



# Journal of Drug Delivery and Therapeutics

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Research Article

## Daily Dietary Nutrition and Nutraceutical Intake in Agricultural Laborers of Hirakud Command Area, Sambalpur, Odisha, India

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### ABSTRACT

Sambalpur is considered as the rice bowl of Odisha for its cultivation activities due to the presence of hydroelectric power house Hirakud Dam, with total capacity of 5,896,000,000 m<sup>3</sup>, 55 km long and is one of the first major multipurpose river valley projects started after India's independence. It irrigates about 75,000 km<sup>2</sup> (19×10<sup>6</sup> acres) of land and therefore, is considered as a blessing to the farmer families. As because of cultivation and allied activities, Agricultural Laborers (ALs) constitute a large portion of the active work force. Study on the nutritional intake in this important fraction of population is lacking. Present study was an attempt to know the food consumption pattern and nutritional intakes of ALs in Hirakud command area of Sambalpur district, India. Data were collected from 300 ALs, consisting of 150 from each gender. Daily dietary pattern and nutritional intake of respondent were calculated through 24 hours dietary recall method. It was observed that ALs consume all most all the food varieties available in Odisha. Cereal consumption was 6.80 and 1.77 % excess than the recommend value dietary allowance (RDA) by Indian Council for Medical Research (ICMR, in 1990). Except cereals, all other food consumption was below the RDA value in ALs. The intake of other food varieties in ALs was > 60% deficit from the RDA values. Consumption of milk was 97% less in case of male ALs and 98 % less in case of female ALs in comparison to the values suggested in RDA. Similarly, consumption of all nutrients was less than RDA norms except Vitamin -C in case of male ALs. The consumption of Niacin and Vitamin -C was excess in case of female ALs. Alternate low cost food supply is suggested to compensate such insufficient nutritional uptake by ALs in the study area.

**Keywords:** Food, nutrient intake, nutraceuticals, nutritional status, 24 hours recall method

**Article Info:** Received 19 June 2019; Review Completed 19 Aug 2019; Accepted 28 Aug 2019; Available online 15 Sep 2019



### Cite this article as:

Pradhan M, Guru P, Paital B, Daily Dietary Nutrition and Nutraceutical Intake in Agricultural Laborers of Hirakud Command Area, Sambalpur, Odisha, India, Journal of Drug Delivery and Therapeutics. 2019; 9(5):56-61  
<http://dx.doi.org/10.22270/jddt.v9i5.3443>

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### INTRODUCTION

Nutritional science deals with the interaction of nutrients and other substances in food in relation to maintenance, growth, reproduction, health and disease of an organism. In one hand, it describe the food intake, absorption, assimilation, biosynthesis, catabolism and excretion<sup>1-2</sup> and on the other hand, it also deals with the nutrition deficiency associated abnormalities and diseases<sup>3</sup>. It is estimated that 190.7 million (14.5%) people were undernourished in India during 2014-2016<sup>4</sup> and the situation even worse in the state Odisha but with an observed improving trend. Although, a constant economic growth is achieved in our country over the last decade, one sixth and one fifth of Indian adult and children are found to be undernourished<sup>5</sup>. So, the ratio between demand and need

for nutritional and nutraceuticals in Indian population need to be lower down.

Health problems are rampant in rural area not merely because of lack of medical facilities but because of general poverty, lack of balanced and nutritious diet to large proportion of rural population and more over lack of knowledge with regard to dietary requirements, the nutritive value of different foods and health. Surveys carried out by National Nutrition and Monitoring Bureau over the past decades in rural and urban areas of 10 states of the country have revealed that, the diets of the middle-income groups in urban areas is fairly satisfactory, where-as the diets of the rural people and slum dwellers is inadequate in many aspects which is a cause for the widespread occurrence of malnutrition and deficiency diseases<sup>6</sup>.

According to population census of India 2001, there are about 402.5 million rural workers of which 127.6 million are cultivators and 107.5 million are agricultural laborers<sup>7</sup>. In other words, pure agricultural workers constitute nearly 58.4 % of the total rural workers, of which 31.7 % are owner cultivators and 26.7 % are mainly agricultural wage earners<sup>8</sup>. The latest available agricultural census data (Govt. of India, Agricultural Census Division, Ministry of Agriculture 2002) also reveal that about 78 % of operational land holding in the country can be classified as marginal and small, having less than 2 hectares. About 13 % holdings have 2 to 4 hectares of land and only 7.1 % have 4 to 10 hectares of land<sup>9</sup>. The agricultural Census data clearly shows that Indian agriculture is dominated by small and marginal farmers, who are basically subsistence farmers. They provide mainly for self-consumption. However, some of these farmers have to sell their produce immediately after harvest at low prices and buy the same products later at high prices.

Agricultural workers constitute the most neglected class in Indian rural structure. Often they are not in a position to earn just enough to meet their minimum basic needs. They are also frequently exposed to the hazards of unemployment and irregular employment. These work forces do not have any type of private nor social security. Being unorganized, they also do not have the voice to seek better living and working condition. Since, they are unskilled; they have no alternative employment opportunities either<sup>10</sup>. So they do not get adequate nutrition for maintaining good health and normal physical efficiency. In order to achieve the maximum output of work good nutrition is one of the basic requirements. It may be mentioned here that the quality and quantity of nutrients vary not only with age but also with intensity of work.

The food requirement of the people varies greatly depending on various factors. Apart from non-occupational activities like walking, dressing, eating etc the nutrient requirement changes depending upon the various activities that one has to perform in his or her daily occupation such as agricultural activities, stone cutting, loading etc. For example a stone cutter requires and expends more energy than a worker in a factory doing light work. Agricultural workers need a wide range of nutrients to keep them healthy and fit. These nutrients can be derived from the daily diet. For maintaining good health and physical efficiency, the diet should provide adequate amounts of all nutrients. The daily requirements of different nutrients for workers engaged in different types of physical activity have been suggested by different Nutrition committees. There is categorization of worker like light or sedentary worker, moderate worker and heavy worker. Agricultural workers come under the category of heavy worker. Thus, the agricultural worker should follow the RDA table of hard worker of ICMR, India. Farmers also called agriculturists are persons engaged in agriculture, raising crops for food or raw materials. Thus more attention needs to be given to obtain data on the physical and Nutritional status of different categories of Agricultural worker in different income group, their knowledge and practices regarding health and nutrition.

The hydroelectric power house Hirakud Dam of Sambalpur with a total capacity of 5, 896, 000,000 m<sup>3</sup>, 55 km (34 mi) long, irrigates about 75,000 km<sup>2</sup> (19×10<sup>6</sup> acres) of land. Its storage capacity of 5.818 km<sup>3</sup> (1.396 cu mi) with grosses of 8.136 km<sup>3</sup> (1.952 cu mi) and drains an area of 133,090 km<sup>2</sup> (32.89×10<sup>6</sup> acres), more than twice the area of Sri Lanka. The dam provides 1,556 km<sup>2</sup> (384,000 acres) of Kharif and 1,084 km<sup>2</sup> (268,000 acres) of Rabi irrigation in districts of Sambalpur, Bargarh, Bolangir, and Subarnpur<sup>11</sup>.

<sup>19</sup>. Therefore, it provides a work force to several millions farm folk mainly in Sambalpur, for which it is called as the rice bowl of Odisha state<sup>15-19</sup>. However, the daily average nutritional uptake about the farm folk of Sambalpur is lacking. Therefore, the present study was conducted to know the daily food nutrition intake of the agricultural labourer (AL) in Sambalpur area.

## MATERIALS AND METHODS

The data for this study were obtained from a random sampling method of three hundred agricultural laborers from Hirakud Command Area of Sambalpur district of Odisha. Random sampling was done by coin toss method after assigning number to participants. Out of 300 subjects, 150 numbers were male agricultural laborers and 150 were female agricultural laborers.

Data were collected by administering the pre-tested interview schedule. All the respondents were interviewed personally by the investigator at the place of work, which enabled him/her to get first-hand information. In the present study daily food intake and nutrient intake of the respondents have been calculated. For recording the data, "24 hours recall method" has been used. During the interview the respondents were asked about the food items she/he consumes daily. Accordingly, the food items she / he consumed during the day were recorded. For measuring quantity of the food stuffs i.e. rice, roti, curry, dhal, etc. the katori or the serving spoon etc. were used as measuring units. These were then quantified using the measurements taken by the respondent to prepare such food items. For example, for one katori of rice, the quantity was arrived at considering the standard measurement. The nutrient content of each food item was estimated following the method used in the article by Gopalan et al.<sup>20</sup>. The average quantity of consumption of each of these major food groups and nutrient groups for a laborer for a day were estimated and compared with the quantity recommended as dietary allowances (RDA) for Indians by ICMR<sup>21</sup>. The dietary and nutrient intake has been expressed as percentages in excess or deficit of the recommended dietary allowances<sup>21</sup>.

## Statistical analyses

All sets of data (n=150) in male and female groups were subjected to check for homogeneity of variance and normal distribution. Chi-square test was performed to compare the mean values obtained for male and female. Data were considered as significance at p< 0.05 level or at 5% confidence level.

## RESULTS AND DISCUSSION

### Dietary intake pattern

Table 1 shows the mean per capita daily consumption of different food items of the agricultural laborer of Hirakud Command Area of Sambalpur against the daily recommended and its deviance in percent to RDA. These intakes were compared with the quantity of dietary allowances recommended (NIN).

**Cereals:** The average intake of cereals was estimated to be 640.84 gm by the male agricultural laborer and 488.52 gm by the female agricultural laborer. It was found that the cereal intake was in excess by 6.807% in case of male agricultural laborer and in excess by 1.77% in case of female agricultural laborer (Table 1). In both the categories (i.e. male and female agricultural laborer) the cereal intake was found to be excess.

**Pulses:** The daily mean intakes of pulses by the male and female agricultural laborer were 23.19 gm and 16.55 gm

respectively. This quantity of consumption was found to be very less in comparison to the RDA. It was 80.67% deficit in case of male agricultural laborer and 81.6% deficit in case of female agricultural laborer. Pulses are rich in protein and also supply energy equivalent to carbohydrates. The deficit intake of protein may cause protein energy malnutrition among the respondents.

**Green Leafy vegetables and other vegetables:** The average consumptions of leafy vegetables by male and female agricultural laborer were found to be 39.51gm and 39.86 gm respectively which amounted to 60.49% and 60.14% deficit of the requirement. Similarly, the intakes of the other vegetables by male and female agricultural laborer were also found to be deficit by 62.64% and 70.20% respectively. Leafy vegetables and other vegetables are always considered as protective and regulatory foods. As the intake of these items has been found to be in deficit, the

laborers may suffer from vitamin and minerals deficiency related diseases.

**Roots and Tubers:** The mean intake of roots and tubers by the male agricultural laborer was 111.74 gm and by the female agricultural laborer was 81.14 gm. It was deficit by 44.13% in case of male agricultural laborer and 59.430% in case of female agricultural laborer. Roots and tubers helps in increasing the calorie content of the foods and excess or deficit intake may affect the calorie percentage. It has been observed and mentioned above that the cereal intake of the workers was more than the RDA, which may be compensating to some extent, the deficiency arising out of less intake of roots and tubers.

**Fruits:** The mean intakes of fruits were found to be 11.81 gm and 16.45 gm by male agricultural laborer and female agricultural laborer respectively which was 88.19% and 89.55% deficit from the recommended amount.

**Table 1.** Average daily food intake by agricultural laborer Compared with RDA values.

	Male	RDA	Excess (+) /Deficit (-) (%)	Female	RDA	Excess (+) /Deficit (-) (%)
<b>Cereals(gm)</b>	640.84 <sup>a</sup>	600	(+) 6.807	488.52 <sup>b</sup>	480	(+) 1.775
<b>Pulses(gm)</b>	23.19 <sup>a</sup>	120	(-) 80.672	16.55 <sup>b</sup>	90	(-) 81.607
<b>Green Leafy Vegetables(gm)</b>	39.51	100	(-) 60.493	39.86	100	(-) 60.140
<b>Other Vegetables(gm)</b>	74.71 <sup>a</sup>	200	(-) 62.643	59.59 <sup>b</sup>	200	(-) 70.203
<b>Roots &amp; Tubers(gm)</b>	111.74 <sup>a</sup>	200	(-) 44.130	81.14 <sup>b</sup>	200	(-) 59.430
<b>Fruits(gm)</b>	11.81	100	(-) 88.193	10.45	100	(-) 89.553
<b>Meat, Fish &amp; Egg(gm)</b>	13.99 <sup>a</sup>	30	(-) 53.356	11.17 <sup>b</sup>	30	(-) 62.778
<b>Oil &amp; Fats(gm)</b>	13.00 <sup>a</sup>	40	(-) 67.500	10.53 <sup>b</sup>	30	(-) 64.911
<b>Milk &amp; Milk Products(gm)</b>	8.76 <sup>a</sup>	300	(-) 97.080	5.36 <sup>b</sup>	300	(-) 98.213
<b>Sugar &amp; Jaggery(gm)</b>	12.84 <sup>a</sup>	55	(-) 76.655	10.09 <sup>b</sup>	45	(-) 77.570

Different super scripts (<sup>a</sup> or <sup>b</sup>) used for the mean values in male than their respective female groups are statistically significant at  $p < 0.05$  level.

**Meat, Fish and Egg:** In the survey it is seen that the average daily intakes of non-vegetarian food is 13.99 gm and 11.17 gm by male and female agricultural laborers respectively. This gives a deficit of 53.35% and 62.77% as compared to the recommended requirement for male and female laborers respectively. Compared to other food items the deficit in the intake of non-vegetarian food is negligible.

**Oils and Fats:** The average daily intake of oils and fats has been found to be 13 gm and 10.53 gm by male and female agricultural laborer respectively which is 67.5% and 64.91% short of that recommended by RDA. Fats and oils provide extra calories which may compensate the lack of calorie intake from other sources.

**Milk and milk products:** The average daily intakes of milk and milk products was 8.76 gm and 5.36 gm in case of male and female agricultural laborers respectively which was 97.08% and 98.23% deficit compared to RDA. It has been found that maximum consumption of milk is by the respondents who had cow as animal resource. The deficit in both milk and pulses intakes, which are the main source of protein, adversely affect the quality of diet in a substantial way.

**Sugar and Jaggery:** The average intakes of 12.84 gm and 10.09 gm of sugar were recorded for the male and female

agricultural laborer which is 76.65% and 77.5% deficit. Most of this sugar consumption came from consumption of tea.

#### Nutrient Intake

Table 2 shows the average per capita daily nutrient intake of male and female agricultural laborers with excess and deficit percentage as compared to RDA.

**Energy:** The daily calorie intakes have been calculated as 2633.43 kcal and 2594 kcal by male and female agricultural laborers respectively. Thus, a deficit by 24.54% and 8.97% is noticed from the RDA norm for the male and female laborers, respectively. This is because of the fact that all food groups were taken in less amount (except cereals) and also due to the use of inadequate amount of fats and oils in their diets which affected the calorie intake as recorded in previous table. The result supports the result of Bellurkar (2015)<sup>22</sup> who noticed in her study that the respondents took less calorie.

**Protein:** The daily requirement of protein as per RDA is 60 gm and 55 gm for the male and female agricultural laborer respectively. But the daily consumption of protein by male and female agricultural laborer has been recorded 20.20 gm and 20.85 gm which is deficit by 66.33% and 62.09%. This is because milk and pulses intakes were very less as compared to RDA norms.

**Table 2.** Average daily nutrient intake by agricultural laborer compared with RDA values.

NUTRIENT	Male	RDA	Excess (+) /Deficit (-) (%)	Female	RDA	Excess (+) /Deficit (-) (%)
<b>CALORIES (Kcal)</b>	2633.4 <sup>a</sup>	3490	(-) 24.543	2594.25 <sup>a</sup>	2850	(-)8.974
<b>PROTEIN (gm)</b>	20.20	60	(-) 66.333	20.85	55	(-)62.097
<b>IRON (mg)</b>	10.78	17	(-) 36.573	10.57	21	(-)49.687
<b>CALCIUM (mg)</b>	346.95	600	(-) 42.174	346.33	600	(-)42.278
<b>VITAMIN A (µg)</b>	346.56 <sup>a</sup>	600	(-) 42.240	355.85 <sup>b</sup>	600	(-)40.692
<b>THIAMINE (mg)</b>	1.23 <sup>a</sup>	1.7	(-) 27.765	1.39 <sup>b</sup>	1.4	(-)0.714
<b>RIBOFLAVIN (mg)</b>	0.57 <sup>a</sup>	2.1	(-) 72.857	0.74 <sup>b</sup>	1.7	(-)56.629
<b>NIACIN (mg)</b>	17.54	21	(-) 16.453	18.41	16	(+)15.086
<b>VITAMIN C (mg)</b>	44.55 <sup>a</sup>	40	(+) 11.383	53.71 <sup>b</sup>	40	(+)34.267

Different super scripts (<sup>a</sup> or <sup>b</sup>) used for the mean values in male than their respective female groups are statistically significant at  $p < 0.05$  level.

**Minerals:** The consumption of Iron and Calcium has been considered in this study. The intake of these minerals has been found to be in deficit among the agricultural laborers. The Calcium intake is deficit by 42.17% and 42.27% in case of male and female agricultural laborers respectively. Likewise, the iron intake is deficit by 36.57% and 49.68% in case of male and female agricultural laborers respectively. This is because of fewer intakes of iron rich food, faulty cooking process and faulty selection of vegetables. Some of respondents grow calcium and iron rich vegetables but they do not consume it, rather they sell it in the local market for money.

**Vitamin A:** The consumption of Vitamin A was 346.5 µg and 355.85 µg by male and female agricultural laborers respectively. This is 42.24% and 40.69% deficit. This may be due to ignorance and less nutritional knowledge.

**Thiamine:** It is an important B-group vitamin. It is required for the proper utilization of carbohydrates in the body and for full utilization of sugars and starches for meeting the energy needs. The consumption of thiamine is 1.23 mg and 1.39 mg by male and female agricultural laborer which is 27.76% and 0.714% deficit from the RDA standard respectively. Compared to other nutrients the deficit intake of thiamine is negligible.

**Riboflavin:** It is essential for several oxidation processes inside the cell and is concerned with energy and protein metabolism. Daily intake of Riboflavin is 0.57 gm and 0.74 gm by male and female agricultural laborer respectively, which is 72.85% and 56.62% deficit from the RDA. This may be due to the lesser consumption of food as compared to recommended quantity. Milk, milk products, eggs, liver are good sources of riboflavin, while wheat, millets and pulses are fair sources. It is recorded earlier that the intake of above items is less which is the main cause of deficit of riboflavin.

**Niacin:** It is a vitamin intimately connected with several metabolic reactions. Hence its necessity is also related to energy requirement. The Table -2 implies that the average intake of Niacin was 17.54 gm and 18.41 gm respectively which is 16.45% deficit in case of male agricultural laborer but 15.08% excess in case of female agricultural laborer. The variation may be due to those whole cereals, pulses are good sources of niacin which were consumed more by women group than male agricultural laborer. The finding of niacin intake by female agricultural laborer of this study lend support to the findings of Bellurkar (2015)<sup>22</sup> who says that the niacin intake of the respondents was quite normal by female agricultural laborer.

**Vitamin C:** It is an essential nutrient for human body as it lacks the capacity for synthesis as in case of other animal species. The average intake of Vitamin C is 44.55 mg and 53.71 mg by male and female agricultural laborer which is 11.383% and 34.26% excess than recommended amount. This excess intake may be as they take more citrus fruits like lemon and tomatoes, green chilies etc.

A therapy is curing of a disease or alleviating pain or injury by a single or combination of medicines<sup>23-25</sup>. Many a time, diet is used for the treatment of disease(s)<sup>24</sup>. For example, in case of wound healing, supportive diets, especially animal proteins are recommended in many clinical cases other than externally used antibiotics<sup>24-28</sup>. Such food substances, different from pharmaceuticals, are more often called as "having medicinal properties,". They are used for therapeutic purposes, can have important role on physiology and even longevity of human<sup>27, 29-32</sup>. When the former are purified from animal or plant, they are usually called as biopharmaceuticals<sup>33</sup>. More particularly, the term "nutraceuticals" is used when food or products derived from food are used as supplements for therapeutic purposes<sup>3, 34-35</sup>. Vitamins, minerals, high-density fatty acids, and herbal products are a few examples<sup>26, 34-35</sup>. And, proper nutraceutical intake has lot of importance in every individual including farmers. So, the parameters studied in this work are extremely important for devising a proper plan in daily dietary managements in ALs of Sambalpur<sup>36-38</sup>. Methods for investigating both environmental and nutritional impact on food availability and uptake must be carried out<sup>39-40</sup>.

**Recommendations:** In view of the above results and the foregoing discussion the following steps are suggested which may improve the nutritional status of the agricultural laborer.

- The intake of all food groups except cereals should be increased so that the nutritional value of the food they consume also increases.
- Some locally available fresh fruits like papaya, mango, guava, etc., iron-rich vegetables and some raw vegetables should be included in the diet in order to enrich the quality of foods
- Proper method of cooking is to be followed to retain the nutritive value of the foods. The common practices such as washing of vegetables after cutting, cutting vegetables in small size, draining of excess water after boiling should be avoided.

- To enhance the quality of the diet, it is essential to include whole cereals and pulses etc. in the menu.
- Germination and fermentation enhance the nutritive value of foods without any additional cost. Thus, sprouted grains and legumes should be included in the meal, which should be eaten raw. Fermented mixture of rice and legumes should be tried.
- Steps should be taken to educate the agricultural laborer on fundamentals of nutrition and role of good nutrition in improving the work efficiency. Nutritional education should focus on selection of low-cost nutritious food. Investigation on low cost alternate food stuffs may also be carried out.

## CONCLUSION:

In the present investigation, it was noticed that the daily food and nutrient intake was below the RDA norms. The nutrient intake of agricultural laborer in this study in Sambalpur area was found below the recommended value for energy, protein, fat, iron, calcium, and vitamin A. The result collaborates the findings of Achinihu et al.<sup>41</sup> who noticed in their study that the respondents were taking lesser nutrients. Many nutrients were found to be deficit as the respondents take fewer amounts of food items. Therefore, a proper management of nutraceuticals in the studied population is recommended.

## ACKNOWLEDGEMENTS

Scheme number No. ECR/2016/001984 by SERB and 1188/ST, Bhubaneswar, dated 01.03.17, ST-(Bio)-02/2017 and DST, Odisha to BRP are acknowledged.

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