Enhancing Synergistic Roles of Stakeholders for Development of Sustainable Livestock Production
Assalamualaikum warohmatullahi wabarakatuh

Distinguished Guests and Delegates, Ladies and Gentlemen,

It gives me great privilege and pleasure to extend to you all a very warm welcome on behalf of Brawijaya University and to say how grateful we are to the organizing committee of The Third Animal Production International Seminar (3rd APIS) and The Third ASEAN Regional Conference on Animal Production (3rd ARCAP) who made this important event happening from today onward. Your attendance in this conference will not be enough before exploring the serendipity of Batu city which has attracted so many visitors in the recent years. It offers you many attractive places to visit varying from leisure facilities to smallholder dairy farms that relevant to the topic of this conference.

The issues of livestock production and food security have been a hot topic of debates all over the world to challenge our capability to feed human population living on earth that is believed will reach 25 billion people by the middle of this millennium. The global call on quality human resources especially in developing countries may not be achieved without adequate supply of animal protein. This has urged animal scientists to make significant effort to increase animal production by inventing new technologies and approaches but have no negative impact on our natural resources because the majority of smallholder farmers face with scarcity of cultivable land to produce adequate quantity and quality fodder for their animals. The practice of uncontrolled fodder scavenging from forest and open land may provoke a serious natural disaster such as landslide, flood and loss of water resources for human beings. Through this stage I would like to extend my concern to all distinguished guests and delegates to pay more attention on sustainable development of animal production that assures our young generation lives on earth safely and happily.

As the rector of Brawijaya University, I am also delighted to welcome you in our green campus sometime in the middle of the conference to hasten mutual collaboration between Brawijaya University and either national or international partners. We are fully aware that in a modern life higher education quality should be built on the basis of collaboration for many reasons. Brawijaya University has 14 faculties that can be grouped into four science trees, that is engineering, humanity, economics, and life sciences. They have been growing significantly not only in the number of student enrollements but many prestigious achievement on research findings, student competitions and administrative transparency are our flagships in the last ten years. Nevertheless, we also realize that first and foremost constraint for any institution is the limit of resources and thereby underpinning the importance of establishing mutual collaboration. It is our opportunities to meet delegates from varying places of origin that open initial discussion for further networking on relevant topics of interests concordance to the main topic of this conference and beyond.

To conclude my address, once again I would like to express my sincere gratitudes to all delegates, partners and conference committee who have made this important international conference occurs. I do hope that your stay and participation in these seminar and conference will be fruitful and unforgettable.
By the name of Almighty Allah Swt. I declare that The Third Animal Production International Seminar (3rd APIS) and The Third ASEAN Regional Conference on Animal Production (3rd ARCAP) are officially open.

Thank you very much
Wassalamualaikum warohmatullahi wabarokatuh.

Batu, 19 October 2016
Brawijaya University
Rector
Prof. Dr. Ir. Mohammad Bisri, MS.
STEERING COMMITTEE

- Prof. Dr. Sc. Agr. Suyadi, MS. (Brawijaya University, Indonesia)
- Prof. Dr. Kusmartono (Brawijaya University, Indonesia)
- Prof. Ifar Subagiyono, Ph.D. (Brawijaya University, Indonesia)
- Prof. Hendrawan Soetanto, Ph.D. (Brawijaya University, Indonesia)
- Prof. Dr. Abdul Razak Alimon (Universiti Putra Malaysia, Malaysia)
- Prof. Dr. Ali Agus, (Indonesian Society of Animal Science)
- Dr. Abu Hasan (Malaysian Society of Animal Production)
- Prof. Liang Chou Hsia, Ph.D. (National Pingtung University of Science and Technology, Taiwan)
- Prof. Dr. E.R. Ærskov (International Feed Resources Unit, Macaulay Land Use Research Institute-MLURI, Scotland, UK).
- Assoc. Prof. Dr. Suntorn Wittayakun (Faculty of Science and Agriculture Technology, Rajamangala University of Technology Lanna, Thailand)
- Prof. Dr. Zaenal Fanani (Brawijaya University, Indonesia)
- Prof. Dr. Djalal Rosyidi (Brawijaya University, Indonesia)
- Prof. Dr. Budi Hartono (Brawijaya University, Indonesia)
- Prof. Dr. Luqman Hakim (Brawijaya University, Indonesia)

SCIENTIFIC COMMITTEE

- Prof. Dr. Trinil Susilawati (Brawijaya University, Indonesia)
- Prof. Dr. Abdul Razak Alimon (Universiti Putra Malaysia, Malaysia)
- Prof. Dr. Ramli Abdullah (Universiti Malaya, Malaysia)
- Cynthia D.K. Bottema, Ph.D. (University of Adelaide, Australia)
- Prof. Marsetyo, Ph.D. (Tadulako University, Palu, Central Sulawesi, Indonesia)
- Dr. Umar Paputungan (Sam Ratulangi University, Manado, North Sulawesi, Indonesia)
- Assist. Prof. Dr. Wilaiporn Chanchai (Faculty of Science and Agriculture Technology, Rajamangala University of Technology Lanna, Thailand)
- Prof. Dr. Siti Chuzaemi (Brawijaya University, Indonesia)
- Dr. Gatot Ciptadi (Brawijaya University, Indonesia)
- Dr. Lilik Eka Radiati (Brawijaya University, Indonesia)
- Dr. Qafar Sjofjan (Brawijaya University, Indonesia)
- Dr. Masdiana Ch Padaga (Brawijaya University, Indonesia)
- Dr. Eko Widodo (Brawijaya University, Indonesia)
- Dr. Mashudi (Brawijaya University, Indonesia)
- Dr. Ita Wahyu N (Brawijaya University, Indonesia)
- Hari Dwi Utami, Ph.D (Brawijaya University, Indonesia)
- Anie Eka K., M.Sc (Brawijaya University, Indonesia)
### Organizing Committee

#### Honorary Chairperson
- Prof. Dr. Mochammad Bisri (Rector/President, Brawijaya University, Malang, Indonesia)
- Prof. Dr. Kusmartono (Vice-Rector of Academic Affair, Brawijaya University, Malang, Indonesia)
- Prof. Dr. Sc. Agr. Ir. Suyadi (Dean, Faculty of Animal Husbandry, Brawijaya University, Malang, Indonesia)

#### Chairman
- Dr. Ir. Marjuki, M.Sc.

#### General Secretary
- Chairperson: Aswah Ridhowi, M.Sc.
- Members: Wike Andre, M.Si

#### Treasurers
- Chairperson: Asri Nurul Huda, MP., M.Sc
- Vice-Chairperson: Dr. Ir. V. M Ani N., M.Sc
- Members: Dr. Ir. V. M Ani N., M.Sc

#### Secretariat Team
- Chairperson: Firman Jaya, MP
- Vice-Chairperson: Dr. M. Halim Natsir
- Members: Jaisy Aghniarahim Putritamara, MP
  - Mr. Arifatul Hafidz Achsan

#### Fund Raising and Sponsorship Committee
- Chairperson: Aulia Puspita A. Y., MP., M.Sc
- Vice-Chairperson: Dr. Kuswati,
- Member: Yuli Frita N., MP., M.Sc

#### Program Committee
- Chairperson: Dr. Herly Evanuarini
- Members: Dr. Siti Azizah
  - Trianti Djoharjani, M.Agr. St
  - Awang Tri Satria, ME

#### Consumption Committee
- Chairperson: Dr. Tri Eko Susilorini
- Members: Dr. Sri Minarti
  - Aris Sri Widati, MS
  - Ria Dewi Andriani, MP., M.Sc

#### Receptionist Team
- Chairperson: Poespita Sari Hazanah N., MP
- Members: Premy Puspitawati R., MP
  - Mulia Winirsya Apriliyani, MP

#### Field Trips Committee
- Chairperson: Firmansyah Tri MP
- Members: Dr. Agus Susilo
  - Mr. Djarot Sunarto
Transportation Committee

Chairperson
Dr. Agus Budiarto

Members
Mrs. Nadhiroh
Mr. Sutikno
Mr. Yusuf

Venue and Documentation Committee

Chairperson
Nanang Febrianto, MP

Members
Hely Tistiana, MP
Mr. Kusno Waluyo
Mr. Rosyidi
Mr. Zaenal Abidin
Ms. Dita Anggraini
OUTLINE OF THE CONGRESS

**Congress Name:**
3rd Animal Production International Seminar (3rd APIS) & 3rd ASEAN Regional Conference on Animal Production (3rd ARCAP)

**Themes:**
Enhancing Synergistic Roles Of Stakeholders for development Of Sustainable Livestock Production

**Chairman:**
Dr. Ir. Marjuki, M.Sc (Brawijaya University, Indonesia)

**Date:**
19-21 October 2016

**Venue:**
Royal Orchid Garden Hotel and Condominiums The Shining City of Batu

**Official Website:**
http://apis.ub.ac.id

**Secretariat for APIS 2016:**
Faculty of Animal Husbandry Brawijaya University, Malang Indonesia
Telephone: +62 341 553513
Mobile/ Line/ WA: +62 857 076 327 91
E-mail: info.apis@ub.ac.id
ACKNOWLEDGMENTS

BRAWIJAYA UNIVERSITY

INDONESIAN SOCIETY OF ANIMAL SCIENCE

UNIVERSITI PUTRA MALAYSIA

MALAYSIAN SOCIETY OF ANIMAL PRODUCTION

RAJAMANGALA UNIVERSITY OF TECHNOLOGY LAMNA
<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.30-</td>
<td>Legumes wafer for improvement the post-weaning etawah crossbreed goats performance</td>
<td>Brilian Desca Dianingtyas</td>
<td>FN - 352</td>
</tr>
<tr>
<td>12.40-</td>
<td>Utilization of cricket meal in creep feed diet of growing etawah cross breed goats</td>
<td>Dewi Apri Astuti</td>
<td>FN - 332</td>
</tr>
<tr>
<td>12.50-</td>
<td>Performance of first cutting of Pennisetum purpureum cv. Mott under different level of light and nitrogen fertilizer</td>
<td>David A. Kaligis</td>
<td>FN - 360</td>
</tr>
<tr>
<td>13.00-</td>
<td>Amino acid characterization of tofu waste fermentation using effective microorganism-4 and Lactobacillus plantarum culture</td>
<td>Eka Fitasari (MODERATOR 2)</td>
<td>FN - 325</td>
</tr>
<tr>
<td>13.10-</td>
<td>In vitro digestibility profiles of cricket meal as protein source in the ration</td>
<td>Dewi Apri Astuti</td>
<td>FN - 331</td>
</tr>
<tr>
<td>13.20-</td>
<td>Production of roughage feed under different drying methods and evaluation of the feeding value</td>
<td>Jayaweera B. P. A.</td>
<td>FN - 333</td>
</tr>
<tr>
<td>13.30-</td>
<td>In vitro nutrient digestibility of Chromolaena odorata-based silage treated with Corypha gebanga meal and rumen content</td>
<td>Yelly M. Mulik</td>
<td>FN - 335</td>
</tr>
<tr>
<td>13.40-</td>
<td>Production, characterization and purification of xylanase from Staphylococcus aureus MBXi-K4</td>
<td>Indah Wijayanti (MODERATOR 1)</td>
<td>FN - 336</td>
</tr>
<tr>
<td>13.50-</td>
<td>To estimate intestinal truly absorbed protein of alfalfa hay and alfalfa silage using new dutch system (DVE/OEB)</td>
<td>Parisa Kheyrandish</td>
<td>FN - 340</td>
</tr>
<tr>
<td>14.00-</td>
<td>Chitosan protection to saga leaves extract (Abrus precatorius Linn) and Lingzhi mushroom (Ganoderma lucidum) from rumen microbial degradation</td>
<td>Dwiria Evvyernie</td>
<td>FN - 342</td>
</tr>
<tr>
<td>14.10-</td>
<td>Effects of different types of cakes in rations on the</td>
<td>Amani Osman</td>
<td>FN - 348</td>
</tr>
</tbody>
</table>

**Notes:**
- **FN:** Field Number
- **MODERATOR:** Moderator
- **Location:** Room: Panderman 2
- **Date:** Friday, 21 October
- **Time:** 12:30-14:40
## LIST OF CONTENT

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECTOR SPEECH</td>
<td>3</td>
</tr>
<tr>
<td>FOREWORD DEAN THE FACULTY OF ANIMAL HUSBANDRY</td>
<td>5</td>
</tr>
<tr>
<td>WELCOME MESSAGE</td>
<td>6</td>
</tr>
<tr>
<td>SPEECH FROM CHAIRMAN OF APIS 2016</td>
<td>7</td>
</tr>
<tr>
<td>WELCOME SPEECH FROM MSAP PRESIDENT</td>
<td>8</td>
</tr>
<tr>
<td>CONGRESS COMMITTEE</td>
<td>9</td>
</tr>
<tr>
<td>OUTLINE OF THE CONGRESS</td>
<td>12</td>
</tr>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>13</td>
</tr>
<tr>
<td>ORGANIZATIONAL INFORMATION OF BATU</td>
<td>14</td>
</tr>
<tr>
<td>GENERAL INFORMATION OF THE CONGRESS</td>
<td>15</td>
</tr>
<tr>
<td>OPENING AND CLOSING CEREMONIES</td>
<td>17</td>
</tr>
<tr>
<td>INFORMATION AND CONFERENCE DETAILS</td>
<td>19</td>
</tr>
<tr>
<td>GUIDELINE FOR POSTER PRESENTATION CONFERENCE</td>
<td>20</td>
</tr>
<tr>
<td>ORAL PRESENTATION PROGRAM</td>
<td>23</td>
</tr>
<tr>
<td>LIST OF CONTENT</td>
<td>25</td>
</tr>
</tbody>
</table>

### Keynote Speakers Presentation

<table>
<thead>
<tr>
<th>Speaker</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review of Researches for Development of Sustainable Livestock Production</td>
<td>66</td>
</tr>
<tr>
<td>Breeding Program of Local and Imported Beef/Dairy Cattle Breed for Development of Sustainable Livestock Production</td>
<td>72</td>
</tr>
<tr>
<td>Current Analysis on Beef Self Sufficiency Program in Indonesia</td>
<td>78</td>
</tr>
<tr>
<td>Current Development Trends in Global Broiler Production</td>
<td>79</td>
</tr>
<tr>
<td>Feeding Management of Ruminant Animals to Reduce Their Contribution for Gas Emission</td>
<td>85</td>
</tr>
<tr>
<td>Manipulation of Ruminal Fermentation and Methane Mitigation by Feeding Management: Strategic Success Keys for Smallholder Dairy Farm with Environmentally Friendly</td>
<td>88</td>
</tr>
</tbody>
</table>

### Oral Presentation 1 Focus Session: Feed and Nutrition (1)

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smallholder dairy cattle farmer capacity in providing feeds and nutrient in several population densities of villages of Sleman Regency DIY Province – Indonesia</td>
<td>95</td>
</tr>
<tr>
<td>Nutritional properties of several seaweed species for dairy cattle</td>
<td>98</td>
</tr>
<tr>
<td>Inclusion of various levels of peanut hay (rendeng) in the rabbit diet</td>
<td>101</td>
</tr>
<tr>
<td>The use of corn fodder for rabbit production</td>
<td>104</td>
</tr>
<tr>
<td>Development of beef cattle using agricultural by-product in West Java</td>
<td>107</td>
</tr>
<tr>
<td>Changes in nutrition and fibre silage water hyacinth (Eichornia crassipes) as ruminant feed fermented with several fermentative materials</td>
<td>110</td>
</tr>
</tbody>
</table>

### Oral Presentation 1 Focus Session: Feed and Nutrition (2)

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance of broiler chickens fed diets supplemented with several palm polysaccharides</td>
<td>116</td>
</tr>
<tr>
<td>Supplementation of the diets with rich – selenium feedstuffs on the performance of 4 weeks old broiler chickens</td>
<td>121</td>
</tr>
</tbody>
</table>
Effect of storage time and physical form of diet with formulated from local feed based on nutrient composition of the diets

Enrichment of Feedstuff With Fermented Soybean Peel to Increase Rabbit Body Weight

Broiler chickens performance as affected by animal fat and plant oil under hot arid conditions of Sudan

Calcium and phosphorous absorption of field grass during the dry season at medium altitude in Garut

Isolation and screening of lactic acid bacteria from dadih for glutamic acid production as precursor of γ-Amino Butyric Acid (GABA) induced heat stress in broiler

The effect of fertilizers on soil characteristics of sand-mining land and nutrients content of sorghum patir 3.7 (Sorghum bicolor (L) Moench)

Arbuscular mycorrhizal fungi and rock phosphate role on plant growth of sorghum (Sorghum bicolor L.) as a forage

The Potential of Local Feed Sources for Silage Production in Supporting The Cattle Raising Business in East Ramontongkor Village

Legumes wafer for improvement the post-weaning etawah crossbreed goats performance

Utilization of cricket meal in creep feed diet of growing etawah cross breed goats

Performance of first cutting of Pennisetum purpureum cv. Mott under different level of light and nitrogen fertilizer

Amino acid characterization of tofu waste fermentation using effective microorganism- and Lactobacillus plantarum culture

In vitro digestibility profiles of cricket meal as protein source in the ration

Production of roughage feed under different drying methods and evaluation of the feeding value

In vitro nutrient digestibility of Chromolaena odorata-based silage treated with Corypha gebanga meal and rumen content

Production, characterization and purification of xylanase from Staphylococcus aureus MBXi-K4

To estimate intestinal truly absorbed protein of alfalfa hay and alfalfa silage using new dutch system (DVE/OEB)

Chitosan protection to saga leaves extract (Abrus precatorius Linn) and Lingzhi mushroom (Ganoderma lucidum) from rumen microbial degradation

Effects of different types of cakes in rations on the performance of culled Cyprus shami does in Half Elgameda, Kassala State, Sudan

Changes in nutrition and fibre silage water hyacinth (Eichornia crassipes) as ruminant feed fermented with several fermentative materials

Effect of Phanerochaete chrysosporium to enzymatic activity and lignin on fermentation process of cocoa pod (Theobroma cacao)

Effect of fish oil and its combination with tomato powder supplementation on laying performance of native chicken

Effect of substitution of meat bone meal with protein concentrate of mealworm (Tenebrio molitor L) on performance of broilers
Chitosan Protection To Saga Leaves Extract (Abrus Precatorius Linn) And Lingzhi Mushroom (Ganoderma Lucidum) From Rumen Microbial Degradation

Evvyernie D1,2, Sukria HA1,2, Harlina E1,3, Suningsih N2, and Zetira W2

1Biopharmaca Research Center Bogor Agricultural University. Bogor 16128, West Java. Indonesia.
2Department of Nutrition and Feed Technology, Faculty of Animal Science, Bogor Agricultural University. Bogor 16680, West Java. Indonesia.
3Department of Clinics, Reproduction and Pathology, Faculty of Veterinary Medicine, Bogor Agricultural University. Bogor 16680, West Java. Indonesia.

Corresponding author: erniedea8492@gmail.com

Abstract

The purpose of research was study the use of 2% chitosan as a protector of herb saga leaves extract (Abrus precatorius Linn) and lingzhi mushroom extract (Ganoderma lucidum) from microbial degradation in the rumen in vitro. Randomized block design with five ration treatments and three times collection of rumen fluid as a block. The treatments were RO (control) = basal ration (35% forage and 65% concentrates), R1: RO+ saga leaves extract, and R2: RO+ saga leaves extract protected by 2% chitosan, R3: RO+ lingzhi mushroom extract, and R4: R0+ lingzhi mushroom extract protected by 2% chitosan. Parameters observed were total population of rumen microbes (protozoa and bacteria), concentrations of total VFA and NH3, dry and organic matter digestibility (DMD and OMD). The results showed chitosan protection to both extracts were not influence the population of bacteria and protozoa as well as NH3 concentration, but decreased 16,4% VFA total (P < 0.05) and 35% average digestibility (P < 0.05) in saga leaves extract and also decreased 20% VFA total (P < 0.05) in lingzhi mushroom extract without interfere the digestibility. As conclusion, 2% chitosan can be used as protector to lingzhi mushroom extract than to saga leaves extract from degradation of rumen microbes due to its ability maintaining the digestibility.

Keywords: chitosan, digestibility, in vitro, lingzhi mushroom (Ganoderma lucidum)

Introduction

Improvement of animal productions can be triggered by feed additive addition into the ration. The use of synthetic additives is common in the farm due to their continue availability, although they still left the residue in the animal products. Nowadays, as the development of health knowledge, the kind of residue has potency as carcinogenic factor for human who consume that kind of animal products. To reduce that risk, the investigation of save feed additives as an alternative should be done continuously.

Many herbs and mushroom have capacity as feed additives for anti bacteria, antioxidant, anti mastitis and anthelmintic. The use of them in animal ration is restricted by their anti nutrition content, which interferes the fermentation process in the rumen, for example saponin reduced the growth of protozaa (defaunation), hence impacts decreased the methane production (Guo et al., 2008). Rahminiwati et al. (2010) said that kemuning and saga leaves extracts could be as prebiotic because their ability to reduce non-pathogenic...
bacteria such as *Lactobacillus rhamnosus*, *L. agilis* and *L. amylophilus*. Moreover, addition of saga and kemuning leaves meal in goat lactation rations caused reducing only some amount of somatic cell count and EPG as well as the use of lingzhi mushroom meal in ration of dairy cow lactation (Evynemie *et al.* 2012; Tresia *et al.* 2015). Although those finding results showed that herbs and mushroom have potency as anti mastitis and anthelmintic on dairy goat and cow, but the use of them were not more than 1% in ruminant ration due to their role as anti bacteria will kill the microorganisms in the rumen. So that, in this present research, herbs and mushroom in high level were used after they protected by chitosan. Chitosan is a natural biopolymer derived from the deacetylation of chitin and is not degraded in the rumen (Fadel El-Seed *et al.* 2003).

The purpose of research was study the use of 2% chitosan as a protector of herb saga leaves extract (*Abrus precatorius* Linn) and lingzhi mushroom (*Ganoderma lucidum*) from microbial degradation in the rumen in vitro.

**Methodology**

This research used randomized block design with 3 (three) kinds of ration as a treatment and 3 (three) times collection of fresh dairy goat rumen fluid or inoculums as a block. The treatments were: R0 (control) = basal ration; R1: R0 + saga leaves extract, and R2: R0 + saga leaves extract protected by 2% chitosan, R3: R0 + lingzhi mushroom extract, and R4: R0 + lingzhi mushroom extract protected by 2% chitosan. The basal ration contained 35% forage and 65% concentrate which fulfill the requirement of dairy goat lactation 55% TDN and 12% crude protein. The forage was consist of 25% Napier grass and 10% Indigofera spp, and the concentrate was consist of coconut meal, tempah waste, dates fruit waste, rice bran, premix, DCP and CaCO3 (Yuniarti *et al.* 2014). Extraction of saga leaves and lingzhi mushroom used infuse method with water as a solvent. Spray dry method was used to protect the both extracts using 2% chitosan.

The variables measured for in vitro studies were: protozoa and bacteria total populations (Ogimoto and Imai 1981); VFA total concentration (General Laboratory Procedure 1996), NH3 concentration (General Laboratory Procedure 1996), dry matter digestibility (DMD) and organic matter digestibility (OMD) (Tilley and Terry 1963). Data were analyzed using ANOVA and contrast orthogonal (Steel dan Torrie 1993).

**Results and Discussion**

The rumen microbes and their products by feeding rations contain saga leaves or lingzhi mushroom extracts with or without 2% chitosan protection is provided in Table 1. There were no differences among population of protozoa and bacteria rumen of all treatment rations compared to control. That means addition of herb or mushroom extracts not interferes the growth of rumen microbes in this research.

In 4 (four) hours rumen fermentation in vitro, production of VFA total decreased around 18% when saga leaves and lingzhi mushroom were protected by chitosan (R2). Table 1. Rumen microbes and their products by feeding rations contain saga leaves and lingzhi mushroom extracts with and without chitosan protection

<table>
<thead>
<tr>
<th>Variables</th>
<th>Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R0</td>
</tr>
<tr>
<td>Protozoa Total (log cell ml^-1)</td>
<td>6.97 ± 0.07</td>
</tr>
<tr>
<td>Bacteria Total (log CFU ml^-1)</td>
<td>7.11 ± 1.30</td>
</tr>
<tr>
<td>VFA total</td>
<td>151.07b ±</td>
</tr>
</tbody>
</table>
CHITOSAN AND ITS ROLE IN THE DIGESTIBILITY OF RUMEN MICROBES

Table 1: Volatile Fatty Acids (VFA), Ammonia (NH3) Concentrations and Organic Matter Digestibility (OMD) in the Presence of Different Treatments

<table>
<thead>
<tr>
<th>Treatment</th>
<th>VFA (mM)</th>
<th>NH3 (mM)</th>
<th>DMD (%)</th>
<th>OMD (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1 Control</td>
<td>12.76 ± 4.23</td>
<td>11.25 ± 4.23</td>
<td>74.50a±</td>
<td>69.87a±</td>
</tr>
<tr>
<td>R2 RO+ saga leaf</td>
<td>11.33 ± 2.80</td>
<td>9.91 ± 2.80</td>
<td>74.69a±</td>
<td>70.18±</td>
</tr>
<tr>
<td>R3 RO+ lingzhi</td>
<td>12.89 ± 2.14</td>
<td>12.78 ± 1.24</td>
<td>51.86b±</td>
<td>42.24b±</td>
</tr>
<tr>
<td>R4 RO+ lingzhi+2%</td>
<td>11.79 ± 4.91</td>
<td>12.73 ± 2.90</td>
<td>74.06b±</td>
<td>69.61a±</td>
</tr>
<tr>
<td>R5 RO+ lingzhi+2%</td>
<td>10.94 ± 2.90</td>
<td>71.75b±</td>
<td>1.19</td>
<td>0.41</td>
</tr>
</tbody>
</table>

Notes: R0 Control, R1: RO+ saga leaves extract, R2: RO+ saga leaves extract protected by 2% chitosan, R3: RO+ lingzhi mushroom extract, and R4: RO+ lingzhi mushroom extract protected by 2% chitosan. VFA = volatile fatty acids concentration, NH3= ammonia concentration, DMD= dry matter digestibility, OMD= organic matter digestibility. * significance in the same row compared to R1 and R3 (P<0.05). The NH3 concentration of R2 increased around 29%, but R4 decreased around 2%. Chitosan is alkaline due to high NH2 content. Chitosan can solubilize in organic solvent like formic acid, acetic acid and glutamic acid by protonation of NH2 content to be NH3 (Rinaudo, 2006). Through this mechanism, VFA production (especially formic acid and acetic acid) from the chitosan protected-rations (R2 and R4) could be used to solve the chitosan and caused increasing the NH3 concentration in R2, but almost not affected NH3 concentration of R4 due to lingzhi mushroom content. However, the digestibility of R2 drastically decreased around 35% as consequently of alkaline ecosystem in the rumen (the fermentation process of digestion was 48 hours) (P<0.05). The average decreasing of R4 digestibility was only slightly around 4%, because rumen ecosystem almost the same to R3 after chitosan was solved by VFA, where it might be caused by lingzhi mushroom content such as polysaccharide, peptidoglycan, beta-D-glukan, that have capacity to stabilized pH or rumen ecosystem.

Conclusion

As conclusion, 2% chitosan can be used as protector to lingzhi mushroom extract than to saga leaves extract from degradation of rumen microbes due to its ability maintaining the digestibility.

References


Tilley JMA, Terry RA. A two stage technique for the in-vitro digestion of forage crops. J. British Grassland Soc. 18 (1963) 104-111.

