



## STUDY ON POSSIBLE USE OF HIGHLY PROTEINACEOUS ZOOPLANKTON AS A DIRECT SOURCE OF SUPPLEMENTARY FOOD FOR THE PREVENTION OF PROTEIN ENERGY MALNUTRITION (PEM).

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### ABSTRACT

Protein energy malnutrition (PEM) is the condition when the body does not get enough protein to maintain healthy tissues and organ's function resulting from inadequate or unbalanced diet. PEM is considered as the most lethal form of malnutrition due to lack of protein from the inadequate quantity and quality of food availability. Poor quality and quantity of food is considered as one of the important factor for PEM. Considering some fact, although the full utilization of terrestrial sources, it will not be able to keep up with the future demand of food supply for growing population of the world. Present study is set to evaluate the availability of another highly proteinaceous source of food for human. Zooplanktons are well known for its high protein content 52% to 59%. Nutritional importance of zooplankton community for survival and healthy growth of fishes has been proved by studies<sup>1</sup>. Nutritional evaluation of mixed zooplankton (protein estimation) has been done from dry matter as well as from fresh matter in correlation to the nutritional requirement of undernourished living beings to assess the future possible use of zooplankton as one of the direct source of food.

**KEYWORDS:** *Protein energy malnutrition, Zooplankton, Protein, Food*



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## INTRODUCTION

Nutrition is the intake of food, considered in relation to the body's dietary energy supply (DES)<sup>2</sup>. It is one of the key important factors in the promotion of good health throughout the entire life course. Lack of proper intake of food considered in relation to the body's dietary energy supply (DES) leads to malnutrition. If the intake of nutritious food is more than the body's dietary energy supply (DES) it leads to over nutrition and if the intake of nutritious food is less than the body's dietary need it leads to the under nutrition. The World Health Organization (WHO) defines malnutrition as "the cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions." Malnutrition has two basic forms: over malnutrition and under malnutrition. Under nutrition problem is severe in the developing countries rather than the developed countries<sup>2</sup>. Under nutrition is resulting from the inadequate consumption of essential nutrients (especially proteins) and micronutrients from the food. It is due to the inadequate quality or quantity of food. There are two basic types of under nutrition one is protein energy malnutrition (PEM) which lacks enough protein from food which has most importance in reference to the good quality of food availability; another one is micronutrient deficiency<sup>2</sup>. Protein energy malnutrition (PEM) is the most lethal type of malnutrition which is basically lack of protein and calories which is necessary for key body functions such as provision of essential amino acids and it is due to inadequate quantity and quality of food. Protein deficiency and energy deficiency is go by hand in hand. Protein deficiency is kwashiorkor and energy deficiency is marasmus<sup>3</sup>. According to studies<sup>1</sup> previously done, though there are numerous factors responsible for the under nutrition, inadequate quantity and quality food is playing the leading role. Proper nutrition of the population is considered as an important key for determining the good health and progress of the society. The problem of maintaining the proper nutrition of the world population is becoming worst as the world population

increasing. State of world population report 2011 says that there will be seven billion people inhabit the earth on 31 October 2011. According to some studies it is predicted that terrestrial source will not be able to keep up with the growing population<sup>4</sup> so it is necessary to find out new sources of food supply which will help to resolve this problem. Ocean is one of the researcher's mainly focuses to resolve this problem. Studies have already been done to determined possible use of ocean as a promising source of food supply for human. Though there are various source of food material available in the ocean only small fraction of aquatic food is used by human in the form of fish, molluscs and crustaceans etc<sup>5</sup>. One of the most promising food material present in the ocean which considered as a highly proteinaceous is zooplankton. Zooplankton community mainly crustacean is used as a fish for food<sup>6</sup>. In the aquaculture system studies have been done to prove potential of zooplankton community for proper growth and survival of the fishes. Biochemical estimations done on zooplankton community to evaluate the chemical composition shows that zooplankton biomass has very high percentage of protein 52 to 59 % of dry weight<sup>7</sup> as compared to other organic content of this community. Zooplanktons are highly proteinaceous.

## MATERIALS AND METHODS

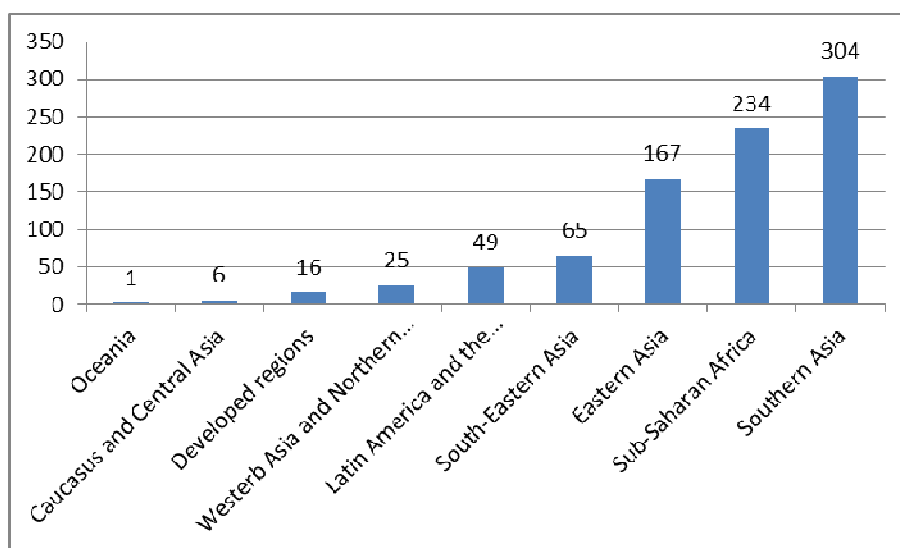
Mixed zooplanktons were collected from Wadali lake of Amravati city. Sample collection was performed in between 05:30 AM to 08:30 AM by vertical and horizontal hauls at surface water of two and half feet depth with the use of plankton net having 150  $\mu$ m mesh size and 80  $\mu$ m mesh size. Collected sample was resuspended with lake water in large 3 liter bottle and were finally brought to the laboratory. Sample was separated using different mesh size plankton net to avoid macro animals and was further cultured by using organic manure (cow dung and yellow grass) for seven days in two aquarium tank having 30 liters of water

capacity. After seven days sample of cultured zooplankton were taken for protein estimation. This sample was divided in to two parts one for protein estimation from fresh zooplanktons and another for protein estimation from dried zooplanktons. Fresh sample was taken in pre-weighed glass jar and some part of the sample was dried at 60<sup>0</sup> C until the constant weight is obtained. Total protein was estimated by Lowry et al., (1951) method<sup>8</sup>.

## RESULTS AND DISCUSSION

According to State of Food Insecurity in the World 2012 report about 870 million people are estimated to have been chronically undernourished. This represents 12.5% of the global population. The vast majority of these undernourished, almost 852 million live in developing countries where the prevalence of undernourishment is estimated at 14.9% of the total population (FAO 2012).

**Table 1**



(Source: FAO 2012) Undernourishment in 2010-2012 by region (millions).

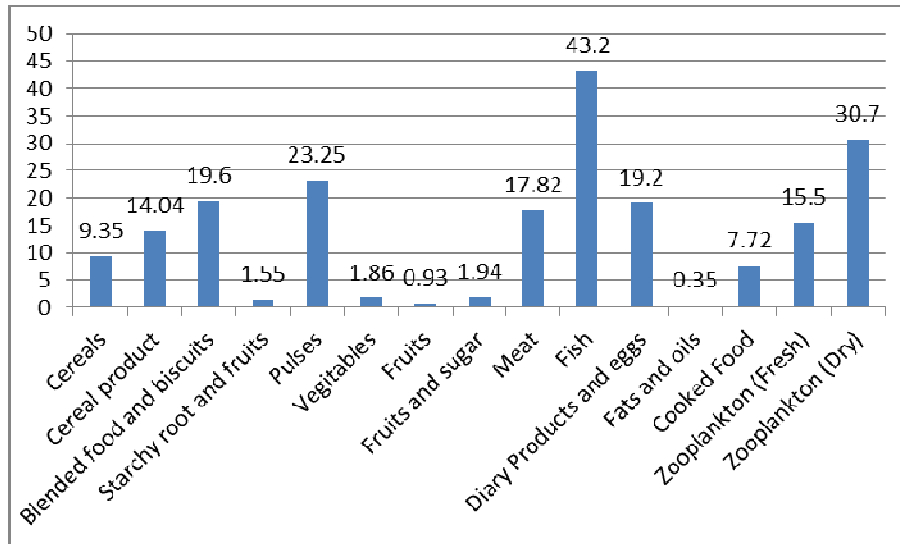
Although there is a decline in the global number of undernourished 18.6% to 12.5% between 1990-1992 and 2010-2012, however, according to new UN hunger report 2012, 852 million people suffering from hunger in developing countries. According to the United Nations, same number of people, including 170 million children worldwide, suffering from protein-energy malnutrition. Prevalence<sup>9</sup> of protein-energy malnutrition is greater than 75%. Undernutrition contributes to five million deaths of children under five each year in developing countries<sup>10</sup>. World Health Organization 2012 which states that poor nutrition is the most important single threat to

the world's health and it is due to the poor quality and quantity of food hence proper nutrition of the population is under prime importance. Ever since it was recognized that the proper nutrition of the world population represents a global problem of the highest importance and terrestrial source will not be able to keep up with the growing population, nutritionist has been steadily searching for new sources of food supply<sup>4</sup> due to the fact that food shortage is the main catalyst of malnutrition<sup>11</sup>. The total world animal standing crop has been estimated at 33.500 metric tons of which 21,500 metric tons are zooplankton<sup>12</sup>.

**Table 2**

Protein Content of Zooplankton	
Dry Sample	Wet Sample
30.4mg/100mg	15.5mg/100mg

**Table 3**



**Source (FAO 2012). Comparison of average protein present in food in gram/100 gram of edible portion of food (per cent of weight).**

Protein content of mixed zooplankton from dry sample as well as wet sample in the Wadali Lake of Amravati City is given in the Table-2. It is compared with other sources of protein which are expressed as gram per 100 gram of edible portion of the food (per cent of weight) in Table-3 which represents major source of protein as a natural source. As per it, fish contains 43.2% of edible portion, the second highest source of protein is pulse (23.5%), and the third is animal meat as protein source with 17.82 %. In our study fresh zooplanktons content 15.5% of protein which is nearly close to the value of meat. According to review of Schwimmer et al., zooplankton is equivalent in its nutritive value to the best of animal meat<sup>13</sup>.

The average protein values<sup>14</sup> ranged from, 21.07 to 34.65%. Dry matter protein content (30.7 %) of our results was found relatively low as compared to proteinaceous content (52-59%) from dry planktons' as reported<sup>7, 15-17</sup>. Lowered values in our observations could be due to the reduced biomass of phytoplankton in this season as values were estimated in the month of October. Rao et al., in their study also showed decline in the protein during the month of September to November<sup>15</sup>. Protein content is comparatively low in organisms with high water content such as Ctenophore and Hydromedusae which ranged between 30 - 40% in terms of dry weight<sup>18</sup>.

<b>Dietary Reference Intake for Protein</b>	
<b>Age Group</b>	<b>Grams of protein needed each day</b>
<b>Children ages 1-3</b>	13
<b>Children ages 4-8</b>	19
<b>Children ages 9-13</b>	34
<b>Girls ages 14-18</b>	46
<b>Boys ages 14-18</b>	52
<b>Women ages 19-70+</b>	46
<b>Men ages 19-70+</b>	56

Source IOM<sup>19</sup> 2002/2005: *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids (2002/2005)*.

Considering its high proteinaceous nature in many parts of the world, zooplankton community is used as a food for human. For example<sup>20</sup>, Bombard (1956) when he was drifting in small boat for 113 days who courageously crossed the Atlantic Ocean with no initial food supply, zooplankton acted as an emergency food for his survival in emergency condition when there was no other source of food. Also food shortage during world war second in Britain the request by<sup>21</sup> Kerr to the British parliament was led for practical use of plankton for humans as food. United States government was also in support and initiation of the possible use of plankton as a food source for humans<sup>17</sup> Clarke (1939) introduced the concept of plankton food web structure as food source for human<sup>21</sup>. Kishinouys 1899 had reported that in China and Japan the medusae of *Rhopilinema esculenta* and *R. verrucosa* are eaten and in the East Indies, species of *Mysidae* are caught in bulk and

there is a trade for it as a sauce<sup>7</sup>. Experiment performed on rat showed rat derived some nourishment from plankton but were able to assimilate only small fraction of it<sup>17</sup>.

## CONCLUSION

Thus, zooplankton can be used as a supplementary protein food to avoid protein-energy malnutrition in most affected part of the world. Main question is the making availability of zooplankton as a food with low price value. Further studies are required to find out the innovative technology for making zooplankton available as a food at cheap coast at commercial level. Rather than harvesting zooplankton from the water which could disturb the food web chain, commercial culture of zooplankton could be one of the solution. Powder of dried zooplankton could be use as a supplementary protein to deal with the protein-energy malnutrition.

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