

**PHYSIOLOGICAL RESPONSES OF CAMELS TO
DIFFERENT SOURCES AND LEVELS OF
SELENIUM**

By

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LIST OF ABBREVIATIONS

ADG	Average daily gain
Alb	Albumin
ALP	Alkaline phosphatase
ALT	Alanine aminotransferase
APRI	Animal production research institute
ARC	Agriculture research center
AST	Aspartate amino transferase
BUN	Blood urea nitrogen
BW	Bodyweight
Ca	Calcium
CAT	Catalase
CC	Camel calves
CF	Crude fiber
CG	Control group
CP	Crude protein
CR	Creatinine
d	Day
dl	Deci liter (10^{-2} liter)
DM	Dry matter
EE	Ether extract
FBW	Final body weight
g	Gram (10^{-3} kilogram)
GHS-Px	Glutathione peroxidase
Glb	Globulin
Glu	Glucose
GR	Growth rate
h	head
IBW	Initial body weight
ISG	Inorganic selenium group
IU	International unit
K	potassium
L	liter
MDA	Malondialdehyde
mg	Milli gram (10^{-3} gram)

ml	Milli liter (10^{-3} liter)
NFE	Nitrogen free extract
ng	Nano gram (10^{-9} gram)
nm	Nano meter (10^{-9} meters)
nmol	Nano mole
OM	Organic matter
OSG	Organic selenium group
Se	Selenium
T3	Triiodothyronine hormone
T4	Thyroxine hormone
TBG	Total body gain
TC	Total cholesterol
TG	Triglycerides
TL	Total lipids
TP	Total protein
ROS	Reactive oxygen species
rpm	Revolution per minute

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SUMMARY

This study was carried out at The Camel Studies and Production Development Center, at Matroh governorate that belong to Camel Research Department, Animal Production Research Institute, Agricultural Research Center, Giza, Egypt.

This experiment was conducted for 115 days to evaluate the effect of selenium supplementation from different sources on blood metabolites, antioxidant status, mineral profile and growth performance of growing Maghrabi camels with average initial body weight (IBW) 172.47 ± 10.56 kg, aged 18 months. All animals were kept in individual semi opened pens

All animal were offered concentrated feed mixture (CFM) plus alfalfa hay plus rise straw at 2% of BW on dry matter basis. Weighting animals were done biweekly, monthly blood samples were taken from jugular vein in heparinized tubes. Glucose, total protein, albumin, total cholesterol, triglyceride, total lipids, alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, blood urea nitrogen, creatinine, thyroxine and triiodothyronine. Antioxidant biomarkers; glutathione peroxidase, catalase, malondialdehyde, and total antioxidant capacity. Mineral profile selenium, sodium, potassium, and calcium were determined.

Growth performance was studied through calculation of individual average daily gain, total weight gain, and growth rate.

The obtained results could be summarized as follows:

1. Blood plasma metabolites

a. Glucose

Results showed that Glu concentration increased gradually through the experimental period in all groups. Selenium supplemented groups OSG and ISG were significantly higher than the control.

b. Total protein

Over all mean of TP were 6.76, 8.12 and 7.98 g/dl for CG, OSG and ISG. It clearly had shown an improvement of N metabolism that could be attributed to better utilization of dietary protein and ruminal true protein-N in the digestive tract.

c. Albumin

Also, Alb concentrations were recorded higher values in treated groups than control. It was 4.87 and 4.80 in OSG and ISG respectively, while it was 3.92 in CG.

d. Globulin

In the same line, Glb concentrations were recorded higher values in treated groups than control. It was 3.25 and 3.18 in OSG and ISG respectively, while it was 2.84 in CG.

e. Triglycerides

The presented data showed that values of TG are similar in all group with nonsignificant differences among the three groups.

The values were 62.00, 55.77 and 62.07 mg/dl for CG, OSG and ISG, respectively.

f. Total cholesterol

During the experimental period cholesterol values took a fluctuated trend in all groups. The differences among all groups were in narrow range (61.20 – 67.33 mg/dl)

g. Total lipids

In the presented study, a significant differences between the two treated groups and control and the values were 457.87 mg/dl in OSG followed by 450.93 mg/dl for ISG which were significantly higher than CG which was the lowest at 365.56 mg/dl.

2. Liver functions

a. Alanine aminotransferase

Through the experimental period, ALT values were gradually increased in treated groups and decreased in control. However, the overall mean of the ALT values in all groups were insignificantly differ, but all values were in the normal range as reported by other workers in previous studies.

b. Aspartate aminotransferase

Values of AST activity in all groups took the same trend decreased after one month of experiment then increased tell the end of the experiment. But all values were within the normal range.

c. Alkaline phosphatase

Results showed that ALP activity increased gradually through the experimental period in all groups. Organic selenium supplemented group OSG was significantly higher (138.72 IU/L) than the other two groups ISG and CG (134.33 and 114.29IU/L).

3. Kidney functions

a. Blood urea nitrogen

BUN values were insignificantly differ among the three groups during the experimental period. All groups were close, but the ISG was the lowest (18.51 mg/dl) in comparison with CG (20.17 mg/dl) and OSG (20.85 mg/dl).

b. Creatinine

The creatinine values were fluctuated in all groups throughout the experimental period. The overall mean of the three groups was 1.58 mg/dl at the beginning then decreased to 1.48 mg/dl then increased to 1.69 mg/dl followed by another decrease to 1.47 mg/dl.

4. Plasma hormones

a. Triiodothyronine

T3 concentration increased gradually through the experimental period. The average of the three groups in the beginning was 8.91 ng/ml then it increased to 10.30 ng/ml by the end of the study. The treatment showed a significant increase more

than control with superiority to the organic selenium source which was the highest.

b. Thyroxine

These results showed that T4 concentrations did not differ significantly during the experiment among all groups. The values ranged between 100.88 and 107.87 ng/ml.

5. Antioxidant biomarkers

a. Glutathione peroxidase

At the beginning all groups almost similar in GSH-Px values but, through the experiment CG these values changed within narrow range (5.8 IU/g Hb). While, the supplemented groups widely changed (9.95 IU/g Hb). Se addition increase GSH-Px activity by about 22 % In OSG and 20% in ISG more than control.

b. Malondialdehyde

All results clearly indicated that an improvement of antioxidant status was achieved by Selenium addition in growing camel diets. A significant decrease in MDA activity by about 38% for OSG and by about 29% for ISG lower than control CG.

c. Catalase

These results give the impression that inorganic Se supplementation has best effect on improve the activity of CAT than organic Se. This increase was 22.4 % for organic

supplementation and 26.8 % for inorganic supplementation. But no significant variation according to Se source.

d. Total antioxidant capacity

Generally the results showed that, TAC take the same trend of the other antioxidant biomarker due to Se supplementation regardless source. In concern, organic Se supplemented animals are raised by about 11% and inorganic was 21% compared with control without any supplement.

6. Mineral profile

a. Selenium

The obtained results showed that a rapid increase in blood Se levels in supplemented groups by about two folds according to supplement giving the superiority to organic source which was 17% higher than inorganic. This result reflect the sensitivity of camels to oral Se supplementation.

b. Sodium

An insignificant differences among the three groups were observed. The data showed that most of Na values are in OSG which was higher than the other two groups but insignificantly ($P>0.05$). On the other side, the effect of experimental months appeared as fluctuated trend.

c. Potassium

In comparing the treated groups (OSG and ISG) with control (CG), both supplemented groups are higher significantly ($P < 0.05$) than control. The overall mean among the three groups were 4.29 mmol/L for OSG (the highest) followed by 4.87 mmol/L for ISG then 3.94 mmol/L for CG (the lowest). During the experimental months K values gradually increased in all groups

d. Calcium

Also Ca showed a significant increase ($P < 0.05$) in supplemented groups (OSG and ISG) compared with control (CG). With respect to the effect of period, all groups recorded the lowest K values at the beginning of study, thereafter, the treated groups tended to be increased ascendingly with the advancement of age reaching the highest values by the end of the experiment. On the other hand, CG recorded fluctuated values up and down.

7. Growth performance

The growth performance of the experimental camel calves is almost similar in all groups in their initial body weight. But by the end of the experiment, total body gain (TBG), average daily gain (ADG) and Growth rate (GR) showed significant differences ($P < 0.05$) among experimental groups with superiority in OSG which supplemented by organic selenium source followed by ISG group with inorganic supplement and the control group (CG) was the lowest. An increase by about 51.2% was observed in OSG more than control while, ISG was

increased by 32.1 % more than control also. However, the source effect was 14.4 % superiority to organic Se higher than inorganic Se.

CONCLUSION

Selenium supplemented diets for growing and fattening camel, especially from organic source has a positive effect on growth performance and antioxidant responses via the recorded increases in ADG, TBG, and FBW especially in the OSG. In addition, the recorded enhancement on blood total protein, albumin, globulin, which were higher in treated groups (with especial reference to OSG) than the control one but still within normal physiological range and metabolic hormones (T3 and T4).

Furthermore, increase the antioxidant enzymes activity and the noticeable reduction in MDA in the treated groups than control group. Therefore, further studies are required to define the effects of Se supplementation and to quantify interactions between other not studied physiological responses of pre-puberty camels. The level, source, and synergistic combinations of other trace mineral supplementation should be considered when determining the most beneficial effect for productive and reproductive performance and the health of camels at the early stage of age.