بسم الله الرحمن الرحيم

شبكة المعلومـــــات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

﴿ قـــســـم ﴾

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد اعدت دون آية تغيرات

يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of
15 – 25c and relative humidity 20-40 %

بعض الوثائق الأصلية تالفة

بالرسالة صفحات

لم ترد بالأصـــل

SOME DIETARY FACTORS AFFECTING RUMEN ACTIVITY AND MICROBIAL PROTEIN SYNTHESIS

BY

KHALID ZEIN EL-ABEDEIN MOHAMAD KEWAN

B.Sc. Agric . Sci . (Animal prod.)

Menoufiya University

A Thesis

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS
FOR THE DEGREE
OF
Master of Agicultural Science
IN
ANIMAL PRODUCTION
(ANIMAL NUTRITION)

Menoufiya University
Faculty of Agriculture
Animal Production Department
SHEBIN EL-KOM

1996

APPROVAL SHEET

Title : Some dietary factors affecting rumen activity and microbial protein synthesis.

Name: Khalid Zein El-Abdein Mohamad Kewan.

This Thesis, for the degree of M.Sc. has been approved by :

Prof.Dr. A.Z. Metwaly

Prof.Dr. M. Rahmy

Prof.Dr. B.M. Ahmed

Associate Prof.Dr. H.T. Tais

Committee in Charge

Date : 22/ 6 / 1996

SUPERVISION COMMITTEE

SIGNATURE

PROF. DR. BARAKAT M. AHMED B.M. Ahmed

Prof. of Animal Nutrition
Feculty of Agriculture
Minufiya University

Dr. HAMDY T. TAIE H.T. Taie

Associate Prof OF Animal Nutition

Faculty OF Agriculture

Minufiya University

ACKNOWLEDGEMENT

First of all thanks , my merciful god for his continous help during all my life , my work and this study.

I would like to express my sincer gratitude and deepest thanks to Dr. B.M. Ahmed , Prof of Animal Nutrition and Head of the Departement of Animal Production Faculty of Agriculture, Minufiya University for valuable suggestions, his encouraging spirit , kind help , designing the work , valuable guidance , reading and correcting the thesis and providing most of the facilities which enabled me to complete this thesis .

I would also like to express my deepest thanks to Dr. H. Taie , Associate Prof of Animal Nutrition , Department of Animal Production , Faculty of Agriculture , Menufiya University for planning , faithful guidance, continuous supervision , reading and correctiong the thesis , kind assistance during the course of this work.

Thanks are also due to all staff members of Animal Production Department Fac. Agric. Menoufiya . Univ. for their cooperation and help during this work.

CONTENTS

INTRODUCTION

In two recent conferences, one held in Alexandria (1992) under a title of Manipulation of Rumen Micro- organisms and the other held in Ismailia (The 5 th Scientific Conference on Animal Nutrition , 1995) it was suggested that more work is needed to gain more information on microbial protein synthesis and rumen fermentation and factors affecting them (Borhami et. al., 1992, Mehrez, 1992 and 1995).

Mehrez (1995) discussed in detail some of these factors i, e., dietary protein and extent of its degradation, adequacy of available nitrogen in the rumen to satisfy microbial nitrogen needs, dietary fiber, starch and sugars, rumen environment factors as pH, additives, temperature...etc.

Borhami et. al., (1992) stated that the rate and extent of microbial growth in the rumen could be studied using a variety of laboratory procedures. However, measurement of microbial yield *in vivo* is not an easy task. The estimation of microbial yield in vivo presents problems involving measurenent and calculations. While literature values for microbial yield reflect problems in measurements, these can be no doubt that the real variations in yield is due to various diets and feeding conditions. Averages of microbial yields for different calsses of diets and/or method of estimation showed marked variations (Van Soest , 1982). Therefore, the present study was conducted to investigate the effect of variying levels of protein and fiber in the diet on digestibility.N balance and some rumen fermentation parameters (pH, NH_3-N, VFA). Rate of solid and fluid passage from the rumen was estimated . Microbial protein synthesis was also determined.

REVIEW OF LITERATURE

I- Some factors affecting digestion and rumen fermentation:

I.1. Dietary crude protein:

It is evident that the protein entering the rumen is fermented by the rumen micro-organisms, giving rise to peptides, amino acids (AA.) and ammonia(NH_3). The non protein nitrogen (NPN) consumed can also produce AA and NH_3 simultaneously with the synthesis of microbial protein (MCP) using NH_3 ,AA, or peptides In the rumen, the balance between the breakdown and synthetic reactions controls the utilization of protein and NPN compound (Borhami et. al., 1989).

Rumen microbial protein synthesis requires an adequate supply of nitrogen to achieve maximum efficiency . If nitrogen is not adequate, uncoupled fermentation may occur and this will result in fermentation without useful ATP production (Buttery , 1977) . In contrast, if the nitrogen level is excessive, energy may be limiting factor for efficient utilization of nitrogen . Therefore , for maximal efficiency of microbial growth to occur, nitrogen and energy availability in the rumen must be balanced.

Although the nitrogen concentration in a diet may appear to be adequate for maximum microbial growth, resistance of the protein to ruminal degradation may result in nitrogen deficiency . McMeniman and Armstrong (1977) determined that 2.0 g of

available nitrogen per 100 g organic matter digested (OMD) is the minimum amount required for efficient microbial protein production for low roughage diet..

Thomas (1977) found that with starch cereal diets there are distinct possibilities of nitrogen inadequacy, particularly with corn in which the protein is highly resistant to ruminal degradation.

Smith (1979) stated that degradation of organic matter(OM) and synthesis of MCP are depressed when nitrogen is deficient for growth of ruminal bacteria. The ruminal bacteria prefer to use NH_3 as the source of nitrogen for growth (Allison, 1969 and Bryant,1974). However, ruminal bacteria are efficient scavengers of NH_3, and they can grow on relatively low concentration of NH_3 in ruminal fluid (Schaefer et. al., 1980).

De Boer and Kennelly (1989) examined the effect of dietary crude protein (CP) concentration (11 VS 16 % CP) on milk yield and feed digestibility in lactating dairy cows. Data showed that , apparent digestibilities of dry matter (DM) were not influenced (68.0 vs 68.5 %) by dietary CP concentration, but both CP digestibilities and nitragen retention were increased CP concentration.

Data from Stern et. al., (1983) and Moller, (1985) suggested that, when diets contain 11 to 25% CP, the major proportion of the increase in passage of non ammonia - nitrogen (NAN) to the

small intestine (SI) resulting from increased nitrogen intake was due to the large ammonts of CP escaping ruminal degradation. These data also suggested that passage of microbial nitrogen was influenced more by dry matter intake (DMI) and other dietary factors than by nitrogen intake . They also found that the relationship between the CP content of the diet and concentration of NH_3 in ruminal fluid was relatively high (r^2 = .50). However, the reltionship between the concentrations of NH_3 in ruminal fluid and passage of microbial nitrogen to the SI was very low (r^2 = 0.08) when concentration of NH_3 in ruminal fluid ranged from 2 to 30 mg/dl.

Klusmeyer et. al. (1991) showed that the organic matter truly digested (OMTD) and microbial nitrogen passage to the SI were not significantly affected by CP content of the diet . Also, they found that a mean value of about 2 mg of NH_3- N/dl of ruminal fluid was adequate for maximizing OMTD and MCP synthesis and that the amount of OMTD was more directly related to the amount and efficiency of MCP synthesis than was the concentration of NH_3 when it was more than about 3 mg/dl of ruminal fluid.

Hume (1970); Hume et. al. (1970); and Leibholz and Hartmann (1972) reported no differences in apparent DM digestion or site of digestion by sheep due to level or source of nitrogen . However , Owens et. al. (1973) with lambs , showed