EVALUATION OF NUTRITIONAL SYSTEMS FOR MAXIMIZING MILK PRODUCTION

By

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B. Sc. Agric. Sci. (Animal Production), Ain Shams University, 2004
M. Sc. Agric. Sci. (Animal Production), Cairo University, 2009

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Approval Sheet

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ABSTRACT

Ahmed Abdelkader Ibrahim Aboamer: Evaluation of Nutritional Systems for Maximizing Milk Production. Unpublished Ph.D. Thesis, Department of Animal production, Faculty of Agriculture, Ain Shams University, 2015.

The aim of this study was to assess the impact of incorporating the nutrient synchrony concept into the traditional least cost ration to be more appropriate to ruminants. Ruminal in situ degradation kinetics of organic matter (OM) and crude protein (CP) for seven feed ingredients were determined using in situ technique and used subsequently with available information about feeding management in order to formulate a synchronous least-cost ration using a new developed software application "Lacto-Sheep". Fifteen multiparous lactating Barki ewes (35.71 ± 1.75 kg), suckling single were randomly assigned to three groups (5 ewes each). The first group fed the least-cost ration (R1); The second group fed synchronous least-cost ration (R2); The third group fed synchronous least-cost ration with minimal amount of berseem; only one-third of berseem quantity (R3). The calculated synchrony index (SI) for R1 was 0.6 compared with 0.87 and 0.90 for R1 and R2, respectively. Results revealed that R1 had insufficient N to support maximum microbial protein synthesis, over 75% of the day. Although, R2 and R3 were considered to be synchronous, R3 had less total number of hours that predicted N:OM ratios were out of the permissible range of synchronization compared with R2. There were no significant effect of dietary treatment on in OM, CP, CF, NFE digestion coefficients and nutritive values. Both R1 and R2 showed a considerable decrease ($P < 0.05$) in EE digestibility. Blood serum total protein, globulin, AST and triglycerides concentration were not significantly affected. However, R3 had a significantly higher serum albumin than R1. Feeding on synchronous rations resulted in an increase in serum ALT. Group fed on R1 had the lowest serum glucose concentration (32.79 mg/dl). In contrast, R3 had the highest serum

glucose concentration (58.58 mg/dl). Serum cholesterol concentration was significantly increased in R3. Daily milk yield and its composition and characteristics did not significantly affected among dietary treatments; however, synchronous least cost ration (R2) had the highest daily milk yield, ECM and milk fat%. Feeding of synchronous diets resulted in an insignificant increase in milk urea-N and significant increase in serum urea-N. Group fed on R2 had the highest milk production efficiency. The highest net income (EGP/h/60d) was recorded by the group fed on R2 followed by those fed on R3 then those fed on R1, being 154.08, 140.43 and 80.38, respectively. The proposed synchronous least cost ration was more appropriate for ruminant animals compared with the traditional least cost ration.

Key Words: Synchronous least-cost ration, milk yield and composition, ruminal in situ degradation kinetics, Lacto-Sheep, lactating Barki ewes.

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ABBREVIATIONS

ADG	Average daily gain
ALT	Alanine aminotransferase
AST	Aspartate aminotransferase
BSC	Body condition score
BW	Body weight
CF	Crude fiber
CFM	Concentrate feed mixture
CLR	Common language runtime
CP	Crude protein
d	Day
DE	Digestible energy
DIP	Degradable intake protein
dl	Deciliter = 10^{-2} liter
DM	Dry matter
DMI	Dry matter intake
ECM	Energy corrected milk
ED	Effective degradability
ED_{CP}	Effective degraded fraction of CP
ED_{OM}	Effective degraded fraction of OM
EE	Ether extract
EGP	Egyptian pound
FCM	Fat-corrected milk
g	Gram = 10^{-3} kg
GAMS	General algebraic modeling system
GE	Gross efficiency
h.	Hour
HLS	Hybrid local search
hrs.	Hours
IU	International unit
k	The rumen outflow rate (fraction/h.)

kg	Kilogram = 10^3 g
LCR	Least-cost ration
LINDO	Linear interactive and discrete optimizer
LP	Linear programming
Mcal	Mega calorie = 10^6 calorie
mg	Milligram = 10^{-3} gram
ml	Milliliter = 10^{-3} liter
MP	Mathematical programming
MPE	Milk production efficiency
MSF	Microsoft solver foundation
MUN	Milk urea nitrogen
N	Nitrogen
NDF	Neutral detergent fiber
NEI	Net energy intake
NEL	Net energy of lactation
NFE	Nitrogen free extract
NLP	Nonlinear programming
NPN	Non-protein nitrogen
OM	Organic matter
RDP	Rumen degradable protein
RUP	Rumen undegradable protein
SI	Synchrony index
SLCR	Synchronous least-cost ration
SNF	Solids-not-fat
SUN	Serum urea nitrogen
TS	Total solids
UIP	Undegradable intake protein