Evaluation of protein quality of cereal based Breakfast recipes by chemical score and NDPCal% 

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Abstract
Breakfast is the first meal of the day that breaks the fasting period of the previous night. The first meal should contain sufficient amount of glucose, protein and calcium. It is good to have complete proteins in diet that supplies all tissue requirements. Egg is selected as a reference protein. The ‘chemical score” reveals the most limiting amino acid in the test protein. “NDPCal%” relates protein quality to the energy intake. This study reveals some limiting amino acids in popular cereal based breakfast recopies and its supplements to fulfill that amino acid in the particular recipe.

Key words: chemical score, NDPCal%, complete protein, limiting amino acid, calcium

Introduction-
Breakfast is the first meal of the day eaten after waking up, usually in the morning. The word in English refers to breaking the fasting period of the previous night. From last meal of the day till the morning the body remains in starving condition and it needs continuous supply of glucose, protein and other nutrients to perform its day to day tasks. Prior taking the breakfast when one wakes up in the morning it almost completed approx 12 hours of starving condition. To restore the constant supply of Glucose, protein and other nutrients, breakfast is necessarily required and it fulfill all required nutrition and render the body feeling of fullness entire day.

Importance of protein in breakfast –
The nutritive value of the protein depends to an important degree on the relation of its amino acids in its molecule to those required for building of new tissues. A high-quality protein is also referred to as a complete protein. We can say Complete protein is protein that has all the necessary amino acids. Amino acids are the building blocks that form protein. Egg contains all the necessary amino acids hence called reference protein.

Amino acids are compounds that combine to make proteins. When a food is eaten that contains protein, digestive system breaks the protein down into amino acids. The body then combines the amino acids in various ways to carry out body functions.

Types of amino acids

A. Essential amino acids
B. Non Essential amino acids

The body needs 20 different amino acids to maintain good health and normal functioning. People must obtain nine of these amino acids, called the essential amino acids,.These are leucin ,lysine, isoleucin, valine, phenylalanine, threonine, tryptofan and methionine through food. Good dietary sources include meat, eggs, tofu, soy, quinoa, and dairy products. A healthy body can manufacture the other 11 amino acids.
Chemical score –

The Chemical Score (CS) or amino acid score is expressed as the ratio of each essential amino acid in a test protein to the respective amino acid in the reference protein. Egg is selected as a reference protein. The Lowest amino acid ratio calculated for anyone of the essential amino acids is the chemical score of the protein. Hence, the chemical score reveals the most limiting amino acid in the test protein.

NDPCal% -

The net dietary protein calories percent (NDPCal%) method was developed by Platt in 1961. It relates protein quality to the energy intake. Dietary protein value expressed as percent of total calories. The net dietary protein value is the utilisable content of the diet. The NDPCal% of 5 is adequate to maintain health so, it will be good for adults whereas NDPCal% of 8 or above value will support the growth in Individual. Hence, Infant, Children, Adolescent and pregnant women would need to consume diets above 8% of NDPCal% to promote growth. Higher NDPCal% values reflect a wasteful usage of protein, Lower NDPCal% reflects a low protein content. Chemical score and NDPCal% may also be used to determine suitable proportions of ingredients in a dish.

Objectives-
1. Selection of popular breakfast recipes almost based on cereals
2. To evaluate the protein quality of 12 cereal based breakfast recipes,
3. To standardize recipe
4. To calculate chemical score of each standardized recipe.
5. To calculate NDPCal% of each standardized recipe.
6. To suggest other food ingredient/additional to compensate limiting amino acid.

Methodology

The popular breakfast recipes were listed down. Out of them 12 recipes were selected.

List of recipes-

1. Poha
2. Veg Upma
3. Veg Daliya
4. Sago Khichdi
5. Aloo ka Paratha
6. Gobhi ka Paratha
7. Veg Sooji Chilla
8. Sooji ka Halwa
9. Samosa
10. Vermicelli Upma
11. Aate Ka Halwa
12. Veg Sandwich

All the recipes were standardized and chemical score and NDPCal% was calculated by following formula

\[
\text{mg of amino acid in 1 gm total nitrogen of test food} \times 100
\]

\[
\frac{\text{mg of amino acid in 1gm total nitrogen of reference protein}}{
\text{Protein calories} \times \text{Chemical Score}
\]

NDP Cal % =

Total Calorie
Result and Discussion-

This study is performed on various Indian Breakfast Recipes which has been selected by keeping in mind the Indian cuisines commonly consumed at the breakfast in Indian homes. During entire course of tenure, the work has done on improvising the protein quality of those recipes so, the protein in the selected dishes can’t get wasted and get effectively utilized by the body. The Results and findings are mentioned below, categorized according to the different ingredients used in the recipes and their most limiting amino acid content with their NDPCal%.

Table no 1-NDPCal% of cereal based recipes

<table>
<thead>
<tr>
<th>S. No.</th>
<th>RECIPES</th>
<th>MAIN INGREDIENTS</th>
<th>QUANTITY</th>
<th>NDPCAL%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Poha</td>
<td>Poha,Potato,Peas,Peanuts</td>
<td>1 Bowl (approx 150 gm cooked)</td>
<td>6.31</td>
</tr>
<tr>
<td>2</td>
<td>Veg Upma</td>
<td>Sooji,Veggies,Peanuts,Peas</td>
<td>1 Bowl (approx 150 gm cooked)</td>
<td>7.46</td>
</tr>
<tr>
<td>3</td>
<td>Veg dalyla</td>
<td>Dalyla,Moong Daal,Veggies</td>
<td>1 Bowl (approx 150 gm Cooked)</td>
<td>8.27</td>
</tr>
<tr>
<td>4</td>
<td>Sago Khichdi</td>
<td>Sago,Potato,Peanuts</td>
<td>1 Bowl (approx 150 gm cooked)</td>
<td>4.3</td>
</tr>
<tr>
<td>5</td>
<td>Aalo Ka Paratha</td>
<td>Potato,Wheat ,Flour</td>
<td>1 Paratha( approx 100-125 gm cooked)</td>
<td>5.38</td>
</tr>
<tr>
<td>6</td>
<td>Gobhi Ka Paratha</td>
<td>Cauliflower,Wheat flour</td>
<td>1 Paratha( approx 100-125 gm cooked)</td>
<td>6.17</td>
</tr>
<tr>
<td>7</td>
<td>Veg Sooji Chilla</td>
<td>Sooji,Veggies,Peanuts.</td>
<td>1 Cheela (approx 70-80 gms cooked)</td>
<td>7.3</td>
</tr>
<tr>
<td>8</td>
<td>Sooji Ka Halwa</td>
<td>Sooji, Sugar,Nuts,Ghee</td>
<td>1 Bowl(approx 100-125 gm cooked)</td>
<td>3.46</td>
</tr>
<tr>
<td>9</td>
<td>Samosa</td>
<td>Potato,Peas,Refind Flour,</td>
<td>1 Pc(approx 90-100gm cooked)</td>
<td>5.18</td>
</tr>
<tr>
<td>10</td>
<td>Vermicelli Upma</td>
<td>Vermicelli,Veggies,Peas</td>
<td>1 Bowl(approx 100-125 gm)</td>
<td>5.27</td>
</tr>
<tr>
<td>11</td>
<td>Aate Ka Halwa</td>
<td>Wheat Flour,Sugar, nuts,Ghee</td>
<td>1 Bowl(approx 100-125 gm Cooked)</td>
<td>6.14</td>
</tr>
<tr>
<td>12</td>
<td>Veg Sandwich</td>
<td>Bread,Veggies,Cheese(10gms)</td>
<td>1 Square/ 2 Triangles 100gm cooked</td>
<td>8.34</td>
</tr>
</tbody>
</table>

It is found that NDPCal% was lowest in sooji ka halwa and sogo khichidi i.e.3.46 and 4.3 respectively. veg sandwich , veg dalyla , veg sooji chilla contain 8.34,8.27,7.46 and 7.3 respectively. That means it has contain high quality proteins.

Cereal Based Recipes-

Chart no 1: graphical presentation of NDPCal % of all cereal based recipe

Graphical representation of Ndpca% of cereal based breakfast recipes
The study reveals that all Wheat based recipes either from whole wheat flour or from refine flour based have NDPCal% mostly between 5-7, depending upon other ingredients it may be go till 8.

Vegetables based recipes have NDPCal% in between 5-8 depending on protein rich ingredients like peas or beans or legumes etc.

Sago have no or negligible protein content so, the recipe have very low NDPCal%, addition of peanuts brings it up.

Table no 2: Limiting amino acid of cereal based recipe

<table>
<thead>
<tr>
<th>Dish</th>
<th>Limiting Amino Acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poha</td>
<td>Lysine</td>
</tr>
<tr>
<td>Veg Upma</td>
<td>Lysine</td>
</tr>
<tr>
<td>Veg Daliya</td>
<td>Lysine</td>
</tr>
<tr>
<td>Sago Khichdi</td>
<td>Lysine</td>
</tr>
<tr>
<td>Aaloop Ka Paratha</td>
<td>Lysine</td>
</tr>
<tr>
<td>Gobhi Ka Paratha</td>
<td>Lysine</td>
</tr>
<tr>
<td>Veg Sooji Chilla</td>
<td>Lysine</td>
</tr>
<tr>
<td>Sooji Ka Halwa</td>
<td>Lysine</td>
</tr>
<tr>
<td>Samosa</td>
<td>Lysine</td>
</tr>
<tr>
<td>Vermicelli Upma</td>
<td>Lysine</td>
</tr>
<tr>
<td>Aate Ka Halwa</td>
<td>Lysine</td>
</tr>
<tr>
<td>Veg Sandwich (Cheese)</td>
<td>Lysine</td>
</tr>
</tbody>
</table>

Lysine was found as limiting amino acid in all cereal based recipe

Conclusion –

1- After calculating chemical score of recipes we get most limiting amino acid, an essential amino acid which is present in lowest amount in specific breakfast recipe. To improve the protein quality of the dish we can add or suggest some food stuff or food which is rich in the specific amino acid (most limiting amino acid).

2- It was observed that the cereal based (wheat/rice) recipes like Poha, Veg Upma, Veg Daliya, Aloo Paratha etc. are having Lysine as their most limiting amino acid which can be compensated by consuming Milk or Milk products like curd, cheese, Lassi, Milk Shake etc and with the fruits like Apple, Papaya, Mango, Banana etc which improves the protein quality of the dish as these are rich in Lysine.

3- After finding the chemical score, calculation of NDPCal% is done. Calculating the NDPCal% of the recipes suggests us to how to improve protein quality of the desired recipe to make it usable for body (ranging between 5-8,) and prevent the protein from wasting.

4- The findings suggest that recipes which scores less on NDPCal% indicates low protein content, and higher NDPCal% indicates high protein content. A very high NDPCal% suggests wasteful protein. Can be corrected by adding the desired ingredients to it so, the recipe’s protein can’t get wasted.

5- It has been observed that recipes which have cereals like wheat or wheat products or rice or rice products as their major ingredient have NDPCal% between 5-7 it can be raised upto 8 if added protein rich ingredients like peas in Samosa and poha, peanuts in poha and Veg Upma etc.

6- Recipes which has Sago or Vegetables as their main ingredient have very low NDPCal% which indicates low protein content of the dish, addition of protein rich ingredient as Peanuts in Sago Khichdi, Cheese in Veg Sandwich brings the protein content up as well as NDPCal%.
References:


