UNIVERSITI PUTRA MALAYSIA

THE IN VITRO DIGESTIBILITY STUDY OF FECAL AND FEED SAMPLE OF WHITE RHINOCEROS

MUHAMMAD HUSAINI ABD. LATIF

FP 2017 117

THE IN VITRO DIGESTIBILITY STUDY OF FECAL AND FEED SAMPLE OF WHITE RHINOCEROS

MUHAMMAD HUSAINI BIN ABD. LATIF

FACULTY OF AGRICULTURE

UNIVERSITI PUTRA MALAYSIA

SERDANG, SELANGOR DARUL EHSAN

2016/2017

THE IN VITRO DIGESTIBILITY STUDY OF FECAL AND FEED SAMPLE OF WHITE RHINOCEROS

BY

MUHAMMAD HUSAINI BIN ABD. LATIF

A project report submitted to Faculty of Agriculture, Universiti Putra Malaysia, in fulfilment of the requirement of SHW 4999 (Final Year Project) for the award of the degree of Bachelor of Agriculture (Animal Science)

Faculty of Agriculture

Universiti Putra Malaysia

2016/2017

CERTIFICATION

This project entitled The In Vitro Digestibility Study Of Fecal And Feed Sample Of White Rhinoceros is prepared by Muhammad Husaini Bin Abd. Latif and submitted to the Faculty of Agriculture in fulfillment of the requirement of the course SHW 4999 (Final Year Project) for the award of the degree of Bachelor of Agriculture (Animal Science)

Student's name: Student's signature

Muhammad Husaini Bin Abd. Latif

Matric no: 175265 _____

Certified by:

_____

Dr. Iswan Budy Haji Suyub

Project Supervisor

Department of Animal Science

Faculty of Agriculture

University Putra Malaysia

Serdang Selangor.

Date : _____

ACKNOWLEDGMENT

First of all, I would like to thank to the Almighty Allah for giving me the strength and will to undertake this study and peace be upon His final prophet and Messenger Muhammad S.A.W for making my project paper possible.

I would like to express my sincere gratitude to my advisor Dr. Iswan Budy Haji Suyub for the continuous support to my thesis and study, for his patience, motivation, enthusiasm and immerse knowledge. His guidance helped me in all time of research and writing of this thesis. I could not have imagined having a better advisor and mentor of my study.

Besides my advisor, I would like to thank the rest of my lectures and staffs of Animal Science Department, Universiti Putra Malaysia for their knowledge, kind help, guidance and critics throughout the project from start until the end

I would like to thank to my family, especially my mother Nafiza@Nafiah Bte Mhd. Nawawi and my father Abd. Latif Bin Salim for giving birth to me at the first place and their endless support throughout this project .Last but no least special thank you to my friends who help a lot physically and morally. Thank you for all the support.

TABLE OF CONTENT

TABLE OF CONTENT

LIST OF TABLE

LIST OF FIGURE

LIST OF ABBREVIATION

ADF	acid detergent fibre
ADL	acid detergent lignin
CP	crude protein
DM	dry matter
DMI	dry matter intake
IUCN	International Union for Conservation of Nature
NDF	neutral detergent fibre
VFA	volatile fatty acid

ABSTRACT

As a non-ruminant herbivore, the white rhinoceros has the ability to utilize fibrous plant matter through microbial fermentation in the hindgut. This study was conducted to determine the fermentation ability in the hindgut fermenter which is white rhinoceros and compared to foregut fermenter which is the cattle. As for treatment for this study, the rhinoceros feed provided by Zoo Negara and Napier grass were used as feed sample. The rhinoceros feed was produced from the mixture of hay and concentrate. The total gas production from faecal and rumen inoculum were compared from the feed samples used. Proximate analysis were conducted in order to know the nutritive value of hay, concentrate and Napier grass. For the concentrate sample, the nutrient composition were 5.43% of dry matter (DM), 8.26% of ash (OM), 14.64% of crude protein (CP) and 46.51% of neutral detergent fibre (NDF). For the hay sample, the nutrient composition are 10.08% of dry matter (DM), 6.73% of ash (OM), 17.27% of crude protein (CP) and 45.49% of neutral detergent fibre (NDF). Lastly, for the Napier grass feed sample, the nutrient composition were 9.6% of dry matter (DM), 10.40% of ash (OM), 10.66% of crude protein (CP) and 72.25% of neutral detergent fibre (NDF).

ABSTRAK

Sebagai herbivore bukan ruminan, badak putih mempunyai keupayaan untuk menggunakan bahan tumbuhan berserabut melalui penapaian mikrob dalam sistem pencernaannya. Kajian ini dijalankan untuk menentukan keupayaan penapaian dalam 'hindgut fermenter' iaitu badak putih dan dibandingkan dengan 'foregut fermenter' yang merupakan lembu. Bagi rawatan untuk kajian ini, badak balas yang disediakan dalam Zoo Negara dan rumput Napier telah digunakan untuk sampel makanan. Makanan badak dihasilkan daripada campuran jerami dan konsentrat. Jumlah pengeluaran gas daripada najis dan rumen inokulum dibandingkan dari sampel makanan yang digunakan. Analisis proksimat telah dijalankan untuk mengetahui khasiat pemakanan daripada rumput kering, konsentrat dan rumput Napier. Untuk sampel konsentrat, komposisi nutrien adalah 5.43% daripada bahan kering (DM), 8.26% abu (OM), 14.64% protein mentah (CP) dan 46,51% daripada kandungan gentian neutral detergen (NDF). Untuk sampel hay, komposisi nutrien adalah 10.08% daripada bahan kering (DM), 6.73% abu (OM), 17.27% protein mentah (CP) dan 45.49% daripada kandungan gentian neutral detergen (NDF). Akhir sekali, bagi sampel makanan iaitu rumput Napier, komposisi nutrien adalah 9.6% daripada bahan kering (DM), 10.40% daripada abu (OM), 10.66% protein mentah (CP) dan 72.25% daripada kandungan gentian neutral detergen (NDF).

CHAPTER ONE

INTRODUCTION

The rhinoceros is one of five surviving species of odd-toed ungulates in the *Rhinocerotidae* family. The five different species of rhinoceros include two African species, the white rhinoceros (*Ceratotherium simum*) and the black rhinoceros (*Diceros bicornis*), and three Asian species, Indian rhinoceros (*Rhinoceros unicornis),* Sumatran rhinoceros (*Dicerorhinus sumatrensis*), and Javan rhinoceros (*Rhinoceros sondaicus*). Relative to the four other species which are in the list of endangered wild animals, the white rhinoceros is classed as vulnerable, with roughly 16,000 remaining in the wild in 2007 (IUCN 2008). The white rhinoceros is, after the elephant, the largest extant mammalian herbivore . Its natural diet consists mainly of grasses (Brahmachary *et al.*, 1971, 1974; Laurie, 1982; Dinerstein, 1989; Dinerstein and Price, 1991). As a hindgut fermenter, the white rhinoceros has the ability to utilize fibrous plant matter through microbial fermentation in the hindgut. For large hindgut fermenters such as elephants or rhinoceroses, the horse has been propagated as the appropriate model when designing diets for captive animals (Oftedal et al., 1996). Comparative studies among non-ruminant herbivores showed that the rhinoceros had a similar digestive system to horses and elephants.

A challenge common to all herbivores is the processing of tough plant tissues, notably high in lignin and cellulose. Cellulose is the major structural component of the plant cell wall, and it cannot be hydrolysed by the endogenous enzymes of vertebrates (Stevens and Hume 1995). It is only after symbiosis with cellulase-

producing micro-organisms that sufficient nutritional content can be gained from this food source. Herbivorous mammals utilise fermentation chambers in some portion of the gastrointestinal tract to maximise exposure of fibrous foods to these digestive bacterial agents. The fermentation chamber may be situated in the foregut area of the stomach or in the hindgut area of the caecum and/or colon. Hindgut fermentation takes place mainly in the colon in *perissodactyls* and additionally in the enlarged caecum, which act like fermentation chambers in much the same way as the rumen does in ruminants. This arrangement presents the problem that the cellulose is not fermented until this point, and the volatile fatty acids must be absorbed in the colon, rather than in the small intestine. Hindgut fermenters have a shorter passage time than ruminants, and hence are less efficient in cellulose digestion, for which they compensate with a higher intake of food (Clauss *et al*. 2003, 2007, 2009b).

Herbivores generally face the challenge that a high food intake compromises digestive efficiency by reducing ingest a retention time and time available for selective feeding and for food comminution and a variety of digestive strategies have evolved in response. Ruminants are very successful herbivores. They benefit from potential advantages of a forestomach without being constrained in their food intake as much as other foregut fermenters, because of their peculiar reticuloruminal sorting mechanism that retains food requiring further digestion but clears the forestomach of already digested material.

1.1 Objectives

1.1.1 General Objective

To study the rhinoceros hindgut fermentation ability.

1.1.2 The specific objective:

1. To compare total gas production between Napier grass and rhinoceros feed by fecal and rumen inoculum.
2. To compare the fermentation rate between rhinoceros and cattle

1.2 Significance of Study

Hindgut bacteria can be inoculated in future study as bacterial sources in producing probiotic that aid in ruminant digestion.

1.3 Research problem

A study indicated that the rhinoceros is an inefficient digester. The rhinoceros dry matter intake (DMI) of approximately 1% of body mass when white rhinos were fed grass hays and slightly higher levels 1.2% - 1.6% of body mass when fed alfalfa hay (Foose 1982)

REFERENCES

Budiansky, Stephen (1997). The Nature of Horses. Free Press. ISBN 0-684-82768-9.

Davies, D.R., 1991. Growth and survival of anaerobic fungi in batch culture and in the digestive tract of ruminants. PhD Thesis, University of Manchester

Dhanoa, M.S., J. France, L.A. Crompton, R.M. Mauricio and E. Kebreab et al., 2004. Technical note: A proposed method to determine the extent of degradation of a feed in the rumen from the degradation profile obtained with the in vitro gas production \ technique using feces as the inoculum. J. Anim. Sci., 82: 733-746.

El-Meadaway, A., Z. Mir, P.S. Mir, M.S. Zaman and L.J. Yanke, 1998. Relative efficacy of inocula from rumen liquor or fecal solution for determining in vitro digestibility and gas production. Can. J. Anim. Sci., 78: 673-679.

Hidayat, H.K., C.J. Newbold and C.S. Stewert, 1993. The contribution of bacteria and protozoa to ruminal fermentation of forage in vitro, as determined by microbial gas production. Anim. Feed Sci. Technol., 42: 193-208

M. Clauss, C. Polster, E. Kienzle, H. Wiesner, K. Baumgartner, F. von Houwald, S. Ortmann, W. J. Streich and E.S. Dierenfeld, 2004. Studies on digestive physiology and feed digestibilities in captive Indian rhinoceros (Rhinoceros unicornis)

Mauricio, R.M., E. Owen, F.L. Mould, D.I. Givens and M.K. Theodorou et al., 2001. Comparison of bovine rumen liquor and bovine faeces as inoculum for an in vitro gas production technique for evaluating forages. J. Anim. Feed Sci. Technol., 89: 33-48.

Omed, H.M., D.K. Lovett and R.F.E. Axford, 2000. Faeces as a Source of Microbial Enzymes for Estimating Digestibility. In: Forage Evaluation in Ruminant Nutrition, Givens, D.I., E. Owen, R.F.E. Axford and H.M. Omed (Eds.), CABI Publishing, Wallingford, U.K., pp:135-154.

S. Pashaei, V. Razmazar and R. Mirshekar, 2010. Gas Production : A Proposed In vitro Method to Estimate the Extent of Digestion of a Feedstuff in the Rumen. Journal of Biological Sciences, 10: 573-580

Thomas M. Fletcher, Christine M. Janis, and Emily J. Rayfield, 2010. Finite Element Anakysis Of Ungulate Jaws: Can Mode Of Digestive Physiology Be Determined?

Van der Made, Jan; Grube, René (2010). "The rhinoceroses from Neumark-Nord and their nutrition". In Meller, Harald. Elefantenreich – Eine Fossilwelt in Europa (PDF) (in German and English). Halle/Saale. pp. 382–394

Vaughan, T. A., J. M. Ryan, and N. J. Czaplewski. 2000. Mammalogy. Fourth Edition. Saunders College Publishing, Philadelphia.