Antibiotics in Nutrition

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THE layman regards antibiotics more as drugs than as feed supplements. The entry of antibiotics in the field of nutrition is therefore a new thing. From the reports available it seems likely that antibiotics, because of their quick and convincing effect on the growth of different animals, may occupy an important place as feed supplements.

Effect of antibiotics on various animals:

Growth responses to antibiotics in chick diets were first observed in a number of laboratories. While responses to vitamin B_{12} are obtained primarily on all vegetable protein diets, the responses to antibiotics are seen on a wide variety of diets containing fish meal, peanut meal, cotton seed meal and soya bean meal as the principal protein supplement. Of the antibiotics tried only aureomycin, bacitracin, penicillin and terramycin are particularly effective even at levels as low as 1-2 gms. per ton of diet.

In pigs, aureomycin and terramycin give a better growth response than bacitracin or penicillin. Several reports show that antibiotics stimulate the growth of rats which are given diets containing limiting amounts of vitamins of B-complex. The response was greatest on soya bean containing basal diet and least on casein-sucrose diet. Differences in response due to the kind of diet are observable in other species as well.

Antibiotics might be expected to have a different effect on ruminants whose nutrition basically depends on bacterial synthesis. The idea gained ground that antibiotics act by modification of intestinal flora of experimental and farm animals. Numerous studies have shown that the administration of small amounts, 15 to 100 mgms. per day to young non-ruminating calves increases growth rate, decreases diarrhoea and improves "physical appearance." Aureomycin and terramycin are particularly effective and penicillin is not effective with ruminants.

In general it is found that growth promoting effect of antibiotics is seen marked only with young animals and with older ones it gradually decreases. Again, the effect is found only when the diet is "nutritionally balanced," although instances of vitamin sparing action of antibiotics have been reported.

Theories of mode of action:

(1) "Sparing action" of antibiotics: The vitamin sparing action of antibiotics could explain in part the growth responses on diets marginal in vitamins; it cannot, however, account for the effects observed in nutritionally complete diets. Much of the work on vitamin sparing action has been done with reference to vitamin B_{12}. Response to aureomycin is generally the greatest. Vitamin sparing action has also been obtained with the rats and in cases of thiamine, pantothenic acid and riboflavin deficiencies.

Antibiotics have been observed to exert similar sparing effect on proteins. A number of experiments show that antibiotics do influence protein requirements. The antibiotics increase growth preferably by improving the availability of the protein in the diet and hence contribute to better protein efficiency.

(2) Selective action on intestinal flora: Many workers have suggested

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that antibiotics exert their growth promoting effect through their action on the gut population. Such action could be explained in several of the following ways :

(a) By encouraging the growth of organisms that synthesise known or unidentified nutrients,

(b) By depressing the growth of organisms that compete with the host for supplies of nutrients,

(c) By eliminating known pathogens and

(d) By eliminating bacteria which produce toxins that reduce the growth potential of the animal. General support is there for practically all of the above postulates and at the present time it is difficult to say which one of them is non-operative in practice.

(3) " Infection " theory : It has been shown that growth of chicks on diets containing animal protein is stimulated by penicillin, only when the chicks are housed in a laboratory which had been used for poultry for some years. Chicks from the same batch kept in two other laboratories where birds had not been kept before grew equally well on the ration with and without penicillin. The effect of penicillin was therefore considered to consist in overcoming growth depression produced by undescribed infectious surroundings. The main effect of the infective agent is to cause thickening of the gut wall and hence less efficient utilisation of nutrients.

(4) Other theories : Antibiotics have some effect on water metabolism. In the case of pigs it is reported that they show lower water consumption while in the case of chicks there is an increase in water consumption.

Some workers also think that antibiotics have some effect on the appetite of the animals. It should be stated here that effect of antibiotics is observed only in *ad libitum* feeding and does not occur in experiments with restricted feeding of groups.

Several reports are available to suggest that careful feeding of antibiotics to children, especially with retarded growth, have beneficial effect on growth, mental alertness and absence of gastro-intestinal upsets. There have been some contradictory observations as well and the position seems equivocal at present. Further careful experimentation by several groups of workers is in progress.

The growth promoting effect of antibiotics under certain conditions seems established in several species of animals. Expectations are high ; but it is impossible at the moment to foresee the permanent value of antibiotics as feed supplements. There is a strong evidence that their judicious use usually results in appreciable benefit to growing livestock. Therefore, the economic advantage to be derived from the use of antibiotics is a question of prime importance to animal husbandry.

The therapeutic use of antibiotics in man has occasionally been complicated by the development of resistant strains. It is possible that the continued use of antibiotics as feed supplements may cause similar complications ; however, no spectacular microbiological changes occur when small amounts of antibiotics are given. But there is no doubt that gut population will adapt itself in the presence of antibiotics with the danger of the development of noxious resistant strains. There may also arise organisms that could metabolise and therefore inactivate antibiotics. A careful watch over extended period on the consequences of antibiotic use as feed supplements seems necessary.

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