

I N T R O D U C T I O N

Thomas Robert Malthus, in 'An Essay on the Principle of Population', in 1781, prognosticated war, famine and pestilence unless the men restrained his passion within the bound of reason. The pessimism of Malthus was the result of his conviction that population, if unchecked, will increase in geometrical progression and the means of subsistence or food only in arithmetical progression. Although there are many flaws in Malthusian theory of population especially when applied to developed countries, yet his fears that population growth will far exceed the available supply of food has proved true in developing countries including India. At present India is perhaps in the stage of demographic transition but still the food supply is unlikely to be sufficient for the teeming millions.

~~The annual milk production of the country is~~
estimated at 22-24 million tonnes which provides 100 g of milk per head per day as against 285 g recommended by the National

Nutritional Advisory Committee. In developing countries and particularly in India, where total population (600 millions) and its density - 156 persons per sq. km is high (India reference annual 1976) the malnutrition and hunger are wide spread. Our country needs at least three times more milk than is available at present to meet its population demand effectively and judiciously.

Within the pattern of hunger and malnutrition in the developing block, the greatest problem is that which results from inadequate calories and protein in the diets of large proportion of the population. This calorie protein deficiency may adversely affect the development of young children and the health of nursing mothers.

Protein consumption per capita per day in India is 56 g as compared to 93 g in USA, 87 g in U.K. and 70 g in Japan. It is obvious that our diet lacks very much in protein. The comparison looks more dismal when we compare the consumption of quality proteins. Animal proteins which have high biological value and which are more efficiently utilized than vegetable proteins by man are consumed only to the extent of about 6 g per day per capita in India as compared to 60 g in U.S.A., 52 g in U.K. and 24 g in Japan (Randhawa, 1969).

The majority of countries, excepting a few developed ones, are experiencing acute protein-energy shortage and the consequences that it entails.

According to a survey conducted by Indian Council of Medical Research (1971), it is estimated that out of 100 million children in the age group of one to five year in India, nearly 50% suffer from protein-calorie malnutrition in one form or the other. The need for increasing food production to meet the demand of increasing population is therefore imperative.

According to 1972 Census of India, there are about 178.9 million of cattle and 54.9 million buffaloes. The heavy pressure on land put by human and livestock population has set in almost a competition between human and livestock population for food between them in which the man naturally finds his preference. The continuous increasing trend in prices of foodgrains has virtually deleted the concentrate part of the ration from the animal feed leaving for some selected few high producing animals and draft animals. Most of the Desi cattle even do not get desired quality of the poor quality of roughages like wheat straw, paddy straw and kadbies. The shortage of roughage and concentrates has been reported to be of the order of 55 and 75 percent respectively (Whyte and Mathur, 1968).

The livestock production as compared to crop production per unit area is inferior in food production (Middleton, 1923; Schuphan, 1965; Holmes, 1966 and Duckham and Lloyd, 1967). Thus the annual yield of Energy is 2500 Mcal/ha from Dairy cows and 14,000 Mcal/ha from wheat. The annual yield

of protein is 115 kg/ha from dairy cows as compared to 350 kg/ha from wheat (Holmes, 1962). It is, therefore, clear that the developing countries will not be able to afford animal production if the animals were to compete with man for the limited available resources of food supply. The caloric requirements have to be met before we can think of providing protein of high biological value for our population.

It is, therefore, axiomatic that Animal Nutritionists of developing countries must endeavour to feed animals in such a way that direct competition with man for the limited available food is, as far as possible, avoided. Ruminants, however, need not compete with man; they can, in fact, act as commensals of man. Ruminants can help to maintain the fertility of land by utilizing sown pastures and they can also utilize the by-products of arable farming like straws, haulms etc. Ruminants can, through the activities of their rumen flora, convert non-protein nitrogen to high quality animal protein.

It is, therefore, important that we should ensure efficient utilization of coarse fodders and non-protein nitrogen by ruminants. It is generally agreed that urea-N helps in better utilization of coarse fodders (Balch and Campbell, 1962). However, the factors that govern the utilization of urea-N when ruminants are fed on coarse fodders have still to be clearly defined. The addition of molasses to urea based rations has given conflicting results. Further, urea can also be incorporated in concentrate mixtures and protein can thus be saved. The efficient utilization

of urea as a constituent of concentrate mixture is dependant to a great extent on the concentration of protein in diet. The role of soluble carbohydrates in such rations is still not clearly understood.

Rumen microbes need a supply of N, energy, mineral elements and other growth factors for proliferation urea supplies $\text{NH}_3\text{-N}$ which is the main nitrogenous nutrient required (Bryant, 1963b; Hungate, 1966; Allison, 1969). Carbon skeletons are provided by branched chain volatile fatty acids and possibly by $\text{CO}_2\text{-C}$ because the assimilation of CO_2 by rumen microbes has been demonstrated (Bryant and Robinson, 1961; Bryant and Robinson, 1963; Allison and Bryant, 1963; Bryant and Doetsch, 1954). Further, it has also been reported that NaHCO_3 supplies the $\text{CO}_2\text{-C}$ for the multiplication of rumen microbes (Chawla and Phillipson, 1975).

The present investigation, therefore, envisages to study the effect of sodium bicarbonate on the utilization of urea-N and cellulose digestion in ruminants. It also aims at comparing the effect of NaHCO_3 vis-a-vis the carbohydrate sources such as molasses and starch when the ruminants are fed on urea based rations.