Nutrtion/practical **Dr.Zainab A. Mutter**

Rumen microbiology

Bacteria, protozoa, and fungi exist together in the cow's rumen. Bacteria make up about half of the living organisms but do more than half of the rumen's digestive work. Rumen bacteria are classified into fiber digesters, starch and sugar digesters, lactate using bacteria, and hydrogen-using bacteria. They cooperate together and cross feed.

Bacteria

Bacteria make up about half of the living organisms inside of the rumen. However, they do more than half of the work in the rumen. The bacteria work together. Some breakdown certain carbohydrates and proteins which are then used by others. Some require certain growth factors, such as B-vitamins, which are made by others. Some bacteria help to clean up the rumen of others' end products, such as hydrogen ions, which could otherwise accumulate and become toxic to other organisms. This is called "cross-feeding".

Classification of Bacteria

1-Cellulose Digestion Bacteria)Cellulolytic (
Bacteroides succinogenes Ruminococcus flavefaciens

2- Hemicelluloses Digestion Bacteria
Butyrivibrio fibrisolvens
Lachnopira multiparus

3- Starch Digestion Bacteria (Amylolytic)
Bacteroides amylophilus
Succinimonas amylolytica

4- Bacteria Utilizing Sugars
Lactobacillus ruminus
Lactobacillus vitulinus

5- Bacteria Utilizing Acids
Veillonella gazogenes
Selenomonas Lactilytica

6- Bacteria Producing NH3
Bscteroides ruminicola
Selenomonas ruminantium

Clostridium Sporogenes

7- Proteolytic Bacteria
Bacteroides amylophilus

8- Bacteria Producing CH4
Methanobacterium ruminantium
M.formicicum

9- Lipolytic Bacteria
Micrococcus sp.
Fusocillus sp.

10- Vit's –Synthesizing Organisms
B-Complex

Protozoa:

As much as 50% of the microbial mass in the rumen can be made up of protozoa. However, their role, as compared to the rumen bacteria, is not as significant. The protozoa are actually predators to the bacteria in the rumen .Protozoa are about 40 times the size of rumen bacteria.

The rumen protozoa produce fermentation end-products similar those made by the bacteria, particularly acetate, butyrate, and hydrogen. Rumen methane bacteria actually attach and live on the surface of rumen protozoa for immediate access to hydrogen.

Rumen protozoa eat large amounts of starch at one time and can store it in their bodies. This may help to slow down the production of acids that lower rumen pH, benefiting the rumen.

Rumen protozoa multiply very slowly in the rumen --- over 15-24 hours – as opposed to the bacteria that may take as little as 13 minutes to multiply. For this reason, the rumen protozoa hide out in the slower moving fiber mat of the rumen so that they aren't washed out before they have a chance to multiply. Low roughage diets reduce the retention of fiber in the rumen and may decrease the number of protozoa in a cow's rumen.

Rumen Fungi:

Fungi are known to exist in the rumen (up to 8% of the total mass) but they are poorly understood. They attach to feed particles and they reproduce very slowly. They may help out the fiber-digesting bacteria by doing some of the initial work of splitting fibrous material apart and making it more accessible for the bacteria. Higher numbers of fungi have been found in the rumens of cows fed very poorly digestible sub-tropical forage.

Basic Fermentation Chemistry

Microbes that digest cellulose and other substrates also provide at least three other major "services?"

1. **Synthesis of high-quality protein in the form of microbial bodies:**

a) Bacteria & protozoa, which can be digested and absorbed by the host animal.
b) Animals need certain amino acids, which their cells cannot synthesize, "indispensable amino acids" - Fermentative microbes can synthesize & provide them to their host.

2. **Synthesis of protein from non-protein nitrogen sources:**

a) Fermentative microbes can, for example, utilize urea to synthesize protein.
b) In some situations, ruminants are fed urea as a inexpensive dietary supplement.
c) They also secrete urea formed during protein metabolism into saliva, which flows into the rumen and serves as another nitrogen source for the microbes.

3. Synthesis of B vitamins:

a) Mammals can synthesize only a few B vitamins and require dietary sources of the others.
b) Fermentative microbes can synthesize all the B vitamins, and deficiency states are rarely encountered in some animals.