected as objective.


Weight as Constraint option box if weight is selected as constraint click on "Select" Check box weight range to be entered.
'Average Consumption' as constraints table
Problem Name : INDIAN FOOD FINAL - 20/09/2018
Delete | New
Breakfast Snack1 Lunch Snack2 Dinner Per Day Per Week
Addition Optimization
Pyramid Recommended Value
Cost Constraints
Weight Constraints
Avg Cons Constraints
RDA Table
Minimal difference value allowed between Average Diet and Optimal Diet (Absolute value)
Maximum difference value allowed between Average Diet and Optimal Diet (Absolute value)
By clicking the select check box "Avg cons" is selected as constraint




By default all the minimum and maximum values in the RDA are taken from the Databaseand displayed in the RDA table after calculating the calories in the calorie calculator.

## RDA values for Macro & Micro nutrients

### 7.1 Kilocalorie values

Based on the selection at **2. Daily Estimated Calorie Calculator** ( Breakfast, Lunch ...etc. ) the required "Minimum value" of calorie is displayed in the RDA table.

The "minimum value" of calorie is taken from the result given by "Daily Estimated Calorie Calculator".

### 7.2 Setting the "Maximum value" of Calories, min & max values of Macronutrients

Select the desired percentage of calories required more than the "Minimum value" using the drop down menu.(Select 3% or 5% or 10% upto 35% and if 3% selected means 3% higher than min calorie value i.e., 103% of min calorie value. By default 3% is selected. Normally 3% or 5% is enough for optimization.)

By default the three macronutrient min & max values in 'Grams' are calculated as per the AMDR's min and max percentages. "AMDR min and max percentages" displayed by default.

As per country wise the AMDR will vary, so the percentage changing option is given in the screen itself. The percentage can be changed for country wise variation.

By default all the computed values of macronutrients, minerals and vitamins, SFA, MUFA, PUFA, Cholesterol, fiber, sugar will appear on the RDA table, after calculating kilocalories in Daily Estimated Calorie Calculator.

**7.3 Setting "Upper limit"**

1. Fiber
2. Potassium
3. Thiamin
4. Riboflavin
5. Vitamin K
6. Vitamin B12
7. Pantothenic acid
8. Choline

For above nutrients upper limit value allowed is not given by RDA standards,( Adequate intake only given ) so for fixing the max value the 'upper limit dropdown box' is used i.e. from any one 10%, 25%, 50%, 100%, 150%, 200%, 250%, 300% is selected. Normally by default 100% more than RDA min value is selected. (i.e. 200% of RDA min value)

**7.4 Setting "Minimum value" of micronutrients if needed**

To allow changing of the "Minimum value" of micronutrients based on country specific RDA an option is provided to alter the value in the Minimum value cell of each micronutrient.

If need arises to change RDA min value this dropdown box will also be useful. From 50% to 120% selection is possible. If 90% selected this means min value is 90% of RDA.

**7.5 RDA (Breakfast/Snack1/Lunch/Snack2/Dinner/per day/per week – Reference)**

This column displays the recommended dietary allowances for micronutrients as per US- Institute of Medicine, for reference purpose only.

RDA (Lunch) means for lunch RDA Requirement. This is fixed by the percentage for lunch calories ( i.e. 35% of per day calories). The micronutrient requirement of lunch calculated as 35% of RDA

**7.6 Inclusion in "LP" (Optimization)**

User can decide which minerals, vitamins and also SFA, MUFA, PUFA, Cholesterol, Fiber, Sugar that are to be included in the diet optimization by clicking the check box in this "LP" column. This

option helps to select all nutrients or important nutrients or required nutrients as constraints for optimization.

By default all nutrients are selected for 'LP' (i.e. optimization). If any nutrient is not needed for LP then deselect by clicking the checkbox.

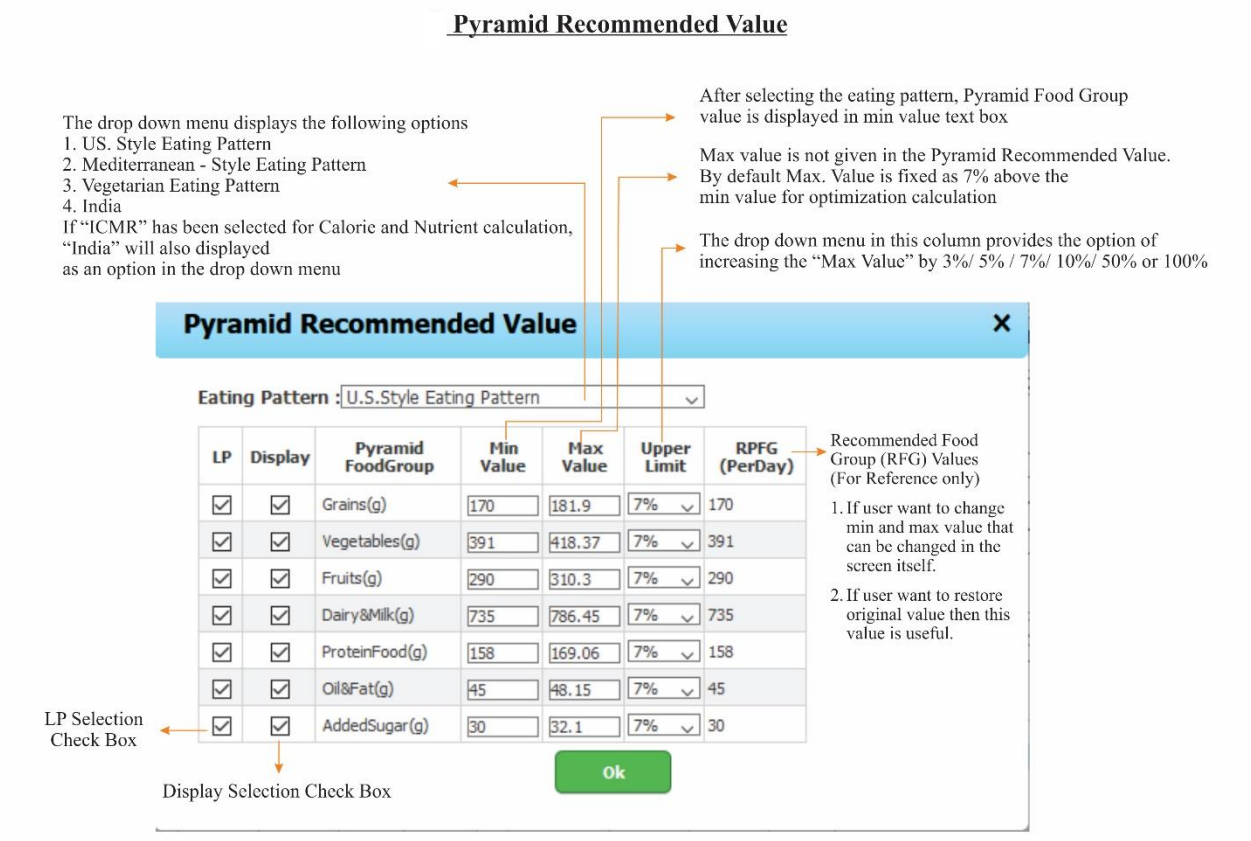
### 7.7 Selection of display

Selection of nutrients for "display" in the "Result" can be made by clicking the checkbox in the "Display" column.

By default all nutrient are selected for display.

**Note:** Display of all nutrients is possible even if only few nutrients are chosen for "LP".

## 8.Pyramid Recommended Value




Eating an appropriate mix of foods from the food groups and subgroups within an appropriate calorie level is important to promote health. Each of the food groups and their subgroups provides an array of nutrients, and the amounts recommended reflect eating patterns that have been associated with positive health outcomes. Foods from all of the food groups should be eaten in nutrient-dense forms. Food group recommended values have been taken from Indian guidelines (National Institute of Nutrition) and Dietary Guidelines for Americans -2015-2020(USDA).

As American guidelines for Food Group values, given in ounce/cup equivalents, have been converted into grams.

The USDA Food Patterns are designed to meet food group and nutrient recommendations while staying within calorie needs. To achieve this goal, the Patterns are based on consuming foods in their nutrient-dense forms (i.e., without added sugars and in the leanest and lowest fat forms). For nearly all calorie levels, most of the calories in the USDA Food Patterns are needed for nutrient-dense food choices, and only a limited number remain for other uses. These calories are indicated in the USDA Food Patterns as "limits on calories for other uses." In Nutrioptimizer the "Limit on Calories for Other Uses" have been allocated as 45% of calories from added sugars and 55% of calories from

solid fats. So instead of “Limit on Calorie for the other uses”, the limit on Added Sugar & Limit on Solid Fat is given in the software.

The major Pyramid Food Groups (1. Grains, 2. Vegetables, 3. Fruits, 4. Dairy & Milk 5. Protein Food, 6. Oil & Fat, 7. Added Sugar) are included in the Nutrioptimizer 1. Pyramid Food Subgroups are not included in the software.

The “Pyramid Recommended Value” link is displayed above the “Weight Constraints” table.

On selecting the link “Pyramid Recommended Value” a table will be displayed.

Pyramid Recommended Value Table gives the option for changing the Min & Max value of each Pyramid Recommended Food Group. This option will be useful for including slight changes that may be required due to cup to gram conversion errors or for changes related to country / region.

In that table user can see the “Eating Pattern” dropdown box.

The drop down menu displays the following options:

- US Style Eating Pattern
- Mediterranean – Style Eating Pattern
- Vegetarian Eating Pattern

- If “ICMR” has been selected for Calorie & Nutrient Calculation, “India” will also displayed as an option in the drop down menu

### 8.1 Pyramid Food Groups

The “Pyramid Food Groups” are:

1. Grains
2. Vegetables
3. Fruits
4. Dairy & Milk
5. Protein Food
6. Oil & Fat
7. Added Sugar

### 8.2 Min Value

The Pyramid food group value is displayed in grams under this column based on the chosen guide lines ( India / US Style Eating Pattern/ Mediterranean – Style Eating Pattern / Vegetarian Eating Pattern).In any other country wise Pyramid food group value variations the values can be modified on the screen itself.

### 8.3 Max Value

For optimization only the Max value is required. All India, USDA food Guidelines give the minimum value only.

Under this column the 107 % of “Min Value” is displayed by default. This value can be altered by selecting any other option in “Upper Limit” drop down menu. In relaxation methods (LP1, LP2, LP3, LP4, LP5) Food Group values are relaxed automatically.

For “Autoiterate”&“No High relaxation method” select 50% more than the guidelines to get the first result. Based on this result reduce the upper limit step by step to 3%. An option is also available to enter any preferred “Max value” directly on the screen itself.

### 8.4 Upper Limit

The drop down menu in this column provides the option of increasing the “Max Value” by 3% / 5% / 7% / 10% / 50% or 100% of “Min value”.

### 8.5 PRFG (Per day)

This column displays the ‘Pyramid Recommended Food Group values’. This serves as a reference in cases where the option for changing “Min Value” of the food group value has been used.

### 8.6 LP Selection Option

By default all Pyramid Food Group are selected for “LP” ( i.e. Optimization)

User can decide which Pyramid Food Group are to be excluded in the Pyramid optimization by deselecting the checkbox in this “LP” Column.

### 8.7 Display

By default all the Pyramid Food Group are selected for display

Deselecting a Pyramid Food Group for “Display” in the “Optimal Solution Result” can be made by clicking the check box in the “Display” Column

### 8.8 Pyramid Food Subgroups:

Pyramid Food Sub Groups are not included in the software. But while selecting the foods for optimization user is advised to consider subgroups; and according to the Guideline recommendation for the Subgroups, the foods have to be selected. Then only the nutrient constraints will be satisfied. For example the vegetables group (US Guidelines) has five subgroups i.e. 1 Dark Green vegetables, 2. Red and Orange vegetables, 3. Legumes (Beans and Peas), 4. Starch Vegetables, 5 Other Vegetables. Recommended subgroup values are given in the US Dietary Guidelines. Though not

included in our software user has to select foods & their quantity considering the Dietary Guideline values of Sub Groups. Then only the nutrients values can be achieved.

For the following Food Groups the Sub Groups are given below for U. S Guidelines :-

Food Group – Grains :

Sub Groups are 1. Whole Grains

2. Refined Grains

Food Group – Vegetables :

Sub Groups are 1. Dark Green Vegetable

2. Red & Orange Vegetables

3. Legumes ( Beans & Peas )

4. Starch Vegetables

5. Other Vegetables

Food Group – Protein Foods :

Sub Groups are 1. Sea Food

2. Meats, Poultry, Eggs

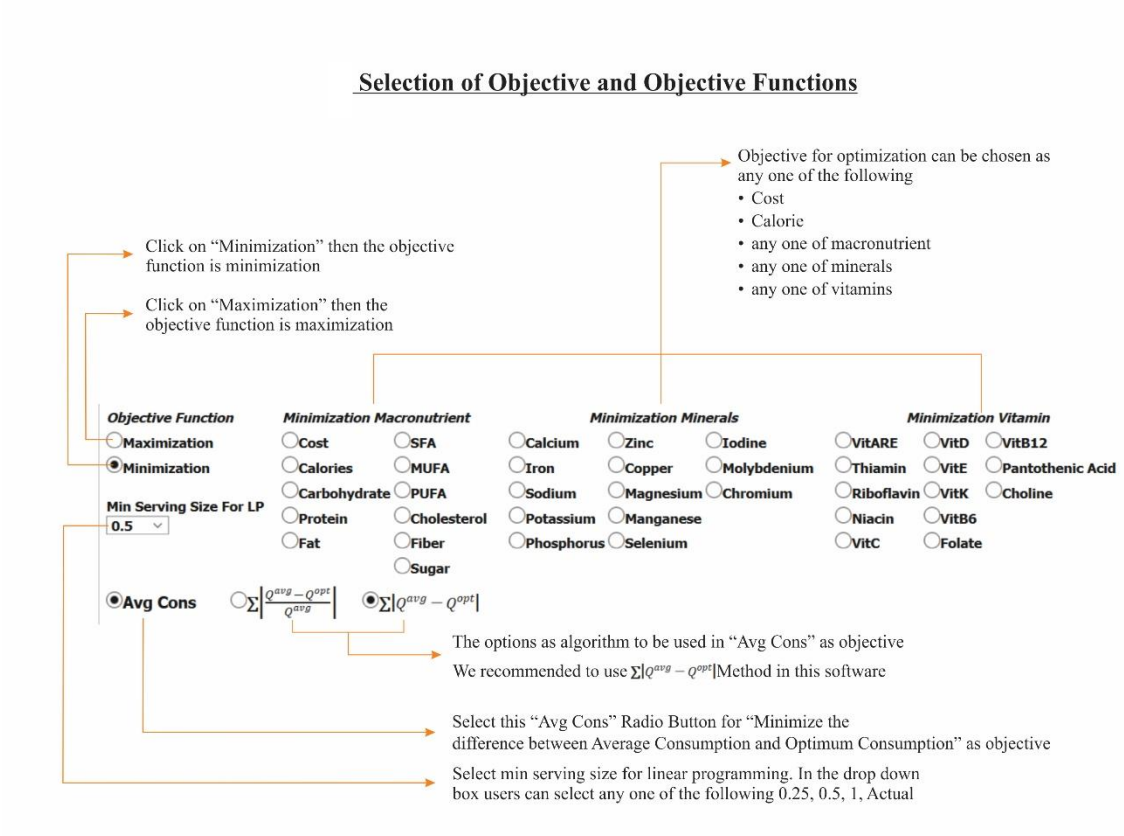
3. Nuts, /seeds, Soy Products

Indian Dietary Guidelines :

The names of the Food Group :

1. Cereals & Millets [ In this software as “Grains” ]
2. Pulses [ In this software as “Proteins Food”]
3. Milk & Milk Products [ In this software as “Dairy & Milk” ]
4. Roots & Tuber [ As Sub Group of “Vegetables” ]
5. Green Leafy Vegetables [ As Sub Group of “Vegetables” ]
6. Other Vegetables [ As Sub Group of “Vegetables” ]
7. Fruits [ As “Fruits” ]

## 9. Selection of Objective and Objective functions.




Normally in optimizing diet the "Objective function" has to be decided i.e.

1. Minimization
2. Maximization

9.1 Click on Minimization --- the objective function selected is Minimization
or
Click on Maximization --- the objective function selected is Maximization

9.2 Selection of objective to be optimized

Any one of the following can be chosen as objective for optimization

a) Minimal departure from Observed/Average consumption
b) Cost or
c) Calories or

d) Any one of the

- Macronutrients
- Minerals
- vitamins

**Note:**

1. If Observed/Average diet is available then user can select as minimal departure from Observed/Average diet as Objective or Constraint.

2. User can select Calorie or Cost also as objective for optimization. In special cases only any one of the Macro & Micro Nutrient is selected as objective for optimization.

3. For clinical use anyone Macronutrient/Minerals/Vitamins may be selected as objective for optimization.

**9.3 The Minimal Departure between Average Diet and Optimized Diet as Objective :-**

The some of the absolute values of the difference between serving Number of each food in the average consumption and the serving Number of that Food in the Optimized Diet is to be minimized.

9.3.1 Click on (Radio Button) "Avg Cons" to select Minimal Departure from Observed / Average Consumption as Objective.

Two options for "Avg Cons" are given.

They are (1) $\Sigma \left| \frac{Q^{avg} - Q^{opt}}{Q^{avg}} \right|$, (2) $\Sigma \left| Q^{avg} - Q^{opt} \right|$

Any one of these options / algorithms is to be selected when "Avg Cons" as Objective.

We recommend to use $\Sigma \left| Q^{avg} - Q^{opt} \right|$ in this software.

So $\Sigma \left| Q^{avg} - Q^{opt} \right|$ is Auto Selected .

9.3.2 For Details about the best algorithm refer Appendix 1.

If "Avg Cons" is selected as Objective, then the Objective function is to be selected as "Minimization" only.

9.4 For Cost, Calories or any one Macro and Micro nutrients user can select "Min" or "Max" as "Objective Functions". For example if "Min" is selected as "Objective Function" and "Calorie" is selected as Objective then "Minimization of Calorie" is the Objective in the Optimization of Diet.

**9.5 Selection of "Cost", "Weight", "Avg Cons" as Constraints :**

**Cost as Constraint :**

Above the RDA table user can see the cost constraint selection option. By default “Cost” is not selected, if cost is to be included as a constraint, click on check box and enter the cost range and also enter the price for the selected foods.

**Weight constraints:**

Above the RDA table user can see the Weight Constraint option. For design of Food Based Formulation weight constraints i.e. total weight of all ingredients in the formulations is one of the constraints.

If weight is to be included as constraint click on ‘Select’ check box and enter the Min weight & Max weight in the text boxes.

**Average Consumption Constraint**

Above the RDA table user can see the “Avg cons” (Average Consumption Constraint) box. If Calorie or any one of the Macro and Micro Nutrients is to be selected as the objective then user can select “Avg Cons” as constraint. Click on the “Select” checkbox to include “Avg Cons” as constraint and enter the Min & Max sum of the difference between Observed/Average Diet and Optimum Diet.

9.6. Selection of Min serving size for LP :Using the dropdown box select any one of the following 0.25/0.5/1/Actual.

Note :Normally '0.5' or '1' as min serving sizes is selected to get the best result. In optimization because of so much constraints the result may not come. Then user can select "0.25" or Actual to get a reasonable solution to identify the problem nutrients. Then improve the solution by adding problem nutrient rich food and also by selecting "0.5" or "1" as min serving sizes.

## 10. Selection of Food Database, Selection of Food and transfer to Food Choice Table

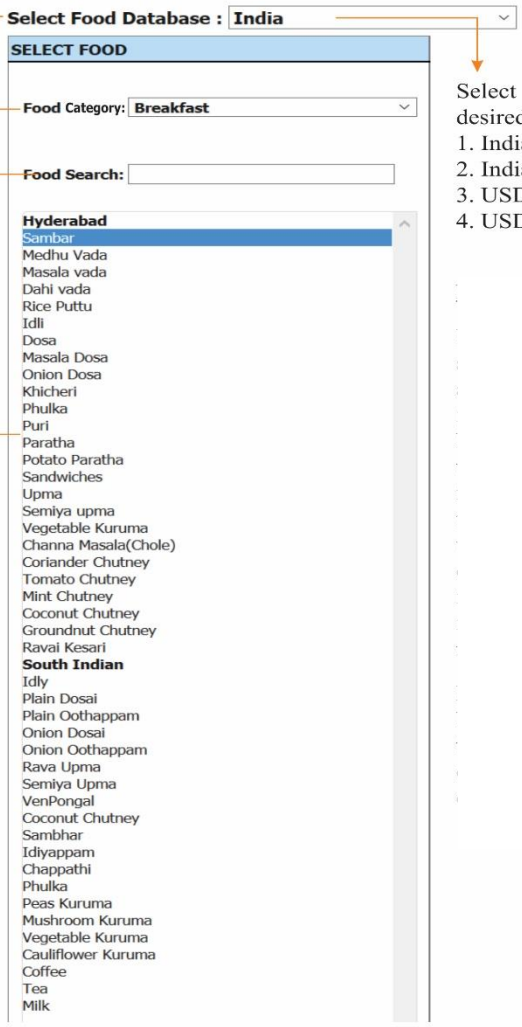
**Select Food Database and Selection of Food and Transfer to Food Choice Table**

Food data base selection

**Food Category**
Select food group first. After selecting the food group food names are displayed

**Food Search**
Enter the food name and click "Enter" button then the name will appear in the food name list

From Food name list select (by clicking) and transfer (by right clicking) to the food choice table (see the manual for detailed explanation)




Select from the drop down box desired food data base from
1. India
2. India Raw
3. USDA Raw
4. USDA with FPID

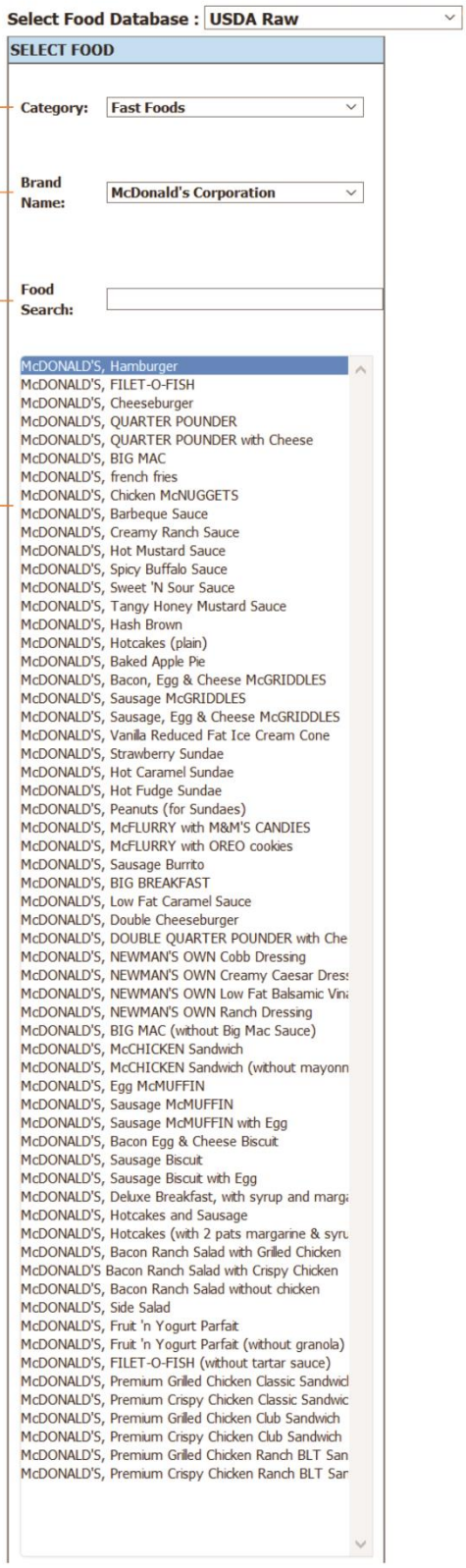
# Select Food USDA

**Category** :
Select the category name from the category name menu list

**Brand Name** :
If Brand Name is there for that category name user can select the Branded Name (i.e, the manufacturer name.)

**Food Search**
Enter the food name and click "Enter" button then the name will appear in the food name list

From Food name list select (by clicking) and transfer (by right clicking) to the food choice table (see the manual for detailed explanation)



### 10.1 Select Food Database

Select preferred Food Database from the drop down menu:

1) India
   Note: This data is for Foods (Multi ingredient Foods / Normal Foods).
   This data includes Nutrients and Food Groups
   The food group values & nutrient values for the various Indian foods existing in the data base have been computed based on custom ingredients using Recipe Calculator 1. The ingredients included for each of the foods can be reviewed by using 'Recipe Calculator 1'
   In case user is not satisfied with this ingredients, using Recipe Calculator 2 food group & nutrient values can be arrived at based on the revised ingredients list.
   Facility to edit ingredients using Recipe Calculator 1'does not exist.

2) USDA SR28

   Note – Nutrients only

3) India – Raw

   Note – Nutrients & Food Group values

   Under the "Indian Raw" option the "Category" drop down lists only basic foods (assigned to Pyramid food groups)

4) USDA with FPID

   *Note: USDA with FPID includes Food Groups & Sub Groups. In our database only major food group values are included (the sub group values are not included). The Cup equivalent and ounce equivalent have been converted into grams (conversion of cup equivalent is approximate because for Fruits &Vegetables density varies for each variety. So for some Fruits & Vegetables approximate values are taken). For accurate results it is preferable to use Pyramid food group data derived from Recipe calculator*

A custom Data base which includes Nutrient and Pyramid Food group values can be built using the Recipe Calculator.

Food database from any other source which contains Nutrient and Pyramid Food groups can be added using the "New Food" tab at the top of the screen.

If any essential Food Database is to be included in the Software Database and that is in "Excel Format" user has to rearrange in the "Excel Format" as per Nutrioptimizer Database Format then user can import the Datas and Store under different heading. These Food Data can be used for optimization.

### 10.2 Select the food category for India

Select food group combo box first then the food group food names are displayed, (Breakfast, Lunch, Dinner, Snacks, Supplementary food, Fruits, Leafy vegetables). From Food Group names select the needed one. After selecting the food group name the food list is displayed in the food list box.

### 10.3 Select the food 'Category' for USDA SR28

Select food category combo box first then the food category names are displayed. From the category name select the needed one and the food list is displayed in food list box.

### 10.4 Select the Brand name for USDA SR 28and Database

Select the Brand name combo box first and then Brand names are displayed. Select the needed one then all food names under the Brand name will be displayed in the Food list box.

### 10.5 Food search

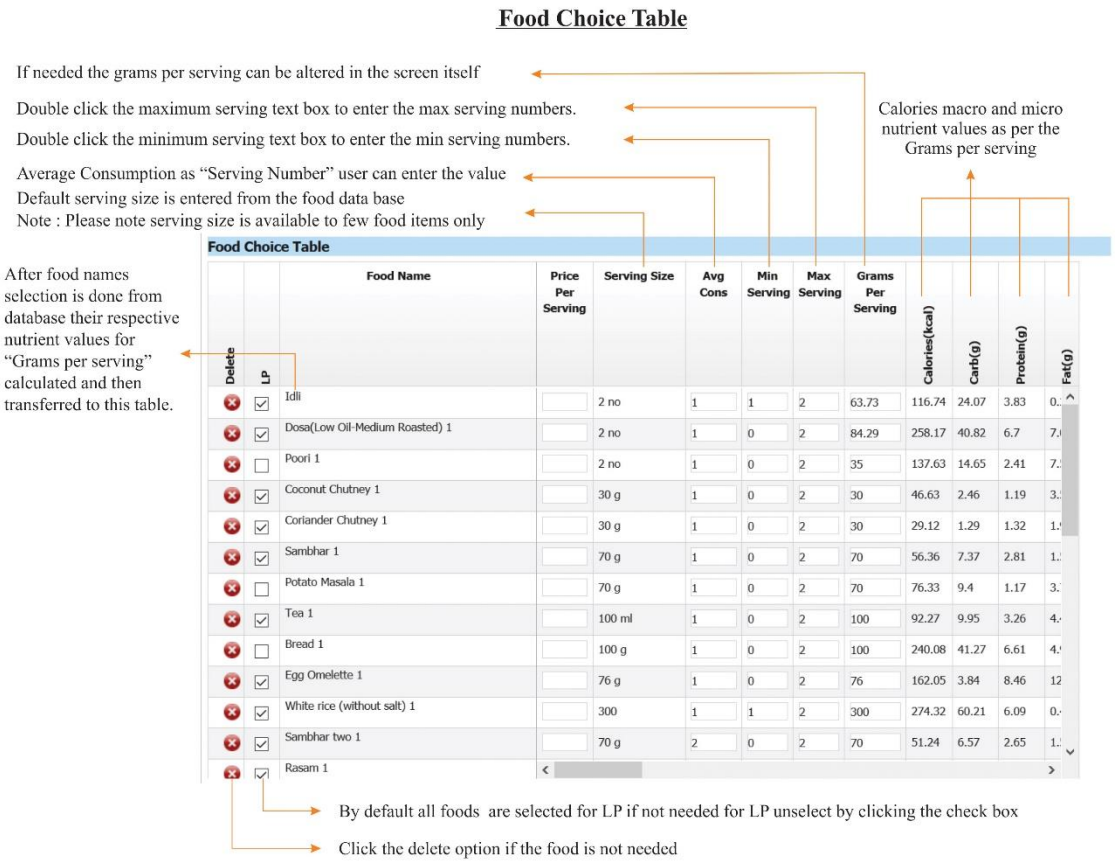
If needed select food search, enter the food name (as Press “Enter” button in the Key Board) and the name will appear in the food name list.

### 10.6 Select the food

After selection of the food, from the food name list then right click on "food", a menu box will display "Add to breakfast", "Add to lunch", "Add to dinner", "Add to snack1", "Add to snack2", "Add to per day', and "Add to per week".

Suppose we are optimizing for "per week basis" then click the "add to per week". The Food chosen, the grams per serving and the Nutrient values and Pyramid Food Group values are transferred to the "Food choice table" from the database. (If the foods are transferred from USDA database the user have to enter the grams per serving; for Indian foods the grams per serving already given; for any change user can edit in grams per serving text box.)

# 11.FOOD CHOICE TABLE




| Delete | LP | Food Name | Price Per Serving | Serving Size | Avg Cons | Min Serving | Max Serving | Grams Per Serving | Calories(kcal) | Carb(g) | Protein(g) | Fat(g) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ☑ | Idli | | 2 no | 1 | 1 | 2 | 63.73 | 116.74 | 24.07 | 3.83 | 0. |
| | ☑ | Dosa(Low Oil-Medium Roasted) 1 | | 2 no | 1 | 0 | 2 | 84.29 | 258.17 | 40.82 | 6.7 | 7. |
| | ☐ | Poori 1 | | 2 no | 1 | 0 | 2 | 35 | 137.63 | 14.65 | 2.41 | 7. |
| | ☑ | Coconut Chutney 1 | | 30 g | 1 | 0 | 2 | 30 | 46.63 | 2.46 | 1.19 | 3. |
| | ☑ | Coriander Chutney 1 | | 30 g | 1 | 0 | 2 | 30 | 29.12 | 1.29 | 1.32 | 1. |
| | ☑ | Sambhar 1 | | 70 g | 1 | 0 | 2 | 70 | 56.36 | 7.37 | 2.81 | 1. |
| | ☐ | Potato Masala 1 | | 70 g | 1 | 0 | 2 | 70 | 76.33 | 9.4 | 1.17 | 3. |
| | ☑ | Tea 1 | | 100 ml | 1 | 0 | 2 | 100 | 92.27 | 9.95 | 3.26 | 4. |
| | ☐ | Bread 1 | | 100 g | 1 | 0 | 2 | 100 | 240.08 | 41.27 | 6.61 | 4. |
| | ☑ | Egg Omelette 1 | | 76 g | 1 | 0 | 2 | 76 | 162.05 | 3.84 | 8.46 | 12 |
| | ☑ | White rice (without salt) 1 | | 300 | 1 | 1 | 2 | 300 | 274.32 | 60.21 | 6.09 | 0. |
| | ☑ | Sambhar two 1 | | 70 g | 2 | 0 | 2 | 70 | 51.24 | 6.57 | 2.65 | 1. |
| | ☑ | Rasam 1 | | | | | | | | | | |

Pyramid Food Group values as Grains, Vegetables, Fruits, Dairy and Milk, Protein, Oil, Solid Fat and Added Sugar values as per the Grams Per Serving

**Food Choice Table**

| Delete | LP | Food Name | VitB12(mcg) | PantothenicAcid(mg) | Choline(mg) | Pyramid FoodGroup | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Grains(g) | Vegetables(g) | Fruits(g) | Dairy&Milk(g) | Protein(g) | Oil(g) | SolidFat(g) | AddedSugar(g) |
| | ☑ | Milk without sugar | 0 | 0.34 | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 | 0 |
| | ☑ | Bread, wheat (Baked Products) | 0 | 0.06 | | | | | | | | | |
| | ☑ | Jams and preserves (Sweets) | 0 | 0 | 0.51 | | | | | | | | |
| | ☑ | Coconut Water(Miscellaneous Foods) | | 0.52 | | | | | | | | | |
| | ☑ | White rice (without salt) 1 | 0 | 0.28 | 0 | 52.02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ☑ | Vegetable Kuruma 1 | 0 | 0.11 | 0.77 | 0 | 18.39 | 0 | 0 | 0.8 | 3.12 | 0 | 0 |
| | ☑ | Rasam 1 | 0 | 0.1 | 0.09 | 0 | 29.73 | 0.85 | 0 | 0.43 | 2.5 | 0 | 0 |
| | ☑ | Milk, buttermilk, fluid, cultured, reduced fat (Dairy and Egg Products) | 0.74 | | 32 | | | | | | | | |
| | ☑ | Ponnanganni Keerai Poriyal 1 | 0 | 0.27 | 0 | 0 | 104.01 | 0 | 0 | 2.36 | 2.12 | 0 | 0 |
| | ☑ | Drumstick Poriyal 1 | 0 | 0.28 | 0 | 0 | 44.66 | 0 | 0 | 13.96 | 1.49 | 0 | 0 |
| | ☐ | Chicken Boneless Two 1 | 0 | 0.73 | 0.41 | 0 | 0 | 4.3 | 0 | 65.27 | 8.22 | 0 | 0 |
| | ☑ | Tatta Payaru (Kaaramani) Sundal | 0 | 0.98 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Pineapple (Ananas comosus)(Fruits) | | | | | | | | | | | |

**11.1** After all the chosen foods and their nutrient and Pyramid food group values are transferred to the food choice table, the following steps are taken

### 11.2 Serving Size

By default serving size is entered from the food database.

### 11.3 “Avg Cons”(Average Consumption) column

The Observed / Average Diet Foods are transferred to the “Food Choice Table” from the Database and the Food Quantities are to be entered in the “Avg Cons” column.

### 11.4 Minimum Serving

In the "Food Choice Table" double click the "Minimum Serving" text box to enter the minimum serving numbers.

"Minimum Serving" means minimum serving number of food mandatorily to be added to the diet. This also indicates the preferred food choice.

**Note:**
The "Minimum Serving" and "Maximum Serving" should be a equal or multiple of the number chosen in min serving size for LP (5.3) dropdown menu.

### 11.5 Maximum Serving

In the "Food Choice Table" double click the "Maximum Serving" text box to enter the maximum serving numbers.

"Maximum Serving" means the maximum serving number of food to be added to the diet. This also indicates the maximum number of serving that can be consumed.

In case "USDA SR 28"/ "USDA with FPID" is chosen in (6.1) then value for "Grams Per Serving" is to be entered for the food chosen.

**Note:**

a. Without filling the "Maximum Serving" and "Minimum Serving" text box for all foods selected, the optimization will not work.
b. The nutrient values are displayed based on the value in the " Grams Per Serving " column. It is mandatory to have " Grams Per Serving " value for the nutrient values to be displayed.

### 11.6 Modifying "Grams Per Serving"

Grams per serving of each "Food Names" can be modified by entering the desired value in the respective "Grams Per Serving" text box.

### 11.7 Selection for LP

By default all foods are selected for LP if not needed for LP unselect by clicking the checkbox. More than 75 Foods can be transferred to this Food Choice Table and because of this “Selection for LP” option the required food can be selected in the Food Choice Table. So every time transfer from Food Database is not needed. Diet Planning by utilizing the Foods in the “ Food Choice Table” only then the time taken for getting Diet Plan is minimized.

### 11.8 Delete the food

Click the delete option if the food is not needed.

**NOTE: It is mandatory for all foods chosen to have the Food Group Values if Food Groups are selected for optimization.**

# 12. Added Food Value Table

Added food value table

## Added Food Value Table

Added food nutrient value table is given to confirm that sufficient foods are added for enabling linear programming.

It is just addition of food values for perserving, per min serving and for per max serving.

The total values for min serving, max serving are given and their percentage to RDA values are given. This will help to analyze infeasible problems.

Nutrient Names

"Average Consumption" Calorie Value for each food

After the food name is selected and transferred to food choice table then min serving value and max serving value entered, after that the same food name with per serving value, min serving value, max serving value for all nutrient values are transferred to this table by default

**Added Food Value Table**

| Food Name | Calories(kcal) | | | | | Carb(g) | | | Protein(g) | | | Fat(g) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Avg Cons | | Per Serving | Min Serving | Max Serving | Per Serving | Min Serving | Max Serving | Per Serving | Min Serving | Max Serving | Per Serving | Min Serving | Se |
| Vegetable Kuruma | 111.77 | 111.77 | 0 | 223.54 | 4.56 | 0 | 9.12 | 1.78 | 0 | 3.56 | 9.77 | 0 | 19.5 |
| Horlicks with Milk | 247.54 | 247.54 | 0 | 247.54 | 31.21 | 0 | 31.21 | 9.49 | 0 | 9.49 | 9.51 | 0 | 9.51 |
| Yogurt, plain, low fat ... | 63 | 63 | 0 | 63 | 7.04 | 0 | 7.04 | 5.25 | 0 | 5.25 | 1.55 | 0 | 1.55 |
| Agathi Keerai Poriyal ... | 111.99 | 111.99 | 223.98 | 223.98 | 7.08 | 14.16 | 14.16 | 5.47 | 10.94 | 10.94 | 6.56 | 13.12 | 13.1 |
| Red Gram Dal (Tuavara ... | 54.84 | 54.84 | 0 | 109.68 | 8.11 | 0 | 16.22 | 3.02 | 0 | 6.04 | 0.99 | 0 | 1.98 |
| Guava, pink flesh (Psi ... | 34.95 | 34.95 | 0 | 69.9 | 6.86 | 0 | 13.72 | 0.89 | 0 | 1.78 | 0.19 | 0 | 0.38 |
| **Total For Per Day** | **2344.98** | **2020.81** | **1168.85** | **3731.08** | **293.48** | **182.62** | **548.71** | **67.65** | **40.55** | **120.56** | **60.86** | **28.06** | **110** |
| **Recommended Value (RDA - UpperValue)** | | **2200-2266** | | | | **247.5-357.5** | | | **66-192.5** | | | **48.89-85.56** | | |
| **% of RDA Satisfied / % of RPFG satisfied** | | | **53.13** % of Goal | **169.59** % of Goal | | **33.2** % of Kcal | **99.77** % of Kcal | | **7.37** % of Kcal | **21.92** % of Kcal | | **11.48** % of Kcal | **45.** % o |

Food names

RDA min and upper limit

Percentage of RDA satisfied

Total Average Consumption Calorie Values

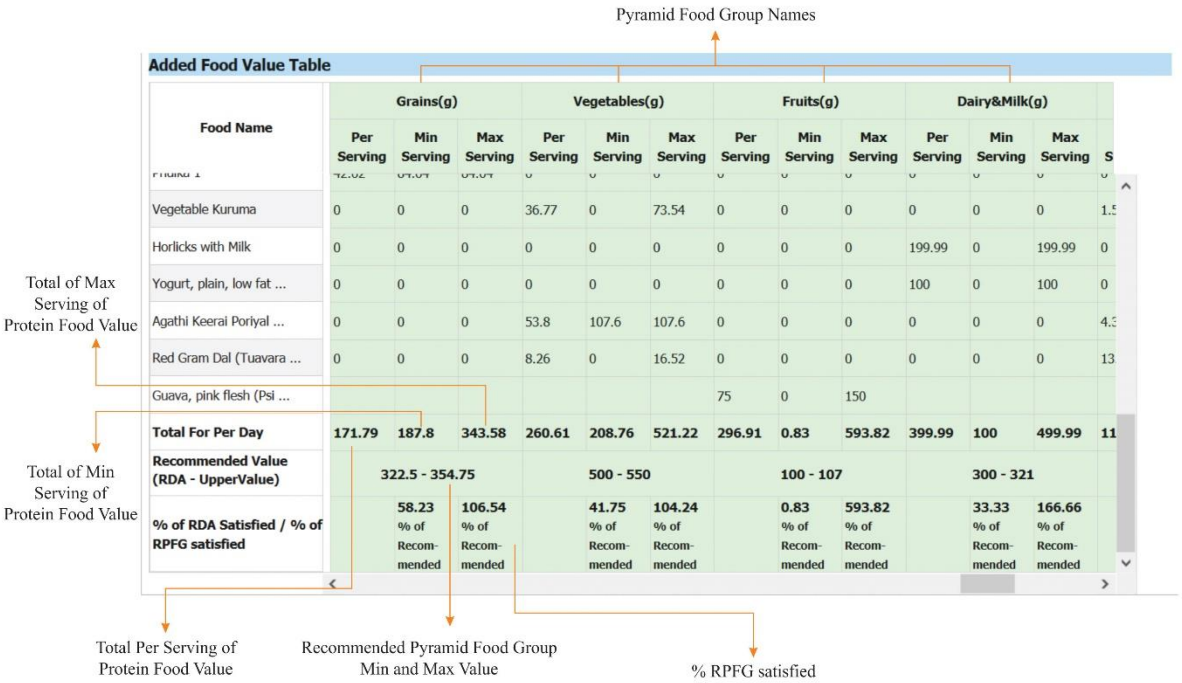
Total per serving value

Total min serving calorie value (for better optimization result, this value should be below or around 70% value of calorie requirement)

Total min serving value for all foods selected

Total max serving value for all foods selected

Total max serving calorie value (for better optimization result, this value should be above or around 130% value of calorie requirement)




12.1 Added food value table is given to confirm that sufficient foods are added for enabling optimization. This table assists us in ensuring that the targeted Diet optimization is achievable based on "Food Choice Table". This will also help in analyzing infeasible problems. As explained in "Food Choice Table"(7) the "Food Name" is selected from Database and transferred to "Food Choice Table" then "Min Serving" number and "Max Serving" number are entered. Based on the selected foods and “Avg Cons” values, "Per Serving" values, the "Min Serving" value, "Max Serving" value are calculated for calories, all Nutrients and Pyramid Food Groups (Min/Max serving number × per serving value) and transferred to this table by default.

12.2 The table displays for each food the values of “Avg cons” for Calories and "Per serving", "Min Serving" and "Max Serving" for Calories, Macro, Micronutrients and Pyramid Food Groups.

12.3 "Added Food Value Table" is just addition of food values for "Per serving", "Min serving", "Max serving".

12.4 At the bottom of the table in "Total" row the total value of Calories, Macro, Micro nutrient and Pyramid Food Groups of all the foods are displayed.

12.5 The "Recommended value" row displays "RDA min" and it's "Upper Limit".

12.6 The "% of RDA satisfied" row displays the "Total Minimum serving" and "Total Maximum Serving" as percentage of "RDA Minimum value".

12.7 This table is used to decide which food is to be added/removed in order to meet the RDA.(In the particular nutrient and Pyramid Food Group column user can see the min and max serving values for each food. User can easily identify the contribution of each food to that particular nutrient. Thus it will help to identify which food is to be changed or serving size is to be altered in the "Food Choice Table".

12.8 In case Minimal Departure from Observed/Average diet is taken as Objective or Constraint user need not consider much about the “Avg Cons” Calories and “Min”, “Max” Calories in the Added Food Value Table.

12.9 In case if “Avg Cons” is not considered for Objective or Constraint then user has to follow as per the details below

1. In case the "Total Maximum serving" calories value is below the "Minimum value" of calories in the "Recommended value" row then, either add foods or increase the value in the "Maximum Serving" option in the "Food choice table". Ensure that the "Total Maximum calorie value is about 130% or above 130% of the "Minimum Value" of calorie requirement. It is very important that the above criteria is to be met for the optimization to be feasible (i.e. A buffer for food choices should be there for optimization to select food & food quantity).

2. In case the "Total Minimum Serving" value exceeds the "Minimum Value" of calorie in the "Recommended value" row then reduce the value in "Minimum Serving" option of the "Food Choice Table". The "Minimum serving" calorie value must be about 70% or below of the "Minimum value" of calorie requirement. It is very important that the above criteria is to be met for the optimization to be feasible. (i.e. A buffer for food choices should be there for optimization to select food and food quantity)

## 13.Result Computation

**The Diet Plan can be computed using the following Optimization Methods :**

### 13.1 Optimization with Minimal Departure from Observed / Average Diet.

Options :

A. Based on Pyramid Food Groups
B. Based on Pyramid Food Groups + Nutrients
C. Based on Nutrients

### 13.2 Optimization with Chosen / Preferred Foods [ Without Minimal Departure from Observed / Average Diet ]

Options :

D. Based on Pyramid Food Groups
E. Based on Pyramid Food Groups + Nutrients
F. Based on Nutrients

For all methods click the "Calculate Optimum" button to get the solution.

In case an optimal solution is feasible the result will be displayed with as "Optimum Solution Found". This is the best possible solution where all the Constraints have been met.

If the display is "Optimum Solution is not found" then that Diet Problem is infeasible.

In optimization even if one or more Nutrient / Pyramid Food Group does not meet the RDA requirement then it is a infeasible problem.

The reason is the Current Diet / Selected Foods (For Optimization) could not meet one or some of the requirements ( i.e. RDA & Recommended Food Group Values). That is even one of the Nutrients / Food Group is not met ( like 1 % Low of RDA or 1 % Low of Recommended Food Group Values ) then also this is infeasible Diet Problem !! ( This is the real face of the Linear Programming ?? )

If user understand this then finding the Optimal Solution ( by the methods provided in "Nutrioptimizer" ) is easy for the user.

For example the Fat value is slightly higher than the RDA value ( in the Current Diet / Selected Foods ) then solution will not come. This is Infeasible Problem. For example "Iron" value is slightly lower than the RDA value ( in the Current Diet / Selected Foods ) then solution will not come. This is also a Infeasible Problem.

Normally in all Diet Problems some of Nutrients and one or two Food Group values will not satisfy with some minimum percentage Lower or Higher than the requirement. Sometimes that value is OK for Nutritionist and User. But Linear Programming says it is infeasible.

In Nutrioptimizer 32 Nutrients and 7 Pyramid Food Groups, total 39 Constraints are considered.

Satisfying 39 Constraints is real challenging Problem. So only Nutrioptimizer has "Auto Methods" to solve the infeasible problems.

**13.3 The Key features of Nutrioptimizer in solving infeasible problem follows :**

**(1) Auto Methods [ Less time consuming Methods] :**

i. Auto Constraint Elimination (Autoiterate )
ii. Constraint Relaxation Methods [ LP1, LP2, LP3, LP4, LP5 ]
iii. RDA Relaxation Method
iv. Changing option for "Serving Size for LP" ( 0.25, 0.50, 0.75, 1, Actual )

**(2) Manual Methods [ Time Consuming Method ]**

1.User can shift to Addition Software by selecting "Addition" above the RDA Table ( The Food names and Serving No. are Auto transferred for Current / Observed Diet ) Then click "Add" to get the Result Table. From the Result Table and display of VitA Low, Vit C High, Sodium High user can easily identify the Problem Nutrients / Pyramid Food Group.

Or

2. User can see the Added Food Value Table.

"In the Added Food Value Table user has to see the Min & Max Serving Total for each Nutrient / Food Group and identify the Problem Nutrients / Food Group. For a Nutrient if Max Serving Total is below the RDA, then how it is possible to satisfy the RDA. If Min Serving Total is exceeding the Max RDA then how it is possible to get result within Max RDA .

After identifying the Problem Nutrient / Food Group from the above Auto / Manual methods, those Nutrient / Food Group should not be considered for optimization. (By deselecting that Nutrient in RDA Table and deselecting Pyramid Food Group in LP Column in the Pyramid Food Group Recommended Value Table.).

From the above two tables for the Current Diet / Selected Foods user can easily identify which Nutrient / Food Group are Problem Nutrients / Food Group

After deselecting the problem Nutrients / Food Group 'Optimal Solution' can be found.

This is not the final 'Optimal Solution'

This is the first ‘Optimal Solution’ and this can be further improved (it is a must to improve the

Problem Nutrient / Food Group values to satisfy the Nutritional requirement) by Adding / Deleting / Exchanging Foods ; increasing / decreasing the Serving No. of existing foods.

This is easy in Nutrioptimizer because Food Group values are available in this Software.

For example “Grains” shortage “Grains” rich food can be added / Grains rich Food Serving No.can be increased.

Logic behind this is for a Specific Calorie requirement if we take Foods as per Dietary Guidelines (which recommends the quantity of food from each Pyramid Food Group) the RDA for Nutrients will be met. Like this “Satisfied Optimal Solution” can be obtained. “Satisfied Optimal Solution” need not to satisfy all the 39 Nutritional Constraints fully.

### 13.4 Common Procedure to follow if “Avg Cons” is considered for optimization :-

The Observed / Average Diet Foods are transferred to the “Food Choice Table” from the Database and the Food Quantities are to be entered in the “Avg Cons” Column in the Food Choice Table. For individual diet model the “Min” & “Max” Serving Numbers normally auto entered while transferring the food data to the “Food Choice Table”( for example Per Day optimization, “Min” column with “zero” and “Max” column with “2”). This option is available only when “Avg Cons” is selected as Objective. User can change the Min , Max serving Numbers as per their requirement.

For “Per week, “Min” value ‘O’ is Auto entered and for Max value three options are given in the “Max” value column 5,6,7 option is available and user can choose any option.

Note : This Auto entry option is available for when “Avg. Cons.” Is selected as Objective only. The another feature in this Software is the Minimal Departure from Observed / Average Diet i.e. , “Avg. Cons.” Can be chosen as

(1) Objective

(2) Constraint (with range)

(3) Both Objective & Constraint.( with range )

The advantage of Constraint option is user can fix the range of Minimal departure from Observed / Average Diet.

#### 13.4.1 First option “Avg. Cons.” as the Objective :-

In the first option “Avg Cons” is the Objective by selecting “Avg. Cons.” Radio Button above “Food Choice Table”. Then select one from the two algorithms given i.e. $\left|\frac{(Q^{avg}-Q^{opt})}{Q^{avg}}\right|$, $|Q^{avg}-Q^{opt}|$.

Click the Radio Button near the Algorithm. We recommend for our Software to select $|Q^{avg} - Q^{opt}|$ (so auto selected ). The Calorie, all Nutrients are as Constraints in the optimization.

### 13.4.2 Second option "Avg. Cons." as Constraint :-

In the second option "Avg. Cons." is the Constraint by selecting in the "Avg. Cons. Constraint"

Small Table. (This Table is above the RDA Table). Now "Calorie" or "Cost" or any one of the Nutrients can be selected as Objective and the remaining as Constraints.

Enter in "Min" value column as zero or required Number as min difference.

Enter in "Max" value column as the allowed max difference from Observed / Average Diet.

In this option the Optimized Diet will be within the range.

### 13.4.3 Third option "Avg. Cons." As Objective and also Constraint :-

In the third option "Avg. Cons." Is selected as Objective and to fix the range ( i.e. the difference between Average and Optimum Diet should be within this range) the "Avg. Cons." is selected as "Constraint" also. In this option the Optimized Diet will be within the range given.[ as close to the Min value in the "Avg. Cons" Table ]

Select the "Avg. Cons." Radio button and also click in the "Select" check box in the Constraint Option Table and enter the "Min" and "Max" value in the Avg. Cons. Constraint Table.

There are many options for arriving Optimal Diet. Ref 10

The procedures are explained below for every options.

## 13.5 Procedures for different options for optimization with Minimal Departure from Observed/Average Diet :

### 13.5.1 A) Optimization Based on Pyramid Food Groups ( with Minimal Departure from Observed / Average Diet )

In this option optimization is done by considering Pyramid Food Groups only.

Select "Avg. Cons." Radio Button for minimal departure as Objective

Or

Select "Avg. Cons." as Constraint by clicking the "Select" Check box and Enter the Range as Min & Max values.

Or

Select “Avg. Cons.” Radio Button as Objective and Select “Avg. Cons.” as Constraint by clicking the “Select” Check Box and Enter the Range as Min & Max values.

Select “Pyramid Optimization “ Check Box.

Deselect all the Nutrients for optimization by “Deselecting “ in the LP Column in RDA Table. ( User can select Carbohydrate, Protein & Fat only and deselect all other Nutrients to get better result.)

Click “Calculate Optimum “ Button.

If feasible, “Optimum Result Found” will be displayed.

If not feasible, “Optimum Result is Not Found” will be displayed.

For Infeasible Problem select Relaxation Method LP2 or “Autoiterate” to get the result.

Select “LP2” and “Pyramid Optimization”.

Then click “Calculate optimum” Button, user will get the result.

Refer Sec. 10. for the detailed procedure and choose the best “Near Optimal Solution”

“Autoiterate “ is constraint elimination method. In this also user will get the Result easily ( because total constraints are low i.e., below 13 ) for reasonable problem.

Select “Autoiterate”, “Pyramid optimization” and click “Calculate optimum “ Button. Compare the results from LP2 method and Autoiterate and choose the best solution.[To get a solution in “Autoiterate” the upper limit of the Recommended Food Group values can be relaxed in the “Recommended Food Group Table”].

The upper limit options are given in the “Recommended Food Group Table”.

By default 7 % is selected and user can select from the options i.e.3 %, 5 % , 7%, 10%, 50% and 100 %. select 7 % or 10 % or 50 % to get easy results in “Auto iterate”. For better result user can select 3 % or 5 % ]

This first optimal solution is not the final.

Improve the solution by Adding / Exchanging of Food Group rich Food or by altering the existing Min / Max servings of those specific Food Group rich foods.[ In the first / previous optimal solution user can easily identify the Food Group rich food in the “Result Table” . In the Result Table user can see for every food the contribution of that food for each Food Group.]

Optimize again to get a satisfactory optimal solution.

If not getting satisfactory optimal solution repeat steps given previously till final satisfactory Optimal Diet obtained.

### 13.5.2 B) Optimization Based on Pyramid Food Groups + Nutrients ( with Minimal Departure from Observed / Average Diet )

In this option , optimization is done by selecting Pyramid Food Group + All Nutrients.

By default all the Nutrients and all Pyramid Food Groups are selected for optimization.

Select “Avg. Cons.” Radio Button for minimal departure as objective.

Or

Select “Avg. Cons” Radio Button as Constraint by clicking the “Select” Check Box and

Enter the Range as Min & Max values.

Or

Select “Avg. Cons.” Radio Button, as Objective and Select “Avg. Cons.” as Constraint by clicking the “Select” Check Box, and Enter the range as Min & Max values.

By default all the Nutrients are selected as Constraints for optimization.

Select “Pyramid optimization” Check box.

Click ‘Calculate Optimum” Button. If feasible result will come.

As 39 Constraints considered for optimization mostly result may not come.

If not feasible , then select any one of the Relaxation Methods LP2, LP3, LP4 and LP5 to get the “Near Optimal Solution” ( LP3, LP4, and LP5 are fine tuning methods) select “LP2”, “Pyramid Optimization” then click “Calculate Optimum” Button.

For reasonable problem result will come. If in LP2 solution arrived then that solution can be improved by the improvement methods LP3, LP4 , LP5.

If solution is not feasible the “Optimal Solution is Not Found” message will be displayed.

Now deselect “Pyramid Optimization” then click “Calculate Optimum” Button.[ LP2 already selected ] In LP2 after getting the First Solution deselect the problem Nutrients ( i.e. it means the nutrients which are not satisfied the RDA value) and then get the “Optimal Solution”.

This “Optimal Solution” is only for the selected Nutrients.

Even though “Pyramid Food Groups” are not considered for optimization, for the quantities of foods in the Result (optimized only for Nutrients ) Pyramid Food Group values are calculated and the values are given in the Result Table and Graph is also given.

Improve the solution by Adding / Exchanging of Nutrient / Food Group rich Food or by altering the existing Min / Max servings of those specific Nutrient / Food Group rich Foods.[ In the first / previous optimal solution user can easily identify the Nutrient / Food Group rich food in the "Result Table". In the "Result Table" user can see for every food the contribution of that food for each Nutrient / Food Group ]

Select "Pyramid Food Group" for optimization and optimize again.

This iteration is to be done till final satisfactory Optimal Diet obtained.

Or

For infeasible in LP2, identify Problem Macro / Micro Nutrients from the "Added Food Table" and deselect them appropriately from the optimization ( Deselect in RDA Table)

Now click "Calculate Optimum" Button to get the "Near Optimum Solution" or "Optimal Solution"

This first optimal solution further improved as explained before to get a satisfactory optimal solution.

### 13.5.3 C) Optimization Based on Nutrients ( with Minimal Departure from Observed / Average Diet )

In this option optimization is done by considering Nutrients only [Pyramid Food Groups are not considered for optimization]

Select "Avg Cons" Radio Button for minimal Departure as Objective.

Or

Select "Avg Con" as Constraint by clicking the "Select" Check Box and Enter the range as Min, Max values.

Or

Select "Avg Cons" Radio Button, as Objective and select "Avg Cons " as Constraint by clicking the "Select" Check Box, and enter the range as Min & Max values.

As Pyramid Food Groups are not considered for optimization there is no need to select "Pyramid Optimization" check Box.

By default all the Nutrients are selected as Constraints for optimization.

Click "Calculate Optimum" Button.

If feasible "Optimum Result Found" will be displayed with the Result Table.

For Infeasible Problem select Relaxation Method LP2 and after getting the result in LP2, that result can be improved by LP3, LP4, LP5 the fine tuning Methods.

After selecting “LP2” click “Calculate Optimum” Button.

For reasonable problem Result will come.

This LP2 solution can be improved by the fine tuning methods i.e. LP3, LP4, LP5.

In LP2 or in the fine tuning methods LP3, LP4, LP5 after getting the solution deselect the Problem Nutrients ( i.e. Problem Nutrients means the nutrients which are not satisfied the RDA value) and then get the “Optimal Solution”. This “Optimal Solution” is only for the selected Nutrients.

Improve the solution by Adding / Exchanging of Nutrient / Food Group rich Food or by altering the existing Min / Max servings of those specific Nutrient / Food Group rich Foods. [ In the First / Previous optimal solution user can easily identify the Nutrient / Food Group rich Food in the “Result Table”. In the Result Table user can see for every food the contribution of that food for each Nutrient / Food Group.]

Even though “Pyramid Food Groups” are not considered for optimization, based on the quantities of foods in the Result (optimized only for Nutrients ) Pyramid Food Group values are calculated and the values are given in the Result Table and Graph is also given.

This iteration is to be done till final satisfactory Optimal Diet obtained.

Or

For infeasible Diet Problem in LP2 identify Problem Macro / Micro Nutrients from the “Added Food Table and deselect them appropriately from the optimization (Deselect in RDA Table ). Now click “Calculate Optimum” Button to get the “Optimal Solution”.

Improve the solution by adding / exchanging of Nutrient or Pyramid Food Group rich Food/ increasing / decreasing the quantity of existing Foods.

This iteration is to be done till final satisfactory Optimal Diet obtained.

To get the best result for optimizing by considering only “Nutrients”, we advise to see

whether the Food Group values are satisfied the Pyramid Food Group Recommended values.

**13.6 Optimization with Chosen / Preferred Foods [ without Minimal Departure from**

**Observed / Average Diet] :-**

The following types of problems can be solved in this method.

(1) Calorie as Objective & remaining Macro &Micro Nutrients, Cost as Constraints.

(2) Anyone of the Macro & Micro Nutrients as Objective and the remaining as Constraints

( without "Minimal Departure from Observed Diet)

In this second option the following types of optimizations are possible:

a) Carbohydrate or Protein or Fat is selected as Objective and Minimization or Maximization of the Macro Nutrients are possible i.e. Minimization of Carbohydrate or Fat or Maximization of Protein is possible.[For Fat is to be selected as Objective then select the Radio Button near "Fat" (above the Food Choice Table) and to select Objective function as minimization select "Minimization" (above the Food Choice Table)]

For example :

i. Carbohydrate Low Diet Plan from the Chosen Foods
ii. Fat Low Diet plan from the Chosen Foods
iii. SFA Low Diet Plan from the Chosen Foods
iv. PUFA High Diet Plan from the Chosen Foods
v. Fiber High Diet Plan from the Chosen Foods
vi. Protein High Diet Plan from the Chosen Foods.....etc., in total 16 options.

b) Any one of the Micro Nutrients is selected as Objective and Minimization or Maximization of the Micro Nutrients are possible

For example :

i. Folate High Diet Plan from the Chosen Foods
ii. Iron High Diet Plan from the Chosen Foods
iii. Potassium Low Diet Plan from the Chosen Foods
iv. Sodium Low Diet Plan from the Chosen Foods
v. Selenium High Diet Plan from the Chosen Foods
vi. Vit A High Diet Plan from the Chosen Foods....etc. in total 42 options

**13.6.1 Common Procedure for different options for optimization with Chosen / Preferred Foods [ without Minimal Departure from Observed / Average Diet ] :-**

In this type of optimization Average or Current Diet is not considered for optimization, instead the Chosen / Preferred Foods for the Diet Plan is considered for optimization. As usual the Food Name & Data are transferred to the "Food Choice Table". Instead of filling the "Avg Cons" column the "Min serving" column is entered with the Number of servings. 'Min Serving' number of foods means that foods are mandatorily to be included in the Diet. In "Max Serving" column the maximum number of Servings allowed in the Diet Plan can be entered.

### 13.6.2 In this method User has to follow the two instructions given below :

User must see the Min, Max Serving Calorie Total in the “Added Food Value Table”.

(1) Selected Foods’ “Min Serving” calories value total should not exceed the “Min Calorie value”

User can see the Total Calorie value in the “Added Food Value Table”. The Total Calorie value should be around 70% or below 70% of Min Calorie value.

Normally buffer food choices is needed for optimization to select the best food and food quantity from the chosen foods.

If “Min Serving Calorie value” Total is around 95 – 105 % then Linear Programming cannot do anything to improve the solution.

(2) Selected Foods’ “Max Serving” Calorie value Total should be greater than the Min Calorie value in the “Added Food value Table”. Normally for easy optimization it should be around 130 % or above 130 % of Min calorie value. Normally buffer food choice is needed for optimization to select the best food from the chosen foods.

If “Max Serving Calorie value” Total is around 100 % to 105 % then Linear Programming cannot do anything to improve the solution.

## 13.7 Procedures for different options for optimization without Minimal Departure from Observed / Average Diet :-

### 13.7.1 D) Optimization Based on Pyramid Food Groups ( without Minimal Departure from Observed / Average Diet )

Select Calorie or any one of the Macro and Micro Nutrients as objective by clicking the Radio button near the Calorie or any one of the Nutrients. ( Automatically “Avg Cons” is deselected as Objective )

Deselect “Avg Cons” as Constraint by deselecting in the “Select” Check Box of “Avg Cons Constraint” Table.

Deselect all the Nutrients for optimization by “Deselecting” in the LP column in RDA Table. ( User can select Carbohydrate, Protein and Fat only and deselect all other Nutrients to get better result.)

Select “Pyramid Optimization” Check Box.

Click “Calculate Optimum” Button.

If feasible, “Optimum Result Found” will be displayed.

For Infeasible Problem select “Relaxation Method LP2 or Auto iterate” to get the result.

Select “LP2” and “Pyramid Optimization”.

Then click “Calculate Optimum “ Button user will get the result.

Refer Sec.10 for the detailed explanation of relaxation methods and choose the best “Near Optimal Solution”.

“Autoiterate” is Constraint elimination method. In this also user will get the Result easily (because total Constraints are low i.e.13)

Select “Autoiterate”, “Pyramid Optimization” and click “Calculate Optimum” Button.

Compare the results from “LP2” method and “Autoiterate” and choose the best solution.

To get a solution in “Autoiterate” the upper limit of the Recommended Food Group can be relaxed in the Recommended Food Group Table.

The changing the upper limit options are given in the “Recommended Food Group Table”.

By default 7 % is selected and user can select from the options i.e. 3 %, 5 %, 7 %, 10 %, 50 % and 100 %. Select 7 % or 10 % or 50 % to get easy results in Autoiterate. For better result user can select 3 % or 5 %.

This first optimal solution is not the final.

Improve the solution by Adding / Exchanging of Food Group rich Food or by altering the existing Min / Max servings of those specific Food Group rich Foods. [ In the first / previous optimal solution user can easily identify the Food Group rich food in the “Result Table”. In the Result Table user can see for very food the contribution of that food for each Food Group ]

Optimize again to get a satisfactory optimal solution.

This iteration is to be done till final satisfactory Optimal Diet obtained.

### 13.7.2 E) Optimization Based on Pyramid Food Groups + Nutrients ( without Minimal Departure from Observed / Average Diet )

In this option, optimization is done by selecting Pyramid Food Group + All Nutrients.

By default all the Nutrients are selected for optimization.

Select Calorie or any one of the Macro and Micro Nutrients as Objective by clicking the Radio Button near Calorie or any one of the Nutrients. ( Automatically “Avg Cons” is deselected as Objective )

Deselect “Avg Cons” as Constraint by deselecting in the “Select” Check Box of “Avg Cons Constraint” Table.

Select “Pyramid optimization” Check Box.

Click “Calculate optimum” Button.

If feasible result will come.

As 39 Constraints considered for optimization mostly result may not come.

If not feasible, then select any one of the Relaxation methods LP2, LP3, LP4 and LP5 to get the “Near Optimal Solution” (LP3, LP4, LP5 are fine tuning methods)

Select “LP2”, “Pyramid optimization” then click “Calculate optimum” Button.

For reasonable problem result will come.

If in LP2 solution arrived, that solution can be improved by the improvement methods LP3, LP4 & LP5.

Refer 10 for the detailed procedure and choose the best “Near Optimal Solution”.

If solution is not feasible, the “Optimal Solution is Not Found” message will be displayed. Now deselect “Pyramid optimization” and click “Calculate optimum” Button.

In LP2 after getting the First Solution deselect the Problem Nutrients (i.e. it means the Nutrients which are not satisfied the RDA value ) in the RDA Table and then get the “Optimal Solution”.

This “Optimal Solution” is only for the selected Nutrients.

Even though “Pyramid Food Groups” are not considered for optimization, for the quantities of foods in the Result (optimized only for Nutrients ) Pyramid Food Group values are calculated and the values are given in the Result Table and Graph is also given.

Improve the solution by Adding / Exchanging of Nutrient / Food Group rich Food or by altering the existing Min / Max servings of those specific Nutrient / Food Group rich Foods. [ In the First / Previous optimal solution user can easily identify the Nutrient / Food Group rich food in the “Result Table”. In the “Result Table” user can see for every food the contribution of that food for each Nutrient / Food Group.]

Select “Pyramid Food Group” for optimization and optimize again.

This iteration is to be done to get final satisfactory Optimal Diet.

Or

For infeasible in LP2 identify Problem Macro / Micro Nutrients from the “Added Food Table” and deselect them appropriately from the optimization (Deselect in RDA Table ). Now click “Calculate Optimum” Button to get the “Near Optimum Solution” or “Optimal Solution”.

This first optimal solution further improved as explained before to get a satisfactory optimal solution.

This iteration is to be done till final satisfactory Optimal Diet obtained.

### 13.7.3 F) Optimization Based on Nutrients (without Minimal Departure from Observed / Average Diet)

In this option, optimization is done by selecting Nutrients only.

By default all the Nutrients are selected for optimization.

Select Calorie or any one of the Macro and Micro Nutrients as Objective by clicking the Radio Button near Calorie or any one of the Nutrients. (Automatically "Avg Cons" is deselected as Objective)

Deselect "Avg Cons" as Constraint by deselecting in the "Select" Check Box of "Avg Cons Constraint" Table.

Click "Calculate optimum" Button. If feasible result will come.

As 32 Constraints considered for optimization, mostly result may not come.

If not feasible, then select any one of the Relaxation methods LP2, LP3, LP4 and LP5 to get the "Near Optimal Solution" (LP3, LP4, LP5 are fine tuning methods)

Select "LP2", then click "Calculate optimum" Button.

For reasonable problem result will come.

If in LP2 solution arrived, that solution can be improved by the improvement methods LP3, LP4&LP5.

Refer 10 for the detailed procedure and choose the best "Near Optimal Solution".

If solution is not feasible, the "Optimal Solution is Not Found" message will be displayed.

In LP2 after getting the First Solution deselect the Problem Nutrients (i.e. it means the Nutrients which are not satisfied the RDA value ) in the RDA Table and then get the "Optimal Solution". This "Optimal Solution" is only for the selected Nutrients.

Improve the solution by adding / exchanging of Nutrient or Pyramid Food Group rich Foods; increasing / decreasing the quantity of existing Foods.

Even though "Pyramid Food Groups" are not considered for optimization, for the quantities of foods in the Result (optimized only for Nutrients ) Pyramid Food Group values are calculated and the values are given in the Result Table and Graph is also given.

Now select LP2 & optimize again by clicking "Calculate optimum" Button.

This iteration is to be done till final satisfactory Optimal Diet obtained.

Or

For infeasible in LP2 identify Problem Macro / Micro Nutrients from the “Added Food Table” and deselect them appropriately from the optimization (Deselect in RDA Table ). Now click “Calculate Optimum” Button to get the “Near optimum solution” or “Optimal Solution”.

This first optimal solution further improved as explained before to get a satisfactory Optimal solution.

To get the best result for optimizing by considering only “Nutrients”, we advise to see whether the Food Group values are satisfied the Pyramid Food Group Recommended values.

### 13.8 Detailed Explanation about the methods available in Nutrioptimizer to solve infeasible Problems

**The Methods available to solve infeasible problems :-**

1. Auto Constraint Elimination ( Auto iterate )
2. Constraint Relaxation Methods [ LP1, LP2, LP3, LP4, LP5 ]
3. Changing RDA percentage for Micronutrients
4. Changing "Serving Size for LP" [ 0.25, 0.5, 0.75, 1, Actual ]
5. Identifying and not considering the Problem Nutrient / Food Group for optimization.

Normally while using the above methods user will get optimized solutions with the indication "Near Optimal Solution found". This means that in "Near Optimal Solution" result, some nutrients values does not meet the lower RDA and some nutrients values exceed the upper RDA.

**Detailed explanation of the above methods :-**

#### 13.8.1 Auto iterate – Auto Constraint Elimination :-

In this method automatically eliminate the Problem Nutrient / Food Group by mathematical Permutation combination Method. [ Problem Nutrient / Food Group means the Nutrient / Food Group for which RDA will not be met during optimization. ]

For low number of Constraints result will come easily within the time ( 3 minutes )

For large number of Constraints result will take long time and so user cannot get the result within 3 minutes.

As "Auto iterate" is Constraint elimination method ( i.e. some nutrient constraint are not considered for optimization ) so the result sometime correct & sometimes not good result ( i.e. when more nutrient elimination is done then the result is not a reasonable one. ) If 3 macronutrients and 7 Food Groups are considered for optimization then "Auto iterate" will give result easily and mostly good result. User can use this method to identify Problem Nutrients.

#### 13.8.2 Constraint Relaxation Methods

i. LP1 – Basic Relaxation Method :-

Small relaxation is allowed for the required nutrients in Lower and Upper values of RDA . This will give the best result in relaxation methods.

ii. LP2 – Increased Relaxation Method :-

In this method considerable relaxation is allowed in Lower & Upper values of RDA.

iii. LP3 – Fine Tuning Relaxation Method :-

After getting the result in LP2, this LP3 Method is used to improve the result obtained from LP2.This is done by reducing the relaxation further than LP2.This method will give better result than LP2.

iv. LP4 – Fine Tuning Relaxation Method :-

After getting the result in LP3 this LP4 method can be used to improve the result obtained from LP3. This is done by reducing the relaxation further than LP3.This method will give better result than LP3.

v. LP5 – Fine Tuning Relaxation Method :-

After getting the result in LP4 this LP5 Method can be used to improve the result obtained from LP4. This method will give better result than LP4.

### 13.8.3 Changing RDA percentage for Micronutrients

( To get a solution first and then to improve the solution)

In LP1 and LP2 solution is not coming even after correcting all data & calories error messages but user is satisfied that realistic foods are chosen then go with RDA changing method. The RDA min value for micronutrient is altered to 90%, 80%, 75%, 70%, 65%, 60%, 50% by using the RDA dropdown menu box.

By changing RDA percentage and selecting LP2 or LP3 or LP4 or LP5 user can get a solution first and then user can improve.

RDA minimum value i.e. only for micronutrients can be altered to get the solution in the optimization.

The RDA max value is not changed. This method will help to solve the infeasible problem.

RDA value 100% mean 100% of RDA minimum required value for micronutrients

RDA value 90% mean 90% of RDA minimum required value for micronutrients

RDA value 80% mean 80% of RDA minimum required value for micronutrients.

RDA value 75% mean 75% of RDA minimum required value for micronutrients.

RDA value 70% mean 70% of RDA minimum required value for micronutrients.

RDA value 65% mean 65% of RDA minimum required value for micronutrients.

RDA value 60% mean 60% of RDA minimum required value for micronutrients.

RDA value 50% mean 50% of RDA minimum required value for micronutrients.

Do not worry for selecting lower RDA because the purpose is to find the solution and it will help to identify the problem nutrients. The required Calories, Carbohydrate, Protein, Fat, SFA. MUFA, PUFA, Cholesterol, Fiber, Sugar remain the same these are not lowered.

So the result we get will not be the below average level because calories and macronutrients are 100% of RDA only. Now the result will be helpful to identify problem nutrients. Then user can improve the Problem Nutrients / Pyramid Food Group value by adding that particular Nutrients / Pyramid Food Group rich foods or by exchange food or change the min or max serving quantities also by selecting 100% of RDA.

**Note:**

The display in the result table for micronutrients like "Calcium is low" or "Choline is low" depends upon RDA percentage selection. By default 100% is selected. If user reduce the % of RDA to 80% and optimizing, now in the result table the display will show only the nutrients below the 80% of RDA min value.

User can select RDA value as 110%,120%,130%,150%,200%. This increased value selection is given so that user can compensate the loss of nutrient values while cooking. If 10% loss while cooking then 110% of RDA can be taken. Mostly 150% and 200% not needed. Suppose the loss of nutrient values while cooking the foods are already calculated while preparing the food nutrient data itself this increased RDA value (i.e. 110% to 130%) will not be needed.

User has to understand that changing to higher RDA value (110 to 130%) micronutrient minimum RDA value only changed (Macronutrients, SFA, MUFA, PUFA, Cholesterol, Fiber, Sugar will not be changed)

**Note:**

In this software our approach is to get a reasonable solution first to identify the problem Nutrients / Pyramid Food Group and then improve the solution to get the best optimal diet.

### 13.8.4 Changing “ Min Serving Size for LP”

Selection of “Min Serving Size for LP” is done using the Dropdown Menu Box.

Select any one of the ‘0.25’, ‘0.5’, ‘1’ and Actual. ‘0.5’ and ‘1’ is normally used. ‘0.25’ rarely used and ‘Actually’ very rarely used. By selecting ‘0.25’ and ‘Actual’ the Infeasible problem may be solved to identify the Problem Nutrient. Improve the solution by adding Nutrient / Pyramid Food Group rich food and also changing the serving size to ‘0.5’ or ‘1’

### 13.8.5 Identifying and not considering the Problem Nutrient / Food Group for optimization :-

By default all the 32 Nutrients + 7 Pyramid Food Group values are selected for optimization. satisfying 39 Constraints is the real task. So deselect some non important Micronutrient to solve the problem. For example if solution is found for 17 Nutrients then improve the solution by identifying the Problem Nutrients. Next select the omitted 15 micronutrients step by step and solve.

If Pyramid Food Groups are included for optimization and if result is not coming then deselect the problem 'Pyramid Food Groups' to get a initial Optimal Solution and improve the solution by adding that particular problem Pyramid Food Group and then optimize to get the improved result.

The upper limit of the Food Group values can be altered in the Pyramid Food Group Table. Use this option in the Pyramid Food Group Recommended Value Table and select 10% or 50% for the major 5 Food Groups and optimize to get the first solution.

### 13.8.6 Full High Relax Method :-

If result is not coming in LP2 or LP3 or LP4 or LP5 then "Full High Relax" Method can be chosen. It is mandatory to select "Full High Relax" method with either LP2 or Lp3 or Lp4 or LP5, click "Calculate Optimum" button then result may come because of maximum possible (available by max allowed foods in the Food Choice Table) high relaxation being done to arrive the solution.

After getting the solution in this method that solution must be improved.

Full High Relax Method is just an appropriate method only to arrive first solution.

### 13.8.7 No High Relax Method :-

This "No High Relax" method is given to identify that without high relaxation the result is arrived or not.

If the result is arrived then there is no high relaxation used and user can see the Nutrient / Pyramid Food Group values are within the Recommended range only i.e. Nutrient will not exceed the upper limit.

**13.9 Error Messages about data and Total Calorie and the solution to the Error Messages.**

If there is some errors in data entry and in selected foods total calories, after clicking “Calculate optimum” the result will not come but the “ Error Messages” about “Data” and “Total calories” appear below the “Food Choice Table”.

**(1)** After clicking "Calculate Optimum" button if "Grams per serving", "Min Serving" and "Max Serving" is not entered then the following error messages will come.

"Please enter 'Min Serving' in Food Choice Table"

"Please enter 'Max Serving' in Food Choice Table"

"Please enter 'Grams per serving' in Food Choice Table"

Then user has to enter the min serving, max serving and grams per serving value according to the message and click the "Calculate Optimum" button.

**(2) Other error messages are given below with cause and remedy:**

Error message is "Cost is selected as constraint. Enter price in food choice table. Enter the price range. Otherwise deselect price as constraint."

Above RDA table "cost constraint selection" table is there. By default, cost is deselected.

If selected user has to deselect by clicking on the check box.

If cost is selected as the constraint then the user has to give cost range in the cost constraint table and also enter the prices in the food choice table for all foods selected.

Error message is "Cost is selected as objective, enter prices in the food choice table."

By default, calorie is selected as objective. If user want to select "cost" as objective user has to select cost objective radio button then user has to enter the prices in the food choice table for all foods selected.

Error message is "Max nutrient values required for potassium in RDA table"

If any max nutrient value is not entered in RDA table, this message will come with the nutrient name.

User can enter the max (upper) value for that particular nutrient, using the upper limit menu.

Error message is " Min nutrient value required for potassium in RDA table " Enter the Min nutrient value as per RDA.

After clearing all the error messages select "Auto iterate" or Relaxation Method and click "Calculate Optimum".

Error messages for missing of Nutrients values in the Database "Sugar, Vit D, Vit E values in the 'Food Choice Table' is empty. Please deselect that nutrients in the 'LP' column and 'Display' column in the RDA table".

For fast foods and restaurant foods and in 'USDA foods' all nutrient values will not be available in the database (i.e. not all the 32 nutrient values but only 10 to 15 nutrients value available). So select the nutrient in the 'LP' column and 'Display' column for which has value in the database. Select the nutrient for optimization which has the value in the database.

**Note:**

For Iodine, Molybdenum, Chromium values are not available in USDA SR 28. So by default these minerals are not selected for optimization. If these are selected then the error message for missing of nutrient values in the database will come as above type. Advised not to select Iodine, Molybdenum, Chromium for optimization while using our database. If in user database these values are available and that database can be included in our software then user can select these three nutrients for optimization.

**(3)** Error messages for 'Min and Max serving calories total' appear above the Added food value table:

1. "Selected food Min serving calories value total exceeded the 'Min RDA calorie value' please change 'Min serving' number of some foods (in 'Food Choice Table) to zero or reduce or select some other foods with low calorie value. (Normally for optimization it should be around 70% or below 70% of min RDA calorie value)"

User has to correct as per the message. Normally buffer food choices is needed for optimization to select the best food and food quantity from the chosen foods.

2. "Selected food 'Max serving calorie value total', should be greater than the 'Min RDA calorie value'. Please add some foods.(Normally for optimization it should be around 130% or above 130% of min RDA calorie value)"

User has to add some foods to correct as per the message. Normally buffer food choices is needed for optimization to select the best food from the chosen foods.

**(4) Meaning of the messages for the LP methods chosen that appear above the Added Food Value Table after clicking "Calculate Optimum"**

In Autoiterate method – The message is as “Autoiterate takes time, please GO with LP1 or LP2”. User has to select LP1 or LP2 click “Calculate Optimum” button to get the result.

.In LP2 or LP3 or LP4 or LP5 – "Calculation takes time. Please refer manual".

Normally this message will come in 'Per week' ('Per day' very rarely). For 'Per week' the food chosen will be normally around 30 or more and also the nutrient constraints are 32. So the result may come after 5 to 10 minutes. As user cannot wait for long time so after three minutes LP2 made to stop and this message will be shown.

Reduce the constraints to 15-20 by deselecting non important micronutrient to solve within the time. If solution is found then improve the solution by identifying the problem nutrients. Next select the omitted 15 micronutrient step by step and solve.

**Note:**

1. The Allowed time for calculation for Breakfast, Lunch, Dinner, and Per day is 2 minutes
2. The Allowed time for calculation for Per week is 3 minutes if the result is not coming within this time, follow the instructions given above. (9.3.1 & 9.3.2)

In LP1 method if the message is "Optimal solution is not found" go for LP2.

In LP2 method if the message is "Near optimal solution found" go for LP3 for improved solution.

In LP4 method if the message is "Near optimal solution found" go for LP5 for improved solution.

In LP5 method if the message is "Near optimal solution found" This is the final improved solution. This is the final "Near optimal solution".

**In LP1 method & LP2 method the message "Optimal solution not found" appears then the following steps are to be taken to get the solution.**

User has to correct as per the messages.

By verifying the "Total Minimum serving" & "Total Maximum serving" calorie value in the "Added Food Value Table"

i. Total "Minimum serving" calorie value should be about 70% or below 70% of the "Recommended calorie value (RDA)"

ii. Total "Maximum serving" calorie value should be about 130% or above 130 % of the "Recommended calorie value (RDA)"

This will help optimization (i.e. A buffer for food choices should be there for optimization to select best food & food quantity)

**(5)** .i. Deselect "Fat" in RDA Table …. then solution may come (If fat rich foods are chosen, often this may occur) Another method to find Fat is high is select "Auto iterate" and click

"Calculate Optimum" then the result will come as "Fat is high" as one of the result messages. In such a case LP1, LP2, LP3,LP4, LP5 will work only on deselecting fat or user has to reduce the fat rich foods.

ii. Deselect protein then solution may come (very rare occasion only this condition may come)

iii. Deselect carbohydrate then solution may come (very rare occasion only this condition may come)

# 14. RESULT TABLE (Optimal Diet)

Because of constraint max and min values finding a optimum solution is not easy. Our aim is to find a near optimum solution first and then only user can identify the problem nutrients and then improve the solution by adding new food or change serving size of existing foods or by adding exchange foods.

To get solution click any one of the LP methods check box and click calculate optimum.

1. AutoIterate: Constraint Elimination Method 2. LP1 and LP2- Relaxation Methods

3. LP3, LP4 and LP5 fine tuning Relaxation Methods.

After getting the near optimal solution improve the solution by adding problem nutrient rich food.

**Result Table (Optimized Diet)**

The result shall be exported to Excel Sheet. Save and Print option from Excel.

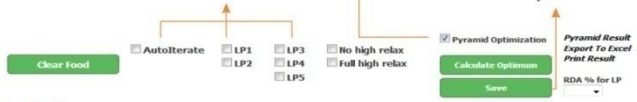
RDA min value for Micronutrients only can be changed for LP by selecting the percentage in the drop down box ie, 50%, 60%, 65%, 70%, 75%, 80%, 90%, 100%, 110%, 120%, 125%, 130%, 150%, 200%. Normally 100% is selected (see the manual for details)

Select the Pyramid Optimization check box then Pyramid Food Group values are included in the optimization calculation as constraints.

Because of constraint restriction near optimum solution found with indication of "Near optimal solution found"and with which nutrients not meet the RDA requirement like Fiber (73.8%), Potassium (72.7%), Choline (76.8%) are low then MUFA high (15.2%), VitB12 high (209.5). The "% of RDA satisfied" is given along with their names.

Different methods for calculating optimum

Save option to save the problem and result, in the software and can be recalled for further improvement




Names of Macro and Micronutrients

The result table will give

1. Foods selected by LP
2. For each food the serving no. is given.
3. For each food the serving in grams also given
4. For each food the calorie and macro and micronutrient values according to serving grams is given. (This will be useful to find which food is essential for particular nutrient)
5. Total, RDA and upperlimit values and percentage of RDA satisfied are all given.

Result Table

Optimal Diet For Per Day:

Near Optimal solution found
Fiber low(73.8%), Potassium low(72.7%), Choline low(76.8%)
MUFA high(15.2%), VitB12 high(209.5%)
Grains (101.4%), Vegetables (111%), Fruits (93.2%), Dairy&Milk (98.3%), ProteinFood (108.6%), Oil&Fat (100%), AddedSugar (99.8%)

Minimum Calories: 2010.0

| Food Name | Servings | Servings In Gram | Cost | Calories(Kcal) | Carb(g) | Protein(g) | Fat(g) | SFA(g) | MUFA(g) | PUFA(g) |
|---|---|---|---|---|---|---|---|---|---|---|
| Egg, whole, cooked, scrambled (Dairy and Egg Products) | 1.1 | 38.5 | 0 | 57.365 | 0.616 | 3.85 | 4.224 | 1.287 | 1.705 | 0.935 |
| Beef, ground, 90% lean meat / 10% fat, patty, cooked, broiled (Beef Products) | 1.1 | 38.5 | 0 | 83.545 | 0 | 10.054 | 4.521 | 1.782 | 1.903 | 0.165 |
| Nuts, almonds (Nut and Seed Products) | 1.1 | 22 | 0 | 127.38 | 4.741 | 4.653 | 10.989 | 0.836 | 6.941 | 2.717 |
| Oil, olive, salad or cooking (Fats and Oils) | 0.494 | 6.916 | 0 | 61.137 | 0 | 0 | 6.916 | 0.953 | 5.044 | 0.726 |
| Oil, safflower, salad or cooking, high oleic (primary safflower oil of commerce) (Fats and Oils) | 1.0 | 13 | 0 | 114.92 | 0 | 0 | 13 | 0.98 | 9.78 | 1.67 |
| Sugars, granulated (Sweets) | 0.845 | 25.35 | 0 | 98.104 | 25.342 | 0 | 0 | 0 | 0 | 0 |
| **Total** | | **1709.671** | **0** | **2009.924** | **255.25** | **103.8** | **68.05** | **19.647** | **33.919** | **9.792** |
| **Recommended Value (RDA - UpperValue) / (RPFG-UpperValue)** | | | **0.0 - 0.0** | **2010.0 - 2070.3** | **226.13 - 326.63** | **50.25 - 175.88** | **44.67 - 78.17** | **17.9 - 22.3** | **13.4 - 31.3** | **13.4 - 24.6** |
| **% of RDA Satisfied / RPFG Satisfied** | | | **0** | **100 % of Goal** | **50.8 % of Kcal** | **20.7 % of Kcal** | **30.5 % of Kcal** | **8.8 % of Kcal** | **15.2 % of Kcal** | **4.4 % of Kcal** |

All Food Group Names and their respective % is displayed

Optimized for min calorie and the result value is given

Selected Food names

Result - serving numbers

Result - serving in grams

Total Carbohydrate

RDA & upper value

% of RDA satisfied

Total MUFA

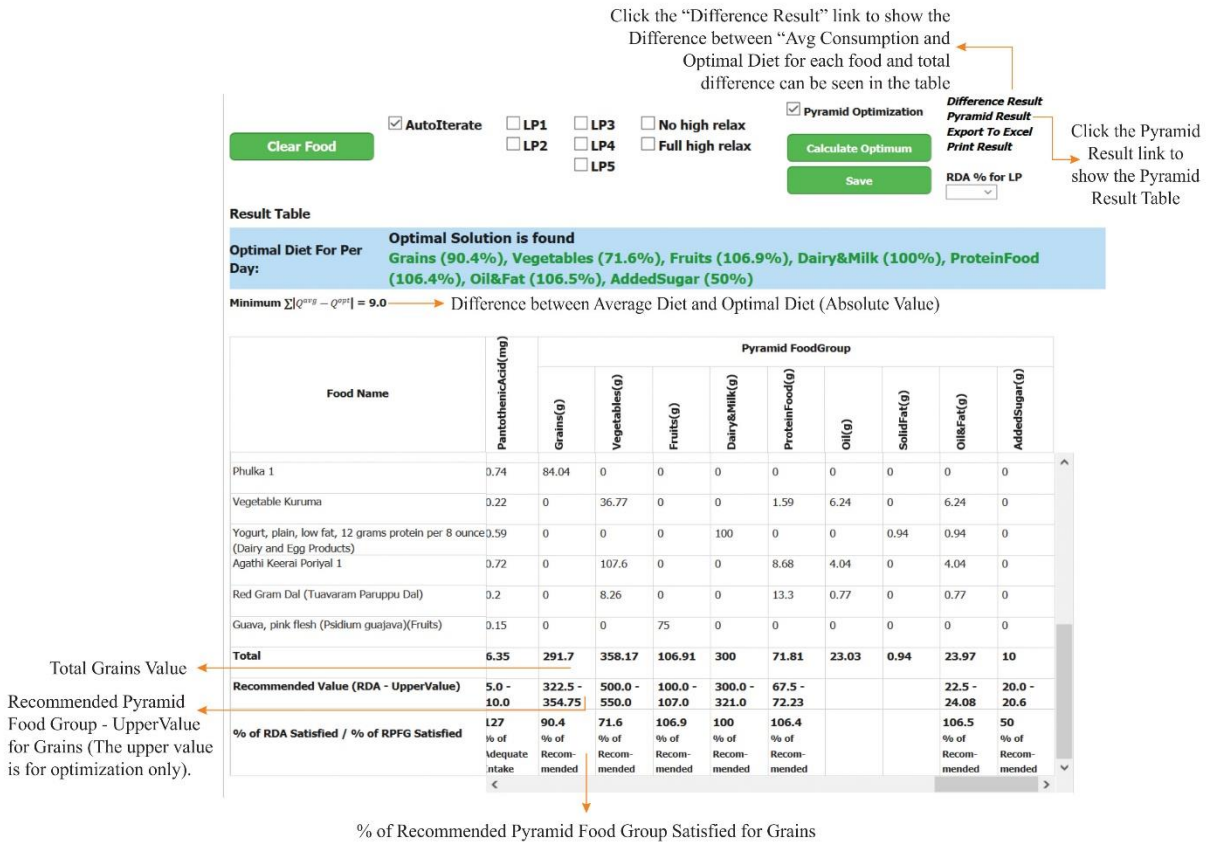
MUFA RDA range (Min.-Max.)

% of RDA satisfied

Required Calories

Carbohydrate range

Percentage achieved on min. calorie requirement




14.1 This table displays the "Optimal Solution" or "Near Optimal Solution" for a diet based on the Nutrient and Pyramid Food Group requirement using the chosen food items.

14.2 If all the RDA requirement / Pyramid Food Group are met then "Optimal Solution Found" is displayed in the table.

14.3 If few RDA / Pyramid Food Group requirement are not met the "Near optimal solution found" is displayed in the table with indication of which nutrient is low or high ( i.e. For Nutrient - "Near Optimal Solution found. Calcium low (90%), Potassium high (108%), Vitamin D low (89%)". In the case of Pyramid Food Group all the Food Group names and their respective % is displayed (i.e. Grains - 110%, Vegetable - 100% etc ).

14.4 The displayed result will contain

1. Selected foods
2. Serving number
3. Serving quantity in grams
4. Calories, Macro and Micronutrient values
5. Food Group Values

14.5 The row "Total" displays the total value of calories, Macro, Micronutrients and Pyramid Food Group values.

14.6 The row "Recommended value (RDA-upper value)" displays the RDA and upper value (Maximum value Allowed ) for Calories, Macro and Micronutrients.

14.7 In the row % of RDA Satisfied / % of RPFG Satisfied in the result table the following values are displayed.

1. The total calorie value is displayed as a percentage of minimum calorie requirement.
2. The total macronutrient value is converted to calories and their value is displayed as percentage of minimum calorie requirement.
3. The total micronutrient value is displayed as the percentage of minimum RDA
4. The total Pyramid Food Group value is displayed as the percentage of the Recommended Food Group value.

14.8 The advantages of the result table is user can easily identify the contribution of each food to that particular nutrient and Pyramid Food Group. For example if Coffee (with milk) is one of the food then its contribution to the nutrient Calcium will be more. User can see easily calcium value in the result table for Coffee (with milk) and if needed user can increase the Coffee (with milk) "Min Serving" quantity in 'Food Choice Table' to get the Calcium percentage of RDA satisfied as 100%.

14.9 All Pyramid Food Group values are given in the result table.

In the result if total quantity of the Dairy & Milk group is not satisfied and having lower quantitythen the Recommended quantity of Dairy & Milk then the required quantity of Dairy and Milk is to be added to get the value equal to the Recommended value

**15. Difference Result Table :**

**Diff between Optimum and Avg Consumption** ×

| Food Name | Servings (Optimized) | Avg Consumption | Difference |
|---|---|---|---|
| Banana, ripe, montham | | 1 | 1 |
| Dates, dry, pale brown | 0.5 | 1 | 0.5 |
| Phulka 1 | 2 | 1 | 1 |
| Vegetable Kuruma | 1 | 1 | 0 |
| Horlicks with Milk | 1 | 1 | 0 |
| Yogurt, plain, low fat, 12 grams protein per 8 ounce (Dairy and Egg Products) | 0.5 | 1 | 0.5 |
| Agathi Keerai Poriyal 1 | 2 | 1 | 1 |
| Red Gram Dal (Tuavaram Paruppu Dal) | 1 | 1 | 0 |
| Guava, pink flesh (Psidium guajava)(Fruits) | 0.5 | 1 | 0.5 |
| **Total** | | | **10** |

Click the “Difference Result” link (Near Calculate Optimum Button) to show the difference between “Avg Cons” (Average Consumption) serving Number and “Optimal Diet” serving Number of each food and also the total difference between “Average Diet” and “Optimal Diet”.

The Table can be seen above. The Food Names and their serving Numbers of Average Consumption and Optimal Result serving Number can be seen in the table.

The difference between “Avg Cons” and “Optimal Result” can also be seen in the “Difference” Column for each food. The Total difference value also given. This table will give the each food contribution for the difference. This will help to modify the Optimal Diet to achieve minimal Difference.

## 16. Improving the result

If some of the RDA is not met then :

"Near Optimal solution found" is displayed along with the name of the nutrients with the indication "High" or "Low" along with percentage of RDA satisfied. In the case of Pyramid Food Groups, percentage of recommended Food Group values satisfied is given.

16.1 Nutrients / Pyramid Food group which are low in the result can be increased by adding/exchanging food or increasing min/max serving of specific nutrient / Food Group rich foods.

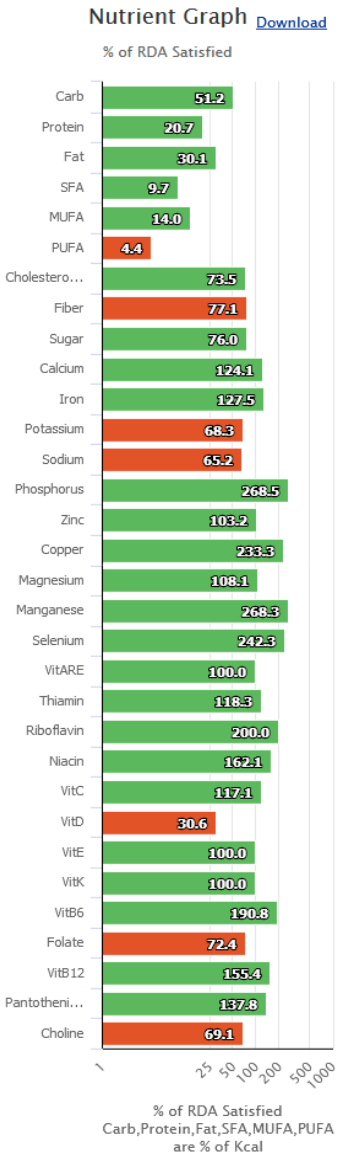
16.2 Nutrients which are high in the result (For Micronutrient, Nutritionist only can decide on allowable high value ) can be lowered by adding/exchanging foods or by altering min/max serving of specific nutrient rich foods. In case of Food Groups which are in high percentage can be lowered by adding/exchanging foods or by altering min/max serving of those specific food group rich foods.

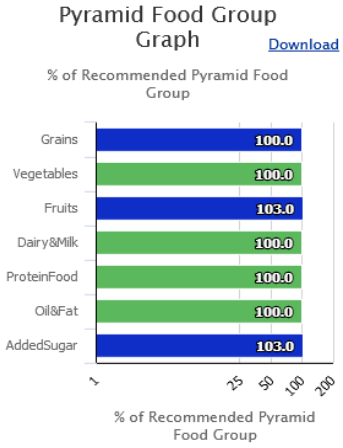
Normally how much high value can be allowed for Micronutrient(i.e. greater than upper RDA) is to be decided by Nutritionist.

16.3 After making these modification, again click "Calculate Optimum" button. Check to see if you get "Optimal solution" or "Near Optimal solution".

16.4 If not repeat steps shown previously till an "Optimal solution" or satisfactory " Near Optimal solution" is found. Detailed explanation to arrive at the result is given in 9.1 to 9.4.10. (In most cases “Near Optimal solution" may be acceptable on the condition that only a few nutrients are not satisfying the RDA but in the range 65%-99%. This range and final decision is to be taken by the Nutritionist). In case of Food groups make sure the content level of the Major 5 Food Group is near 100% only. For the Oil & Fat, Added Sugar make sure the content level is below the 100%.

## 17. Nutrient Graph



This Nutrient Graph is a bar chart which display of the results helps in quick interpretation of the results and aids in the corrective action that may be required.

The percentage of RDA satisfied for each nutrient is displayed along the X axis.

All the Nutrients chosen for “Display” in the RDA Table are displayed along the Y axis.

A nutrient with green bar indicates that this result value is within the RDA minimum and maximum value.

A nutrient with red bar indicates that this result value is below the RDA minimum value (lower limit).

A nutrient with blue bar indicates that this result exceeds the RDA maximum value (upper limit).

The bar against each nutrient displays the % of RDA satisfied. On pointing the cursor to the causes a tool tip displaying the “Name of Nutrient”, “Total” and “ Recommended Value (RDA upper value)” from the result table.

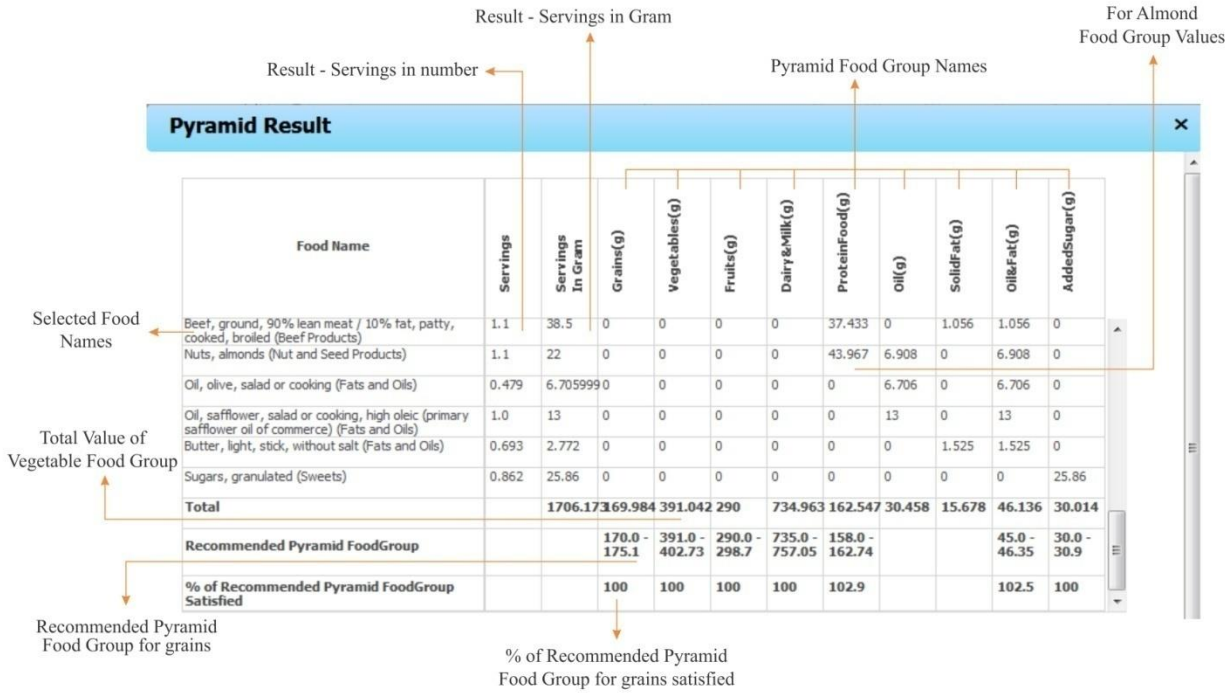
Download:

An option is available to download and print the Nutrient Graph using PNG, JPEG and PDF formats.

## 18 Pyramid Result in separate table & Pyramid Food Group Graph

### 18.1 Pyramid Result

**Pyramid Result Table**




| Food Name | Servings | Servings In Gram | Grains(g) | Vegetables(g) | Fruits(g) | Dairy&Milk(g) | ProteinFood(g) | Oil(g) | SolidFat(g) | Oil&Fat(g) | AddedSugar(g) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Beef, ground, 90% lean meat / 10% fat, patty, cooked, broiled (Beef Products) | 1.1 | 38.5 | 0 | 0 | 0 | 0 | 37.433 | 0 | 1.056 | 1.056 | 0 |
| Nuts, almonds (Nut and Seed Products) | 1.1 | 22 | 0 | 0 | 0 | 0 | 43.967 | 6.908 | 0 | 6.908 | 0 |
| Oil, olive, salad or cooking (Fats and Oils) | 0.479 | 6.705999 | 0 | 0 | 0 | 0 | 0 | 6.706 | 0 | 6.706 | 0 |
| Oil, safflower, salad or cooking, high oleic (primary safflower oil of commerce) (Fats and Oils) | 1.0 | 13 | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 13 | 0 |
| Butter, light, stick, without salt (Fats and Oils) | 0.693 | 2.772 | 0 | 0 | 0 | 0 | 0 | 0 | 1.525 | 1.525 | 0 |
| Sugars, granulated (Sweets) | 0.862 | 25.86 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25.86 |
| **Total** | | **1706.173** | **169.984** | **391.042** | **290** | **734.963** | **162.547** | **30.458** | **15.678** | **46.136** | **30.014** |
| **Recommended Pyramid FoodGroup** | | | **170.0 - 175.1** | **391.0 - 402.73** | **290.0 - 298.7** | **735.0 - 757.05** | **158.0 - 162.74** | | | **45.0 - 46.35** | **30.0 - 30.9** |
| **% of Recommended Pyramid FoodGroup Satisfied** | | | **100** | **100** | **100** | **100** | **102.9** | | | **102.5** | **100** |

Click on the “Pyramid Result” link to view the Pyramid Result Table

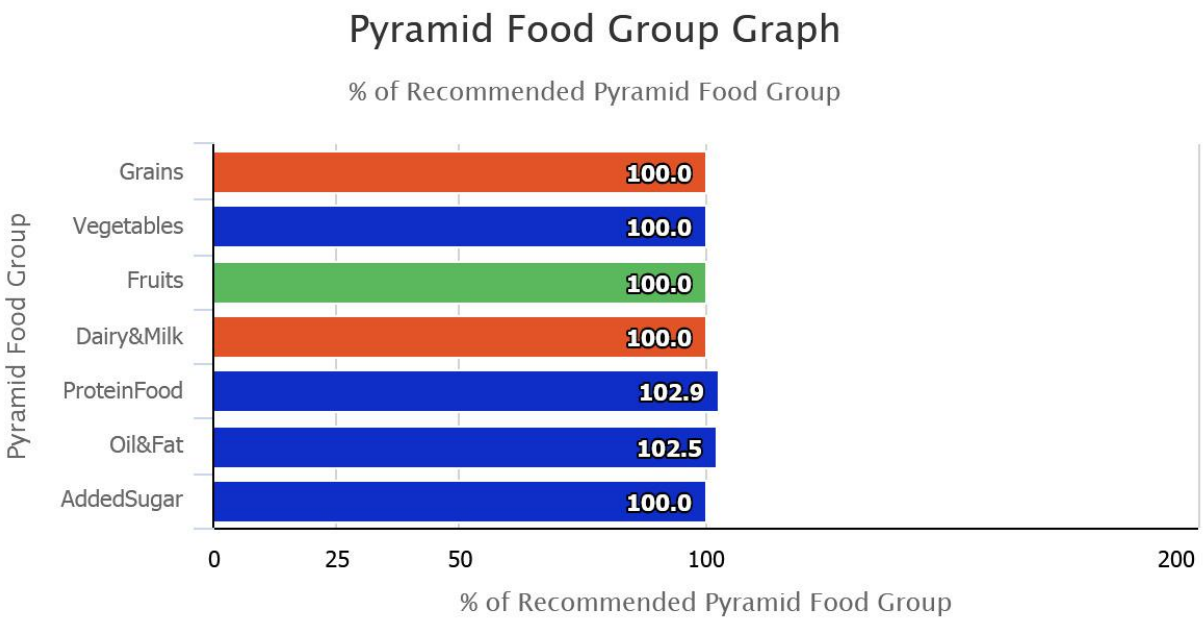
This table displays, in grams, the contribution of each food in the result to the Pyramid Food Group.

The “Total” row indicates summation of each of the Pyramid food group values.

The “Recommended Pyramid Food Group” displays the recommended food group values as per guidelines chosen for this computation.

The “% of Recommended Pyramid Food Group Satisfied” displays percentage of Recommended Pyramid Food Group Satisfied.

### 18.2 Pyramid Food Group Graph




This Pyramid Food Group Graph is a bar chart which display of the results for a quick interpretation of the results.

The percentage of Recommended Pyramid Food Group Satisfied is displayed along the X axis.

All the Pyramid Food Groups chosen for “Display” are displayed along the Y axis.

A Food Group with green bar indicates that this result value is 100% of Recommended Food Group value.

A Food Group with red bar indicates that this result value is below 100% of the Recommended Food Group Value.

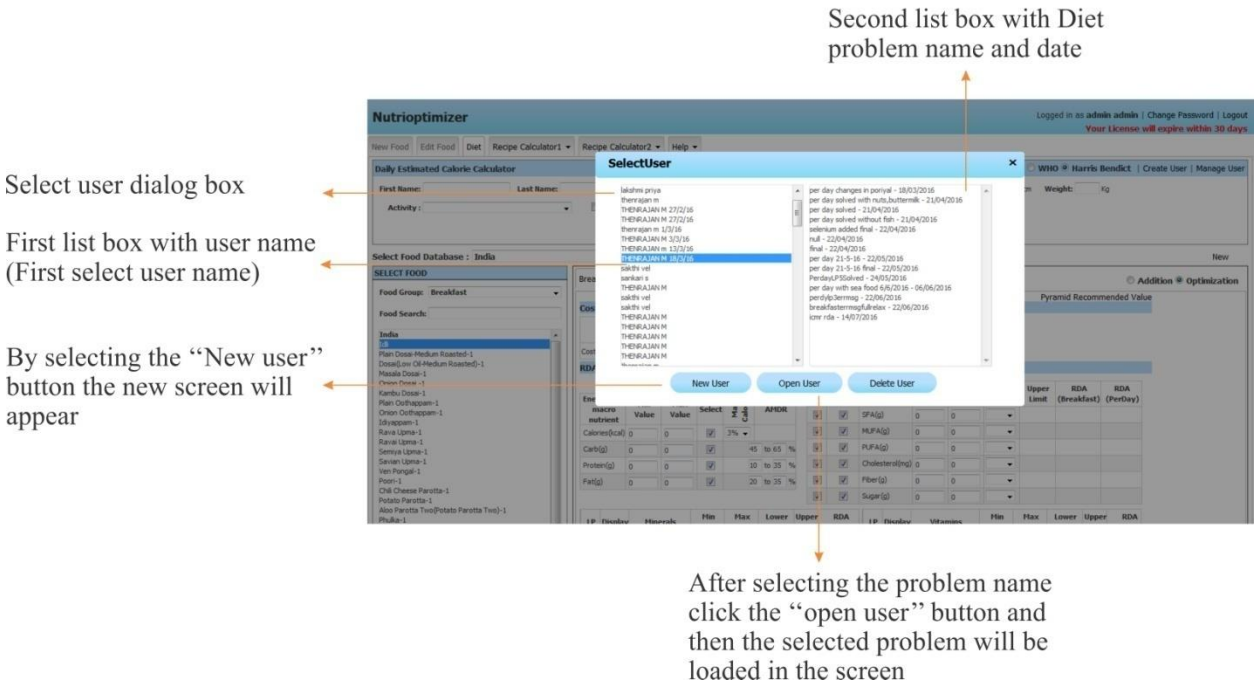
A Food Group with blue bar indicates that this result exceeds the 100% of Recommended Food Group Value.

The bar against each Food Group displays the % of Recommended Pyramid Food Group.

On pointing the cursor to the bar causes a tool tip displaying Food Group Name, “ Total” value (as per the result), the “Recommended Pyramid Food Group Value”.

## 19. Create User

**Create user and Manage user**




By clicking the 'Create User' link new screen will appear for new user.

User can create a new Diet Plan by entering the user name in calorie calculator

## 20. Manage User

By clicking the 'Manage User' link, the "select user" dialog box will appear.

It shows "User Name" in first list box. After selecting the user name, its corresponding saved "Diet Plan names" listed in the second list box. First the "diet plan name" is selected then by clickingthe "open user" button the diet plan will be loaded in the screen. (It is used to recall the saved Diet Plan Name and further improvement of the solution)

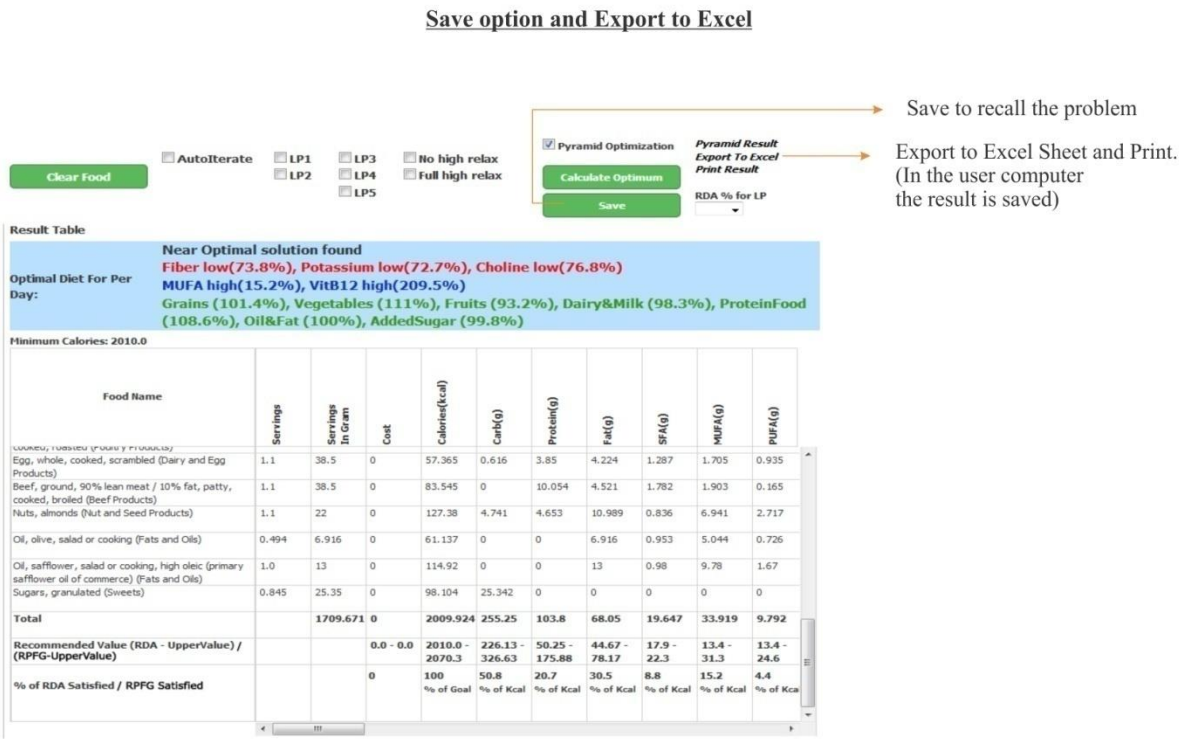
By clicking 'New User' button in the 'Select User' dialog box, new Diet Plan screen will appear.

**'New' Link [ Next to 'Diet Problem Name' drop down box above Addition, optimization selection row ]**

By clicking the 'New' link a new screen with already calculated calorie & RDA values will appear.

This screen can be used to create a new Diet Plan for the same User Name.

## 21. Save Option




| Food Name | Servings | Servings In Gram | Cost | Calories(kcal) | Carb(g) | Protein(g) | Fat(g) | SFA(g) | MUFA(g) | PUFA(g) |
|---|---|---|---|---|---|---|---|---|---|---|
| Egg, whole, cooked, scrambled (Dairy and Egg Products) | 1.1 | 38.5 | 0 | 57.365 | 0.616 | 3.85 | 4.224 | 1.287 | 1.705 | 0.935 |
| Beef, ground, 90% lean meat / 10% fat, patty, cooked, broiled (Beef Products) | 1.1 | 38.5 | 0 | 83.545 | 0 | 10.054 | 4.521 | 1.782 | 1.903 | 0.165 |
| Nuts, almonds (Nut and Seed Products) | 1.1 | 22 | 0 | 127.38 | 4.741 | 4.653 | 10.989 | 0.836 | 6.941 | 2.717 |
| Oil, olive, salad or cooking (Fats and Oils) | 0.494 | 6.916 | 0 | 61.137 | 0 | 0 | 6.916 | 0.953 | 5.044 | 0.726 |
| Oil, safflower, salad or cooking, high oleic (primary safflower oil of commerce) (Fats and Oils) | 1.0 | 13 | 0 | 114.92 | 0 | 0 | 13 | 0.98 | 9.78 | 1.67 |
| Sugars, granulated (Sweets) | 0.845 | 25.35 | 0 | 98.104 | 25.342 | 0 | 0 | 0 | 0 | 0 |
| **Total** | | **1709.671** | **0** | **2009.924** | **255.25** | **103.8** | **68.05** | **19.647** | **33.919** | **9.792** |
| **Recommended Value (RDA - UpperValue) / (RPFG-UpperValue)** | | | **0.0 - 0.0** | **2010.0 - 2070.3** | **226.13 - 326.63** | **50.25 - 175.88** | **44.67 - 78.17** | **17.9 - 22.3** | **13.4 - 31.3** | **13.4 - 24.6** |
| **% of RDA Satisfied / RPFG Satisfied** | | | **0** | **100 % of Goal** | **50.8 % of Kcal** | **20.7 % of Kcal** | **30.5 % of Kcal** | **8.8 % of Kcal** | **15.2 % of Kcal** | **4.4 % of Kca** |

"Save" button is below the "Calculate Optimum" button and above the Result Table.

By clicking the 'Save' button, the dialog box will appear.

The user can enter the 'Diet Plan Name' and "click" the Save button.

Now the Diet Plan will be saved along with the same user name initially entered in the calorie calculator.

The Diet Plan is saved by Diet Plan Name and date and User Name.

Under one user name many Diet plans can be saved.

The Save option stored all the Data (RDA Table, Food Choice Table, Result Table and Added Food Value Table) for that diet plan. (This save option is helpful to recall the diet plan and further improvement of the solution.)

Note : Before going to start a new 'Diet Plan' the active 'Diet Plan' on screen must be saved by the user so that it can be recalled in future. If user doesn't require a 'Diet Plan' to be saved for future

purpose then the Diet Plan need not to be saved.

**21.1 Diet Plan Name Drop Down Box ( Recall of Saved Diet Plans ) :-**

Under 'Diet Plan Name' heading, Diet Plan names are stored with date.

This 'Plan Name' dropdown box is located above the RDA Table.

Near the dropdown box 'Delete' option and 'New' option is there.

By clicking the dropdown box the stored Diet Plan Name list will appear and user can select the desired Diet Plan Name.

By recalling the Diet Plan Name, the optimized solution can be further improved.

By selecting Diet Plan Name and by clicking the 'Delete' link the saved diet plan can be deleted.

By clicking the 'New' link new screen will appear with already calculated calorie and RDA values.

For this new screen Calories and Micronutrient value is need not to be calculated again.

This screen can be used to create a new Diet plan for the same user Name.

User has to select the foods and calculate optimal solution.

**22. Export Result into Excel - Save / Print**

The "Result Table" data can be exported to 'Excel' format by clicking the 'Export to Excel' link, file download dialog box will appear in the screen.

To save in the excel file user has to click the Save File" radio button and click 'ok' button.

Then the 'Result Table' will be stored in Excel file.

By default "Open" with radio button is selected click 'ok' button the 'Result Table' can be seen in the excel sheet in the user computer.

User can print the result by using the Excel file.

## APPENDIX 1

**The best option among the two options given for Minimal Departure from Average Diet Calculations**

As many Authors used $\left|\frac{Q^{avg}-Q^{opt}}{Q^{avg}}\right|$ for the optimization we also provide this method.

We recommend to use $|Q^{avg} - Q^{opt}|$ for the optimization using our software.

**Detailed Explanation:**

**Comparison of Equation /Algorithm used in arriving Optimal Diet with minimal departure from the Current Diet**

| $Q^{avg}$ | $Q^{opt}$ | $\lvert Q^{avg} - Q^{opt}\rvert$ | $\left\lvert\frac{Q^{avg} - Q^{opt}}{Q^{avg}}\right\rvert$ | $(\ln Q^{avg} - \ln Q^{opt})^2$ | $(Q^{avg} - Q^{opt})^2$ |
|---|---|---|---|---|---|
| 1 | 2 | 1 | 1.00 | 0.480 | 1 |
| 2 | 1 | 1 | 0.50 | 0.480 | 1 |
| 1 | 3 | 2 | 2.00 | 1.205 | 4 |
| 3 | 1 | 2 | 0.67 | 1.205 | 4 |
| 1 | 4 | 3 | 3.00 | 1.920 | 9 |
| 4 | 1 | 3 | 0.75 | 1.920 | 9 |
| 2 | 3 | 1 | 0.50 | 0.164 | 1 |
| 3 | 2 | 1 | 0.34 | 0.164 | 1 |
| 2 | 4 | 2 | 1.00 | 0.480 | 4 |
| 4 | 2 | 2 | 0.50 | 0.480 | 4 |
| 3 | 4 | 1 | 0.75 | 0.082 | 1 |
| 4 | 3 | 1 | 0.25 | 0.082 | 1 |

**We are using number of servings for the food quantity and most of the researchers used grams for the food quantity.**

**So, comparison between different algorithms used to arrive optimum solution is done to have a clear idea of which algorithm is the best.**

In most of the articles, authors used $\left|\frac{Q^{avg}-Q^{opt}}{Q^{avg}}\right|$

Up to servings $Q^{avg}$ =4 the different probability options are taken for comparison like if $Q^{avg}$ is 4 and $Q^{opt}$ is 1; $Q^{avg}$ is 3 and $Q^{opt}$ is 2 etc.

Kindly note the values for different four options taken for Linear Programming by the authors in the above comparison Table. From the values user can identify easily is $\left|\frac{Q^{avg}-Q^{opt}}{Q^{avg}}\right|$ totally give different values for optimization.

i.e. For $Q^{avg}$ is 4 and $Q^{opt}$ is 1; then $\left|\frac{Q^{avg}-Q^{opt}}{Q^{avg}}\right| = \frac{4-1}{4}$ =0.75

For $Q^{avg}$ is 1 and $Q^{opt}$ is 4; then $\left|\frac{Q^{avg}-Q^{opt}}{Q^{avg}}\right| = \left|\frac{1-4}{1}\right|$ =3

Kindly note the different values

Compare the results of other options.

For $Q^{avg}$ is 4 and $Q^{opt}$ is 1; For $Q^{avg}$ is 1 and $Q^{opt}$ is 4

$\left| Q^{avg} - Q^{opt} \right|$ is → 3 ; 3 [ used by us]

$(\ln Q^{avg} - \ln Q^{opt})^2$ → 1.92 ; 1.92 [ used in Thrifty Food]

$(Q^{avg} - Q^{opt})^2$ → 9 ; 9 [used in Parke Wilde article based on Thrifty Food, British Eat Well Based articles]

Because of this low value $\frac{Q^{avg}-Q^{opt}}{Q^{avg}}$ = 0.75 (when $Q^{avg} = 4;\ Q^{opt} = 1$) , optimization mathematical process won't consider to increase $Q^{opt}$ equal to $Q^{avr}$.

In $|Q^{avg} - Q^{opt}|$ and $(\ln Q^{avg} - \ln Q^{opt})^2$ and $(Q^{avg} - Q^{opt})^2$ user can see the better differences than $\frac{Q^{avg}-Q^{opt}}{Q^{avg}}$ .

As we are using linear programming (Not Quadratic Programming) to solve the Diet problem we have selected $|Q^{avg} - Q^{opt}|$.