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Conference on Sustainable Animal Agriculture for Developing Countries

"WISDOM OF USING LOCAL RESOURCES FOR DEVELOPMENT OF SUSTAINABLE ANIMAL PRODUCTION IN DEVELOPING COUNTRIES"

The Singhasari Resort, Batu City, Indonesia, October 16-19, 2017

Jointly organized by

Faculty of Animal Husbandry
Brawijaya University Indonesia

Institute of Tropical Agriculture
and Food Security

ANIMAL PRODUCTION SCIENCE

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PREFACE

It is my privilege to thanks to all of authors for your enthusiasm in participating and contributing papers at this 6th International Conference on Sustainable Animal Agriculture for Developing Countries (The 6th SAADC-2017) that had been successfully held on 16-19 October 2017 in The Singhasari Resort, Batu City, Indonesia with the theme of *"Wisdom of Using Local Resources for Development of Sustainable Animal Production in Developing Countries"*

The primary objective of the 6th SAADC-2017 was to provide a scientific forum for animal scientists and producers, and administrators of livestock related agencies, particularly from the developing countries, to share their experiences, discuss issues and suggest recommendations to develop further a more sustainable livestock production.

This proceeding contains selected papers that were presented in the conference based on the quality and relevancy to the confencence. The papers are reflecting responsiveness of animal scientist from various countries in promoting sustainability of animal agriculture for the prosperity of the never ending generations. These proceeding hopefully will certainly enrich the body of knowledge and understanding about various aspects related to sustainable animal agriculture.

Our special thanks are also for the SAADC President for his confidence to our Universitas Brawijaya to organize this prestigious conference. Also, congratulation that SAADC is now listed in the International Congress and Conference Association (ICCA) based on its quality and consistent activities.

We also wish to thank all partners and sponsors for their support to the success of the conference. To colleague members of the organizing committee, please accept my deep appreciation for your hard working in ensuring the success of the conference.

Yours Sincerely,

Prof. Ifar Subagiyo
Chief Editor

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Correlation between chewing time (eating and ruminating) and rumen pH change on lambs

Prima. A, F.D. Nugroho, E. Rianto, E. Purbowati and A. Purnomoadi

Faculty of Animal and Agriculture Science, Diponegoro University, Tembalang Campus, Semarang 50275, Indonesia
agung194@yahoo.com

Abstract

This study aims to examine the relationship between length of eating and ruminating time to changes of rumen pH, and length of ruminating time with the intake of crude fiber. The materials were used 30 lambs aged 3-4 months old with body weight 13.75 ± 2.46 (CV 17.90%). Fed with a complete feed form of pellet contained 14-18% of crude protein and 70-75% of total digestible nutrients. The length of eating and ruminating time was observed through direct observation of lambs every 5 minutes for 2 x 24 hours. Intake of rumen fluid was done at 0 hours (before eating) then 3 hours (after eating). The data were analyzed using correlation and regression analysis. The correlation of rumen pH change 3 h after feeding has strongly negative correlation (r = 0.81) with ruminating at moderate negative (r = 0.59) eating time, and has strongly negative correlation (r = 0.60) with total chewing (eat and rumination). The relationship between the intake of crude fiber with ruminating time was strongly positive (r = 0.80). The ruminating time was very influential on the change of rumen pH. In order to maintain the rumen pH to be neutral pH then the time range required was 405-460 minutes. It can be achieved if the lambs consume crude fiber feed as much as 280-300 g.

Keywords: eating and ruminating behaviour, chewing time, lambs

Introduction

The normal conditions of physiological rumen such as pH is essential for the sustainability of the fermentation process of feed in the rumen. If the rumen pH is low (acid), it will adversely affect the rumen microbe, in turn will interfere the fermentation process of feed by rumen microbes. Therefore, the digestion and absorption of nutrient feed is not optimal. The pH conditions of the rumen to remain normal can be maintained by the buffer. Saliva produced from the mastication process is one of the good buffers to maintain rumen pH (Jiang et al., 2017). Saliva can be produced from the process of mastication. The length of chewing time (eating and ruminating) is influenced by the form of feed and the nutrient content of feed (Suzuki et al., 2014). Chewing during eating aims to minimize feed particles to be easy to swallow and the chewing during ruminations aims to minimize the size of feed particles that are returned to the mouth for easily passing through the rumen. Suspected rumination activity gives a greater influence on salivary secretion and will affect the change of rumen pH. The content of crude fiber is one of the factors that affect the chewing time. The higher the crude fiber of feeds, the higher time the rumination to optimalize feed to digest (Maktabi et al., 2016). The longer the rumination time, the more saliva will be generated and the availability of buffers to keep the rumen pH is sufficient. In the other hand, high crude fiber in the feed causes the proportion of other important nutrients to be low and decrease the digestibility of the feed.

Based on that discussion, it is important to compare the length of eating time with the length of ruminating time in the rumen pH changes and to know the optimal amount of crude

fiber intake in the length of ruminating time. The benefit of this research is to know the relationship between length of eating and ruminating time in rumen pH changes.

Methodology

The materials used in this study were 30 lambs aged 3-4 months with body weight 13.75 ± 2.46 (CV 17.90%), raised in individual cages equipped with drinking and feeding bunk. The feed was a complete feed form of pellet. Crude protein content ranges from 14-18% and total digestible nutrient ranges from 70-75%. The crude fiber intake was calculated from the percentage of crude fiber feed multiplied with dry matter intake.The length of eating and ruminating time was observed through direct observation of lambs every 5 minutes for 2 x 24 hours. The time of rumination was calculated during the lambs chewing but not in the feed bunk. Intake of rumen fluid was done at 0 hours (before eating) then 3 hours (after eating). The rumen fluid was taken using a plastic tube inserted slowly into the mouth and then vacuumed with a vacuum pump. The rumen fluid sample was filtered and pH was measured using Eutech® pH meters. The data were analyzed using correlation and regression. The relationship between two observed variables was known correlation coefficient. According to the method of Santoso (2005), the coefficient value were 0.00 - 0.19 (very low), 0.20 - 0.39 (low), 0.40 - 0.59 (moderate), 0.60 - 0.79 (strong), and 0.80 - 1.00 (very strong).

Results and Discussion

Based on Table 1. the relationship of rumen pH change 3 hours after eating has strongly negative with the ruminating time (r = 0.81), moderate negative(r = 0.59)with eating time, and strongly negative (r = 0.60) with total chewing (rumination and feeding). The graph illustrates that the time of rumination gave a stronger influence in the change of the pH rumen than that of the eating time. This is in line with Yang and Bauchemin (2006) that chewing time increases especially when chewing ruminations increase saliva secretion and will provide enough buffer to maintain rumen pH. Overall, the total time of eating and ruminating illustrates that the less the time intake of the feed, the greater the decrease in rumen pH. This is due to the influence of chewing activity affect the number of saliva secretion (Krause et al., 2002). Based on the equation (Table 2), the rumen pH decreased greatly when the duration of ruminating time was less than 457 minutes, the eating time less than 485 minutes and the total length of chewing (eating and ruminating) was less than 683 minutes.

Table 1. Body weight, dry matter intake, crude fiber intake, ruminating time and change of rumen pH

Parameter	Ranges	Average	Standart Deviasi
DM intake (g/day)	313.34 to 2034.46	1058.57	455.92
CF intake (g/day)	25.63 to 277.30	127.33	74.71
Eating time (minute)	110 to 545	267	101.21
Ruminating time (minute)	35 to 510	262	132.71
Rumen pH at 0 time	5.70 to 7.50	6.93	0.49
Rumen pH at 3rd time	5.10 to 7.20	6.37	0.74
Change of rumen pH	-2.20 to 0.30	-0.56	0.67

Based on Table 2, the relationship of the crude fiber intake has strongly positive correlation (r = 0.80) with ruminating time. It means that the higher the intake of crude fiber, the higher the ruminating time, but at the some points, the length of rumination began to

decline. Based on the equation (Table 2), the optimal intake of crude fiber was 281.72 g that resulted 409 minutes of rumination length. The strong relationship between ruminating time and the intake of crude fiber was caused by rumination aimed in breaking feed particles into smaller and easier to be digested. The higher the crude fiber content in feed, the higher the particles should be broken down into smaller, thus causing the increase of ruminating time (Jalali et al., 2012).

Table 2. The result of equation graph relation of eating and ruminating time, and total chewing time with change of rumen pH and graph relation of crude fiber intake with ruminating time

Parameter	Equation	R^2	r
Correlation of crude fiber intake and ruminating time	$y = -0{,}005x^2 + 2{,}8172x + 12.527$	0.63	0.81
Correlation of ruminating time with change of rumen pH	$y = -7E\text{-}06x^2 + 0.0064x - 1.6769$	0.64	0.80
Correlation of eating time and change of rumen pH	$y = -1E\text{-}05x^2 + 0.0097x - 1.9551$	0.35	0.59
Correlation of total chewing time and change of rumen pH	$y = -3E\text{-}06x^2 + 0.0041x - 1.5594$	0.36	0.60

Conclusion

Based on the results of this study, it can be concluded that the ruminating time is very influential in rumen pH changes. To maintain the neutral rumen pH, it requires 280-300 g of crude fiber and It can be achieved if the lambs consume crude fiber feed as much as 280-300 g, at least.

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