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Development of Rumen in Cattles: An overview

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Introduction

The rumen is an important digestive organ that plays a key role in the growth, production performance and health of ruminants. The rumen is a unique part of the GI tract in ruminants. The anatomical development of rumen is not a simple enlargement of the organ as the animal grows but is markedly affected by diet. Three structural entities may change like capacity, mucosal tissue muscular tissue during development. Rumen development is largely measured by the development of the rumen papillae and rumen muscle mass. Rumen papillae are finger-like projections that protrude from the interior of the rumen wall to increase the surface area of the rumen for greater nutrient absorption. In newborn calves, the abomasum is the largest part of the stomach complex at 65%. Therefore, the rumen of a newborn calf must undergo significant developmental changes to store and digest feed in a manner similar to that of mature cattle. Understanding rumen development in newborn calves is one of the most important focus areas of calf nutrition.

Development of Rumen

Prenatal development: During early intrauterine life, the development of rumen is rapid but in later stage intrauterine life abomasum grew rapidly. Rumen forms major percentage of the stomach at all the time and even at the birth with intense increase in length of rumen in earlier stage while that of abomasum in later stage.

Postnatal development: Abomasum has initially fastest growth in calf soon after a week and growth rate slow down and rapid growth is observed in reticulo-rumen. The development of ruminal papillae



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is very rapid from birth to 3 days of age in calf. At birth, the GI tract of young ruminants is sterile. During the first hours of life, the forestomach becomes rapidly colonized with an abundant bacterial population. The neonates acquire bacteria from the dam, partners, feed, housing and environment. Newborn calves have a smooth epithelium with no prominent papillae. Calves fed solely with liquid feed have been shown to have limited rumen development characterized by decrease in rumen weight, papillary growth, degree of keratinization, pigmentation and musculature development. Weaning age can influence the development of rumen in pre-ruminants. Calves weaned at six weeks of age had longer and wider papillae compared to calves weaned at nine weeks of age.

Effect of diet on Rumen development: Dietary factors influence the development of ruminant stomach. The fore stomach of the milk fed calf develops very slowly and that feeding hay or and grain will cause rapid development of the rumen. Forestomach tissues such as papillary growth development most probably are a result of chemical stimuli and product of rumen fermentation.

For producers bottle-feeding calves from birth (e.g., dairy heifers, dairy bulls/steers, possibly beef calves), providing starter grain within a few days of birth is important, as it encourages grain consumption. Consumption of dry feedstuffs will develop the rumen more quickly for the efficient digestion and absorption of nutrients from dry feedstuffs and reduce the calf's reliance on milk and milk replacer to receive adequate nutrition. The quicker the rumen develops, the quicker a calf can be weaned from milk or milk replacer and be allowed to rely on cheaper dry feed to meet their nutritional needs. Feeding readily fermentable carbohydrates to calves to increase VFA production can stimulate rumen development. Additionally, an early feeding regime and nutrition can influence rumen development and rumen microbial composition, ultimately exerting an effect on the lifetime milk yield in cattle.

Role of reticular groove in milk-fed calves: Fistulated calves from 17th to 56th days of age the milk rarely entered in the rumen when consumed via nipple, but frequently entered when drunk from an open pail. Some scientist reported that moist of the milk fed by nipple to calves between 4 and 13 weeks of age passed to the abomasum. When the calf suckles milk from the teat or bottle, the esophageal groove shuttles milk past the rumen and into the abomasum, where it will begin digestion. Effect of lactation: The capacity of the reticulo-rumen is smaller in dry cows than the milking cows; this is due to hypertrophid alimentary canal during lactation period.



Conclusion

The development of rumen is rapid in early intra-uterine life, but in later part the abomasum grows very rapidly. The abomasum has fast growth post-nately but after one week of the birth it slows down and rumen has the fastest growth rate of all the organs. The animal solely on the milk have less development of ruminal papillae and musculosa, but rapid development is found in the animal supplemented with hay or grain. The milk enters directly into the reticular groove; hence rumen is of little importance. The capacity of alimentary tract is lesser in dry animals than in milking animals, because it gets hypertrophid during lactation while amount of fat is more in dry animals. Calves to consume dry feedstuffs, such as grain, at an early age will increase the onset of rumen development in young calves. Starter grain mixes should be offered to dairy calves within a few days of birth to encourage starter intake and to promote rumen development.

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