EFFECT OF SELENIUM AND VITAMIN E LEVELS ON MILK QUALITY AND SAFETY

By

EHAB NASR MEEBED AHMED DAOUD

B.Sc. Agric. Sc. (Animal Production), Cairo University, 2002

M. Sc. Agric. Sc. (Animal Nutrition), Ain Shams University, 2011

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ABSTRACT

Ehab Nasr Meebed Ahmed Daoud: Effect of Selenium and Vitamin E levels on milk quality and safety. Unpublished Ph D. Thesis, Department of Animal Production, Faculty of Agriculture, Ain Shams University, 2019.

The main objectives of this study were to improve milk quality as well as maximizing profitability from milk production as a quantity and quality. Different types of silage from different regions in Egypt were used to reduce the feed cost and increase feed efficiency for lactating animals. Selenium and vitamin E were supplemented to lactating animals diets to decrease somatic cell counts, this decreasing the probability of mastitis incidence to improve milk quality and safety. The study included three field and laboratory trials which were; *In vitro, In sacco* and *In vivo* evaluation studies of this silage samples which were collected from four different areas in Egypt. These are; El-Salhia, El-Nobaria, El-Monofia and Janaklise. The samples were analyzed for their dry matter (DM), crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL). The silage samples were evaluated *In vitro* and *In sacco*. *In vitro* evaluation was conducted using gas production technic. Gas production (GP) was recorded at 0, 2, 4, 8, 16, 24 and 48 hours of incubation. The organic matter digestibility (OMD), short chain fatty acids (SCFA), and metabolizable energy (ME) were calculated. The *In sacco* experiment, involved dacron bags containing silage samples collected from different regions were incubated in three fistulated Barki rams for 24 h. Samples were taken out at 2, 4, 8, 12 and 24 h of incubation. The obtained results indicated that the Janaklise area silage samples recorded the lowest ($P<0.01$) values of GP through the different times incubation compared to other samples. The silage from El-Salhia had the highest ($P<0.01$) values for OMD and SCFA. The DMD significantly ($P<0.01$) increased within the different

times of incubation with El Salhia silage samples. However, the lowest values ($P<0.01$) were recorded with El-Nobaria silage samples.

Depending on *In vitro* and *In sacco* results, El-Salhia silage was chosen for conducting the lactation trial. Total of 98 Holstein dairy cows (early, mid and late lactation) were randomly distributed among three groups, control group, low supplement (Se & Vitamin E) and low forage (silage) (LSLF) N= 33, high supplement low forage group (HSLF) N=33 and high supplement high forage group (HSHF) N=32. Each group was placed in a pen equipped with free stalls. Cows of the control group (LSLF) and cows of the second group (HSLF) were givin TMR1, while the third group (HSHF) was givin TMR2 (high corn silage content). Second and the third groups (HSLF and HSHF) were supplemented with extra 0.15 mg of Se and 275 IU of vit. E/day. The trial period lasted for 90 days.

The results indicated that milk yield slightly increased for HSLF and HSHF than the control group. Milk fat content was positively and significantly ($P< 0.05$) affected by increasing silage in the ration (HSHF), however, milk protein, lactose, total solids, and milk ash content were not significantly ($P> 0.05$) affected. Fat corrected milk yield (FCMY) and energy corrected milk yield (ECMY) significantly ($P < 0.05$) increased for HSHF compared to HSLF and LSLF. The data as its expected that supplementing lactating animal ration with vitamin E and selenium increased milk content from vitamin E and selenium as well as glutathione peroxidase activity for the ration supplemented with HSLF and HSHF compared to the control group (LSLF).

Concerning the effect of experimental vitamin E + selenium treatments on cation concentration, the data clearly showed that vitamin E and selenium supplementation resulted significant decrease ($P < 0.05$) Na^+ content of milk for HSHF and HSLF compared to LSLF (un-supplemented group). Also, vitamin E and selenium supplementation decreased K^+ concentration for HSHF and HSLF compared LSLF but, these differences were not statistically significant.

Also, total bacterial count and electrical conductivity for the supplemented group were decreased compared to un-supplemented but the differences were not significant.

Data showed that there were significant decreases in DMI/MY, DMI/FCMY4% and DMI/ECMY for HSHF group. HSHF group was more efficient in converting TDNI to MY, FCMY and ECMY, while HSLF group was more efficient than the LSLF group. There were no significant difference between the groups in converting CPI to MY. CPI/FCMY and CPI/ECMY were significant more efficient for HSHF group compared with HSLF and LSLF groups. Protein efficiency (%) and Energy efficiency (Mcal/l) significantly higher for HSHF group compared with HSLF and LSLF groups.

Blood serum analysis, total protein, albumin, aspartate aminotransferase (AST), alanine aminotransferase (ALT), urea, creatinine, sodium, potassium, calcium were not significantly affected by treatments and they were within the normal range. Gpx. activity in serum was in normal range for all groups. However, HSHF group had a significantly higher value than other treatments compared with control group. Concerning to the effect of experimental treatment on blood neutrophil concentration, the data clearly showed that, there were significant ($P < 0.05$) differences between treatments in blood neutrophil percent and it was higher ($P<0.05$) for the control group (LSLF) than other treatments. HSHF group was the most economical efficient group (43.61%) compared with other groups, LSLF group (36.94 %) and HSLF group (36.79%).

Under the present experimental conditions it could be concluded that using high level of corn silage could be very important factor for reducing feed cost additionally, supplementing vitamin E and selenium to lactating animals increased milk quality and safety in terms of that lead to achieve more profitability and sustainability for dairy farms.

Keywords: Selenium, Vitamin E, Milk Quality and Safety

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LIST OF APPREVIATIONS

ABBREVIATION	DEFINITION
ADF	Acid detergent fiber
ALT	Alanine aminotransferase
ASF	animal source feeds
AST	Aspartate aminotransferase
bu	bushel
Ca	calcium
CF	Crude fiber
CFU	Colony forming unit
Cm	Centimeter
^{o}C	Centigrade
CO_2	Carbon dioxide
CP	Crude protein
CPI	Crude protein intake
D	Day
DCP	Digestible crude protein
DIM	Days in milk
DM	Dry matter
DMD	Dry matter disappearance
DMI	Dry matter intake
EC	Electric conductivity
ECMY	Energy corrected milk yield
EE	Ether extract
EGP	Egyptian pounds
FCM	Fat corrected milk
GDP	Gross domestic product
GE	Gross energy
g/h/d	Gram / head/ day
Gpx	Glutathione peroxidase
H	Head