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DIGESTIVE SYSTEM OF CATTLE

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ABSTRACT

The digestion of feeds and fodder in animal is carried out either by enzymatic hydrolysis or by microbial degradation. The enzymatic digestion of simple stomached animal is carried out by the digestive enzymes secreted into the lumen of the gastrointestinal tract by the various glands located in the digestive system of the animals. The microbial digestion of food in ruminant mainly enzymatic is brought about by the enzymes secreted by bacteria, protozoa and fungi present in the complex ruminant stomach. The microbial digestion is more important in ruminants where cellulose, hemicelluloses, pectin, etc., are degraded in the rumen, reticulum, omasum and abomasum stomach and lower tract into simpler form for easily absorption through the alimentary tract. In ruminant the stomach is complex in\nature and lots of different microbes, i.e. bacteria, protozoa, fungi, archaea are present in a complex microbial ecosystem. The microbial degradation precedes the enzymatic digestion of alimentary tract. However, in other herbivores (horses), microbial fermentation takes place in the posterior part of the digestive tract, i.e.in the caecum.

Key Words: - ruminant ,stomach , rumen , non ruminant, microbial digestion, etc.

INTRODUCTION

As cattle are herbivorous animals, it has unique structure (like other ruminant) of stomach to digest and assimilate coarse roughages. It is a misconception that ruminant has four stomachs; in reality it has only one stomach, having four compartments. The stomach includes the rumen or "paunch", reticulum or "honeycomb," the omasum or "manyplies," and the abomasum or "true stomach." First three compartments are non-glandular (no secretion) called as fore-stomach and last one (abomasum) is glandular that functions like simple stomach animal. Cattle get opportunity, they feed at a faster rate without chewing properly and later they 'chew the cud'. At the time of resting, either in sitting or standing position, they regurgitate the feed (from stomach to mouth) for thorough chewing. The sequential events like regurgitation, re-mastication, re-salivation and reglutination is called rumination. Cattle usually ruminate 8-10 hours daily. Rumination helps to reduce the particle size

of fibrous food materials. Therefore, it helps to increase the surface area exposed to the microbes and breakdown of impervious plant coating. For every mouthful they usually chew 30-60 times before re-swallow the feed. The whole process is repeated in every few minutes. Stoppage of rumination is an indication thatn the animal may have a digestive upset, and rumen is not functioning properly.

DIGESTIVE SYSTEM OF CATTLE

Mouth

Prehansion :- Intake or grasping of food.

Mastication :- chewing the food , take about 40 to 50 second for each bolus.

Insalivation:- Three pair salivary gland located in the mouth region. A cow approximately 100-200 saliva release per day and p.h. 8 rich in sodium carbonate and its amount increase with dry and acidic feeds like hay and silage. In ruminant animal no digestion takes place in the mouth.

Regurgitation :- Bolus of food weighs 100-120 gm take 3 seconds for ascending and 1.5

DIGESTIVE SYSTEM OF CATTLE

MAJOR ORGAN'S
ORGAN'S
1) Mouth
2) Esophagus
3) Stomach
4) Small intestine
5) Large intestine
6) Rectum
7) Anus

ASSESRY
Lips
Teeth
Tongue
Salivary gland's
Gall bladder
Pancreas

Simple Stomach
Stomach

Or Monogestic Animals

Compound

Rumen
Or
Pouch
Stomach

Reticulum
Or
Honey Comb

Omasum
Or
Many plies

Abomasums
Or
True

second for descending after mastication for 50 seconds.

Rumination:- The combination of all above processes except prehansion. Rumination process completed in 8 hours.

Oesophagus :- Oesophagus is a muscular canal connects between the mouth and stomach.

Rumen or (pauch) :- Rumen is located in the left side of the abdominal cavity. Rumen plays principal role in ruminant digestion. It acts as fermentation vat. It is the store house of the microorganisms containing favorable bacteria, protozoa and fungi. Rumen it is the largest compartment of the stomach and first part of the compound stomach and storage capacity in 150-200 kg and not development in small calves than not function than calves state the feeding than this is functional . Rumen in animal consists of left side of the body. Rumen p.h. 6.4-6.7 and rumen temperature 39oc .the rumen p.h. increase feeding in poor forage and rumen p.h. decrease than feeding in large amount of radically fermentable carbohydrate. Deferent type of gases present in the rumen. 65 % co2 ,23% CFC and 7% N2o. The major activities of the rumen are i) mixing of feed ii) rumination iii) carbohydrate fermentation iv) microbial growth v) protein synthesis vi) vitamin synthesis and vii) absorption.

FEATURES OF THE RUMEN ENVIRONMENT.

Microbial metabolism Microorganisms present in the rumen facilitate

- break down of coarse fibrous feeds and make nutrients available for the host (animal) as well as for own growth and Reproduction
- synthesis of volatile fatty acids (used as energy by the ruminants)
- Utilization of simple, inexpensive, low quality protein, nitrogen-containing substances (like urea) and store as microbial protein and energy in their cells. Therefore,

Parameters	Normal value	Remarks
P.H.	5.8-6.8 °c	Large amount of readily fermentable carbohydrate may reduce the pH to 4.0, in contrast poor quality roughages increase the pH to 7.5 or above. Extreme higher or lower pH is not conducive for the rumen environment
Temperature	38 – 41° C	Temperature higher than body temperature is due to the heat produced during fermentation
Bacteria (flora)	10^8 – 10^{10}/ml fluid	About 60 species of non-spore forming anaerobic bacteria found in the rumen
Protozoa (fauna)	10^6/ml fluid	Protozoa are larger than bacteria and prey bacteria for their survival. Most of the protozoa are ciliated.
Gas Phase	Anaerobic, CO_2 65%), CH_4 (25%), N_2 (7%) traces of H_2 and O_2	Usually anaerobic environment (devoid of (oxygen), however, small amount of N2 and O2 enters the rumen through ingested feed. Traces of O2 immediately after entering the rumen are utilized. In absence of O2, carbon is the ultimate acceptor of H2 and form methane (CH4). Gases are lost by eructation (belching). Bloat is another condition that occurs when cows can't eructate.
VFA's	Acetate (60-70%) Propionate (15-20%) Butyrate (10-15%)	Microorganism degrades the feed materials and produce VFAs (acetic acid, propionic acid and Butyric acid). VFAs are absorbed directly through the rumen wall and fulfill about 60 to 80 % of the energy requirement of the cow.

they upgrade low quality protein to high quality microbial protein and ultimately meet the protein requirement of the animal.

- Synthesis of B-vitamins and vitamin K, essential for animal health.

- Detoxification of some toxic compounds. However, high quality protein feeds are broken down and converted to microbial protein, thereby reduces the protein value of the feed.

FUNCTIONS OF RUMEN:-

1- Acts as storage place and hold the feed which cow has eaten.
2- Provide place for fermentation by bacteria , yeast, and protozoa etc.
3- Helps in digestion of crude fiber by the enzymatic action of cellulolytic bacteria.
4- Manufacture the vitamins of B complex group
5- Fermentation by volatile fatty acid origin.
6- Builds up the complete protein from non-protein nitrogenous substances like urea ,amide and amines ammonia etc.

RETICULUM OR (HONEY COMB)

The wall of the reticulum has honeycomb like lining. Reticulum is not actually separated from rumen. A small tissue fold lies between rumen and reticulum, materials exchange easily between them, therefore, collectively called reticulo-rumen. The feed must be broken down into small particles before it can pass from reticulum to omasum. Particles greater than 2 mm length are not able to pass the reticulum, thus, return back to rumen and ultimately regurgitated for re-chewing (chewing the curd). Reticulum also acts as a trap for foreign objects (like rocks, nails, and pieces of wire and metal) ingested by the cow along with feed. The nail, wire or sharp metal may puncture the side of the reticulum and can cause “hardware disease”. Reticulum plays major functions like reducing particle size and absorbing some amount of water and VFAs through the reticular wall. Reticulum also acts as pacemaker of rumen contraction. Contraction starts in reticulum which spread to the rumen and thereby mixing of the ruminal content. It is lined with mucus membrane containing many intersecting ridges which subdivide the surface in to honey comb like compartments and storage capacity in cow 8 kg , goat and sheep 2 kg. The located of reticulum immediately behind the diaphragm place it almost in opposition to heart. The groove appears to be less functional in adult ruminants than in suckling animals.

FUNCTION.

1- Continues fermentation
2- Passing fine and properly chewed food to omasum.
3- Helps in regurgitation and rumination
4- Retain hard objects such as wire or nails ,stone and nails etc.

Omasum or (manyplies) : - Omasum has many leaf-like folds and also called as ‘manypiles’. Function of the omasum is not clear. When the ruminal content reaches to the omasum, it contains 90-95% water. However, content passes to abomasum contain only 50% water. Besides water, omasum also absorbs VFAs. . it is storage capacity in cow 19 kg and sheep ,goat 1 kg . the position of omasum in between the honeycomb and true stomach. The floor of the omasum as well as the leaves are covered with stratified squamous epithelium

Function:-

1- To pass food from reticulum to abomasums’.
2- Absorb 50% water from food.
3- Has no secretary power.
4- Causes little fermentation.
5- Churning and maceration of food material.

Abomasum or (true stomach)

Abomasum (true stomach) is the first glandular portion of the ruminant digestive system. It secretes gastric juices, containing hydrochloric acid and enzymes (pepsin and rennin). At birth new born calf, 80% of the total stomach volume is contributed by abomasum. In mature cow the volume of abomasum is about 10% only. pH of the abomasal contents is about 2.0 which facilitates initial breakdown of protein and kills the bacteria which have spilled over from the rumen. The ingesta remain in the abomasum for 1 to 2 hours. the abomasums (true stomach) is the first glandular portion of the ruminant digestive system . it is located to the omasum and extends caudally on the right side of the rumen. The storage capacity of abomasum in cow 23 kg and sheep, goat in 2 kg. The abomasums epithelium posses cells which secrete electrolytic , specially HCL, pepsin, and mucus. The p.h. of this section is the range of p.h. 1.0-1.3 and overall ph of abomasum contents is about ph 2.0. The low PH of abomasal contents is responsible for the death of the microbes entering the abomasum. It is also provide optimum condition for acivity of the peptic enzymes responsible for the digestion of microbial protein in the abomasums.

Function

1- It is receives food omasum and passes to small intestine.
2- Store food for some time.
3- Digestion of food nutrients
4- Absorption of some nutrients.
5- Secretes gastic juice from gastic gland.

Small intestine:- Small intestine has three parts; duodenum, jejunum and ileum. It receives secretions from gallbladder and pancreas, which help in digestion. In small intestine almost all the nutrients are absorbed through the villi (small finger-like projections) into the blood andlymphatic systems after final stages of chemical enzymatic digestion. Protected (by-pass) protein and fats are digested in the small intestine..

Doudenum :- duodenum is the first part of the small intestine . it is closely attached to the body wall by a short mesentery, the mesodenum. Ducts from the pancreas and liver enter the first part of the duodenum.

Junum :-The jejunum is indistinctly separated from the duodenum. It begins approximately where the mesentery starts to become rather longs.

Ileum :-ileum is the last part of the small intestine.

Function:-

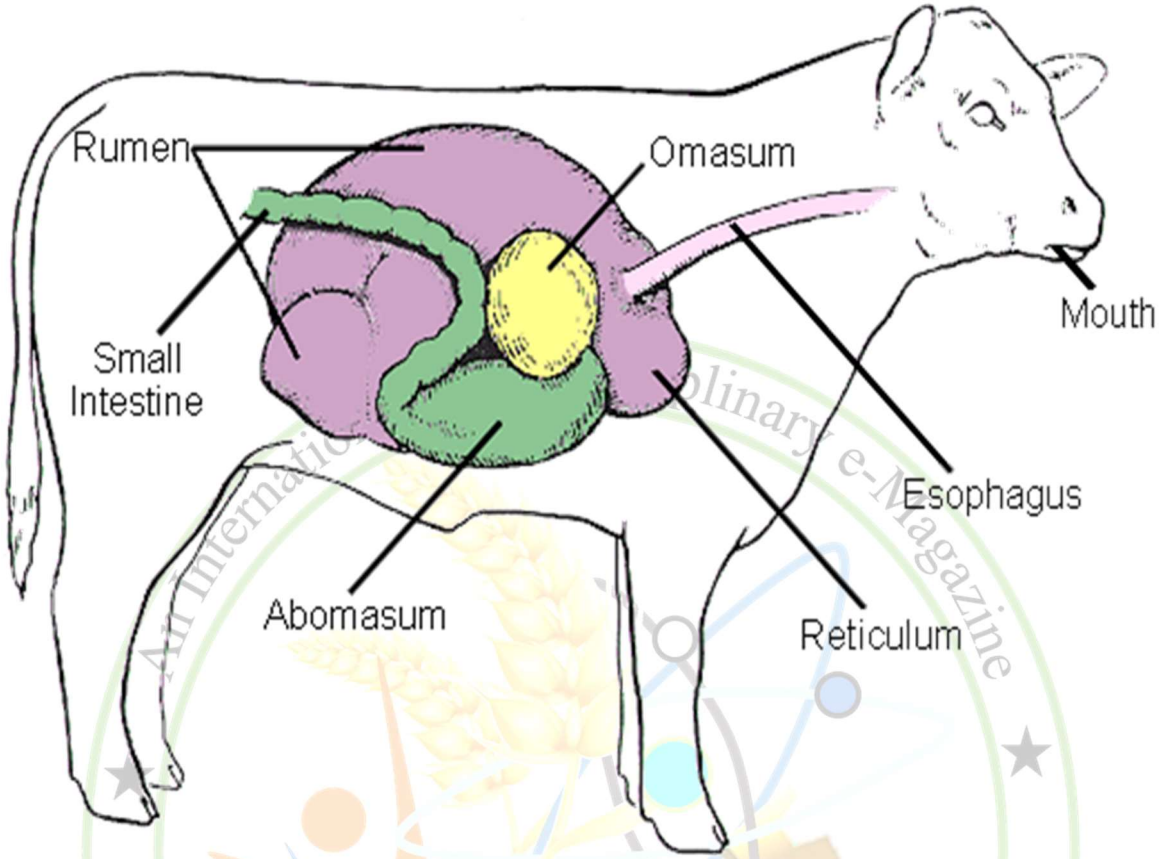
1- Receive the food from stomach.
2- Secretion of digestive juices.
3- Digestion and absorption of food nutrients.
4- Transport food from stomach to large intestine

Large Intestine :- Large intestine consists of caecum and colon. This is the last part of the elementary canal. Some bacterial digestion of undigested feed occur here and feces formed. Primary function of the large intestine is to absorb water, however minerals are also absorbed.

Function:-

1- It receives the food small intestine
2- Bring about bacterial activity and little fermentation.
3- It absorbs some nutrient ,not absorbed by small intestine.
4- Absorption of water from the feed residue.
5- Stores food residue temporarily in rectum.
6- Passes out the faecal material through anus.

Figure no. 1. Digestive system of cattle



REFERANCE

Banerjee, G. C. (1988) Feeds and Principles of Animal Nutrition. Oxford & IBH Publishing Co. New delhi

Banerjee, G.C. (1998) A Textbook of Animal Husbandry – 8th edition. Oxford & IBH Publishing Co.

Bath, D.L., Dickinson, F.N., Tucker, H.A. and Appleman, R.D. (1978) Dairy Cattle – Principles, Practices, Problems, Profits – 3rd edition. Lea & Febiger.

Chatterjee, B.N. and Das, P.K. (1989). Forage Crop Production. Oxford & IBH Publishing. ICAR (2003) Handbook of Animal Husbandry – 3rd edition. Indian Council of Agricultural Research. New Delhi. India.

McDonald, P. Edwards, R. A. Greenhalgh, J. F. D. (2002). Animal Nutrition. 6th edition.Oliver & Boyd.

Mudgal, V.D., Singhal, K.K. and Sharma, D.D. (2003). Advances in Dairy Animal Production – 2nd edition. International Book Distributing Co.National Research Council (1989). Nutrient Requirement of Cattle (NRC), Academic Press, USA

Phillips, C.J.C. (1989). New Techniques in Cattle Production. Butterworths.

Prasad, J. (2001). Principles and Practices of Dairy Farm Management. Kalyani Publishers.

Sastry, N.S.R. and Thomas, C.K. (1991). Dairy Bovine Production. Kalyani Publishers.

Sastry, N.S.R. and Thomas, C.K. (2005). Livestock Production Management – 4th edition. Kalyani Publishers. New Delhi, India.