

Sudan University of Science & Technology
College of Graduate Studies

**Effects of Alfalfa Hay Particle Size and Daily Feeding Frequency
on Lamb Performance and Digestibility Traits**

**أثر حجم دريس البرسيم ونمط التغذية اليومية
على الأداء الإنتاجي وخصائص الهضم للحملان**

A thesis
Submitted For the Fulfillment
Of the Requirements for the degree of
Doctor of Philosophy
In
Animal Production

By
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Abstract

Seventy-two Najdi three month old male lambs weighing an average of 24 kg body weight were used in this experiment. Animal groups were randomly allotted to one of six dietary-treatment groups in a 3x2 factorial arrangement of three diets (9.5 and 14 mm) particle length pelleted diets and long hay diet, and two feeding frequencies (once or twice daily) , 12 animals per group. The complete pelleted diets (9.5 and 14 mm) contained 75% concentrate plus 25% chopped alfalfa hay while the long hay diet (fed as mash form) contained 75% concentrate plus 25% unchopped alfalfa hay. The effect of alfalfa particle length and feeding frequency on lamb performances, digestibility traits and carcass characteristics over a period of 100 days were recorded. The results of statistical data analysis showed that there were no effects ($P>0.05$) of the particles length and long alfalfa hay diet on daily dry matter intake (DMI). Lambs fed the 9.5 mm diet had higher ($P<0.05$) average daily gain (ADG) and gain efficiency than those fed 14 mm or long hay diets. Although ADG, DMI and feed to gain ratio were not affected ($P>0.05$) by frequency of feeding, they were numerically lower in lambs fed twice daily as compared with those fed once daily. Digestion coefficients of DM, CP and NFE were not affected by particle length of alfalfa hay in experimental diets. Apparent digestibility percentage of EE, ADF and NDF higher ($P<0.05$) for long-hay diet versus 9.5 mm diet, whereas no significant differences were noted between 9.5 and 14 mm diets. Although N intake and fecal N excretion did not differ ($P>0.05$) among the three treatment groups, N retention was higher ($P<0.05$) in lambs fed 9.5 mm. Apparent total tract digestibilities of DM, CP, EE and ADF were not affected ($P>0.05$) by feeding the lambs once or twice daily. Neither Fecal, urinary N excretion nor N retention were affected by feeding frequency. There was a significant difference ($P<0.05$) for apparent total tract digestibility of NDF, as NDF digestibility decreased in lambs fed twice daily in comparison with those fed once daily.

Reduction of particle length of alfalfa hay to 9.5 or 14 mm increased ($P < 0.05$) total VFA concentration at all post-feeding times as opposed to long hay diet; the differences between 9.5 and 14 mm diets in total VFA concentrations were not significant ($P > 0.05$). Mean molar proportion acetate increased ($P < 0.05$), while mean molar proportion propionate and butyrate decreased ($P < 0.05$), as lambs fed on long hay diet. The differences between 9.5 and 14 mm diets in mean molar proportions of acetate, propionate and butyrate were not significant ($P > 0.05$). The ratio of acetate to propionate tended to increase ($P < 0.05$) when lambs were fed long hay diet. Rumen total VFA concentrations at all post-feeding times were not influenced ($P > 0.05$) by feeding frequency, except at 10 h post-feeding; Rumen VFA concentration value was higher ($P < 0.05$) in lambs fed once daily than those fed twice daily. Acetate molar proportion was less ($P < 0.05$) in lambs fed once daily compared with lambs fed twice daily. Lambs fed on the long hay diet had a flat $\text{HN}_3\text{-N}$ concentration pattern than those on 9.5 and 14 mm pelleted diets. The pattern in ruminal $\text{HN}_3\text{-N}$ concentration differed between 9.5 and 14 mm diets. Ruminal $\text{HN}_3\text{-N}$ concentration increased ($P < 0.05$) in group of lambs fed twice a day compared with those fed once a day. There was significant ($P < 0.05$) effect of the particle length on ruminal retention time. Lambs fed on 9.5 and 14 mm pelleted diets had shorter ruminal retention time than those fed on long hay diet. Mean retention time was not affected ($P > 0.05$) by feeding frequency. The hot carcass weight and percentage of separable lean increased significantly ($P < 0.05$) as the particle length of alfalfa hay decreased. Particle length did not affect ($P > 0.05$) dressing percentage and separable fat percent. The hot carcass weight, dressing percentage and separable lean, fat percentage were not affected significantly ($P > 0.05$) by feeding frequency. The in vitro dry matter digestibility of three diets (9.5mm, 14 mm and long alfalfa hay) was significantly affected ($P < 0.05$) by particle sizes. DM digestibility of 9.5mm diets were higher ($P < 0.05$) than 14 mm and long alfalfa hay diets. However no significant differences were noted between 14 mm and long alfalfa hay diets. In vitro measurement there was no significant difference between the feeding frequencies once or twice a day in dry matter digestibility %.

ملخص الدراسة

أستخدمت في التجربة 72 رأس من الحملان سلالة النجدي عمر ثلاثة شهور ومتوسط الوزن الحي 24 كيلوجرام حيث وزعت الحيوانات عشوائيا على ثلاثة معاملات (أطوال الألياف 9.5 ملم, 14ملم ,برسيم سائب بدون تقطيع)قسمت كل معاملة الى مجموعتين 3x2 مجموعة تتغذى مرة واحدة / اليوم ومجموعة تتغذى مرتان / اليوم , في كل مجموعة عدد 12حيوان. تم تجهيز ثلاثة علائق للتجربة وهي مكعب العليقتان المعاملة بنسبة 75% مركز + 25% دريس برسيم مقطع حسب الأطوال المطلوب دراستها (9.5 ملم و 14 ملم) أما العليقة المقارنة (الضابطة) فهي مخلوطة سائبة بنفس النسبة (75% مركز مكعب + 25% دريس برسيم سائب). تم تسجيل البيانات الناتجة من تأثير علائق التجربة الثلاثة على وزن الحملان ,معامل الهضم وصفات الذبيحة خلال فترة التجربة التي إستمرت 100يوم. أظهرت نتائج التحليل الاحصائي للبيانات أن تغير طول الألياف فى العليقة لا يؤثر على كمية العلف المأكول يوميا بينما يؤثر على متوسط الزيادة اليومية فى الوزن الحى ومعدل التحويل الغذائي للعليقة الأقل طولاً 9.5 ملم أفضل ($P < 0.05$) من العليقة 14 ملم والعليقة الغير معاملة(السائبة).لم تظهر الدراسة أى تغير معنوي ($P > 0.05$) بين المجموعات التي غذيت مرة أو مرتان في اليوم على كمية العلف المأكول يوميا والزيادة اليومية فى وزن الحيوان أو معدل التحويل الغذائي ولكن أقل تأثيرا في المجموعة التي غذيت مرتين عنها في التي غذيت مرة واحدة . مكافى هضم المواد العلفية(المادة الجافة, البروتين الخام , مستخلص خالي الأزوت NFE) في جميع المعاملات ($P > 0.05$) لا تتأثر بطول الألياف غير إن معدل هضم (NDF,ADF,EE) في للعليقة الغير معاملة (السائبة) أكثر ($P < 0.05$) من العليقة المعاملة(المكعبة) 9.5 ملم و 14ملم الذي لا يوجد فرق معنوي بينهما. نسبة النيتروجين في العلف المأكول والخارج في الروث لا تختلف بين المعاملات بينما نسبة النيتروجين الممتص والمستفاد منه أعلى في العليقة 9.5 ملم وهذا يفسر زيادة الوزن في هذه المجموعة. طريقة التعليف اليومي لا تؤثر على معدلات الهضم (DM,CP,EE,ADF) لجميع المجموعات وكما لا تؤثر أيضا على نسبة النيتروجين في الروث والبول والنيتروجين الممتص , بينما يقل معنويا معدل الهضم NDF في طريقة التغذية مرتين . تقصير طول الألياف في العليقة المكعبة (9.5,14 ملم)

يؤثر على الهضم الميكروبي في الكرش و سرعة مرور الكتلة الهضمية من الكرش مقارنة بمخلوط العليقة السائبة وذلك لزيادة المساحة التي تتعرض للأحياء الدقيقة والإنزيمات مما يؤدي الى زيادة كمية الأحماض الدهنية الطيارة و النيتروجين الأموني . كما أظهرت الدراسة على أن زيادة تركيز الأحماض الدهنية الطيارة في العليقة (9.5 ، 14 ملم) عنه في العليقة السائبة بينما لا يوجد فرق معنوي بين العليقتين. نسبة حامض الخليك الى حامض البروينك أعلى في مخلوط العليقة السائبة عنه في مكعب العلائق المعاملة (9.5 ملم و 14 ملم) بينما نسبة حامض البروينك الى حامض الخليك في العليقة 9.5ملم أكثر ($P<0.05$) من مخلوط العليقة السائبة وهذا يفسر الزيادة في الوزن الحي للحيوانات المغذاة عليها. تركيز الأحماض الدهنية الطيارة لا يتأثر بطريقة التغذية ماعدا عند ال 10 ساعات بعد التعليف فإن التركيز أكثر في الحيوانات التي غذيت مرة واحدة مقارنة بالحيوانات التي غذيت مرتين. أما طريقة تقديم العلف فأن نسبة حامض الخليك الى حامض البروينك أعلى في التعليف مرتين / اليوم مقارنة بمرة واحدة ويرجع ذلك الى طول فترة تعرض المواد العلفية في حالة مرتين / اليوم للأنزيمات الكائنات الدقيقة بالكرش المتخصصة في تحليل المواد العلفية. معدل الزيادة في النيتروجين الأموني في الكرش ثابت في العليقة السائبة عنه في العليقة (9.5،14 ملم) بينما يزيد معدل الزيادة في التغذية مرتين. وزن الذبيحة يتأثر بطول الألياف في العليقة بينما لا يتأثر بطريقة التعليف. كما أظهرت النتائج المعملية (In vitro) تأثير طول الألياف على معدل هضم المادة الجافة أي كلما قل الطول زاد هضم المادة الجافة وذلك لزيادة المساحة التي تتعرض للهضم الميكروبي.

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Abbreviations

ADF	Acid detergent fiber
ADG	Average daily gain
CP	Crude protein (N = 6.25)
DIM	Days in Milk

DM	Dry matter
DMI	Dry Matter Intake.
EE	Either extract
FF	Feeding frequency
FSG	Functional specific gravity
GE	Gross Energy
GI	Gastrointestinal Tract
J	Joule
MRT	Mean retention time
N	Nitrogen
NFC	Non Fiber Carbohydrate.
NDF	Neutral detergent fiber
NEFA	Nonesterified Fatty Acids
NFE	Nitrogen free extract
NSC	Nonstructural carbohydrates
OM	Organic matter
pef	Physically effective fiber
peNDF	Physically effective Neutral Detergent Fiber.
TDN	Total digestible nutrient
TLC	Theoretical length of cut
TMR	Total mixed ration
VFA	Volatile fatty acids

CHAPTER I
INTRODUCTION

CHAPTER II
LITERATURE REVIEW

CHAPTER III
MATERIAL AND METHODS

CHAPTER IV
RESULTS AND DISCUSSION

CHAPTER V

Conclusions and Recommendations

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