# Effect of feed additive "Exogenous Enzymes" on growth performance of Maghraby Camels

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**Abstract:** This experiment aimed to evaluate the effects of a mixture of exogenous enzymes (ZADO®) from anaerobic bacteria on growth performance, feed intake, nutrient digestibility and blood parameters. Eighteen growing Maghraby camels averaged, 268.83 kg body weight; 1.5-2 years. Camels were randomly divided into 3 equal groups (6 in each) of similar weight and age, which were offered complete rations with tow levels of ZADO® product. The first group was Zero g/h/d (control), the second group take 20 g/h/d of ZADO® and the third group 40 g/h/d, over a period of 90 days. Results indicated that 40 g supplementation showed the best response in DM and OM digestibility. Carbohydrate results showed significantly effects of ZADO® supplementation on crude fiber and Nitrogen free extract in R40 being, 78.23 %, 80.60% and R20 being, 75.56%, 77.23%, respectively with insignificant difference between R20 and C ration. NDF digestibility was significantly with R40 (75.77%) followed by R20 (72.99%) and C (71.17 %). Blood parameters of control and tested groups of camels were in normal range with slight decrease in total lipid. Total body gain and average daily gain (ADG) significantly differed among experimental groups being 61.87, 84.82 and 88.65 kg and 0.69, 0.94 and 0.98, in C, R20 and R40 kg, respectively. Data related to feed intake as DM, TDN showed insignificant difference among groups of camels. It could be concluded that growing male Maghraby camels fed on the diet containing ZADO® performed better than those offered the control ration. Moreover, adding ZADO® in camel ration (40g/h/d) was the better, as confirmed by the highest body weight gain, most of blood metabolites and digestibility.

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**Keywords:** Camel, ZADO®, digestibility, daily gain.

## 1. Introduction

The dromedary camel is one of the most important domestic animals in the arid and semi arid regions as it is equipped to produce high quality food at comparatively low costs under extremely harsh environments (Yagil, 1982; Yousif and Babiker, 1989). The role of the camel as a meat producer is becoming more important due to the versatile role it plays rather than as a symbol of social prestige, which was the role it used to play but which has since greatly diminished (Dawood and Alkanhal, 1995). The camel has great tolerance to high temperatures, high solar radiation and water scarcity. It can survive well on sandy terrain with poor vegetation and may chiefly consume feeds unutilized by other domestic species (Shalah, 1983). Tandon, Bissa, and Khanna (1988) noted that the camel is likely to produce animal protein at a comparatively low cost in the arid zones based on feeds and fodder that are generally not utilized by other domestic species due to either their size or food habits. Camel has a great capacity to produce meat. Now, camel has a more important situation as a meat-producing animal in Egypt (Mohmed *et al*., 2009).

In the same time, FAO statistics (FAO, 2010) refers to there are about 24.7 million camels in the World, of which 20.7 million are found in Africa, only 11 thousands from this numbers in Egypt. Also, numbers of camels decreased from year to another in Egypt (141 thousands in 2000, 120 thousands in 2005) according statistics and that contrasted with other countries.

A commercial exogenous enzyme mixture (ZADO®), prepared from anaerobic bacterium, has been shown to improve nutrient digestibility, as well as milk yield of cows fed diets containing Egyptian by-product feeds (Gado et al., 2007; Soliman, 2006), as well as live weight gain and feed conversion of sheep and goats fed wheat straw (Gado and Salem, 2008; Salem et al., 2007). Also, Gado *et al*. (2009) observed that the addition of enzymes increased intake of dry matter (DM) and organic matter (OM) was positively influenced by supplementation, and digestibility of all nutrients was higher in the total tract of supplemented cows with 40 g of ZADO®/h/ day, although the magnitude of the improvement varied among nutrients, with the highest improvement in NDF and ADF than the other nutrients.

The Egyptian Maghraby camel is medium in size with small but pointed hump. Besides pack use, the Maghrebi camel is used for all kinds of agricultural, industrial and draft purposes. A number of types are locally developed serve certain functions.

The Maghrebi camel generally responds to feeding and might gain about 700-1000 grams per day during the first year under intensive conditions (Wardeh, 2004). In the same time, there is a lack of information in the literature on using feed additives in the growing camel's rations. Therefore, the objective of the present study was to evaluate the effects of ZADO® supplementation of diets of Maghraby camel calves on feed intake, growth performance, nutrients digestibility and blood metabolites.

## 2. Material and Methods

### Location

The present study was carried out at two places growth and digestion trial were take place at Camel Studies and Production Development Center in Matrouh governorate which belongs to Camel Research Department, Animal Production Research Institute, Agricultural Research Center and sample analysis and statistics at Animal production department, Faculty of Agriculture, Cairo University ,Giza, Egypt.

### Experimental animals and rations

Eighteen growing Maghraby Camels averaged 268.83 kg body weight; 1.5-2 years old were divided into 3 groups of 6 in each according to live weight for 90 days trial. Animals in the control group C: were fed concentrate feed mixture (CFM) and clover hay plus rice straw without additives, while, in the tested rations animals were fed R20: C+ 20 g ZADO® and R40: C+ 40 g ZADO®.

**Table: 1. Chemical composition and fiber fractions of ingredients in the basal ration.**

| Item | Feedstuffs | | | Ration |
|---|---|---|---|---|
| | CFM | Clover hay | Rice straw | |
| **Chemical composition %** | | | | |
| **DM** | 91.33 | 89.96 | 89.25 | 90.74 |
| **OM** | 89.21 | 90.00 | 86.33 | 88.97 |
| **Ash** | 10.79 | 10.00 | 13.67 | 11.03 |
| **CP** | 14.76 | 13.76 | 4.92 | 13.14 |
| **EE** | 3.08 | 1.28 | 1.03 | 2.41 |
| **CF** | 8.61 | 36.20 | 42.51 | 19.30 |
| **NFE** | 62.76 | 38.76 | 37.87 | 54.12 |
| **Fiber fractions %** | | | | |
| **NDF** | 34.21 | 61.94 | 78.48 | 46.42 |
| **ADF** | 12.67 | 49.70 | 57.02 | 26.86 |
| **ADL** | 2.98 | 4.95 | 10.49 | 4.47 |
| **Cellulose** | 9.69 | 44.75 | 46.53 | 22.39 |
| **Hemi-cellulose** | 21.54 | 12.24 | 21.46 | 19.56 |

*CFM, concentrate feed mixture, NDF: neutral detergent fiber, ADF: acid detergent fiber and ADL: Acid detergent lignin

### Digestion Trail

Digestive trail were conducted to determine the nutritive value of experimental rations. Each trial was divided into two stages: a preliminary 21-day period to allow the animals to adapt to each feed, and a 7-day experimental period during which voluntary feed intake was measured and total collection of feces. Feces samples were weighed and dried at 60°C for 24 hrs in a hot air oven. The dried samples of feces and feeds were ground to pass through 1mm sieve. Representative samples of feed and feces were stored in emerged bottles for chemical analysis. Meanwhile, the digestion coefficients and nutritive values of the experimental rations were calculated.

### Chemical analysis

Feeds and feces were analyzed for proximate analyses (A.O.A.C., 1990). Nitrogen free extract was calculated by difference. Fiber fractions were analyzed according to Van Soest and Wine (1967) and the cellulose and hemicelluloses were calculated by difference.

### Blood parameters

Blood samples were collected from camels at the end of digestion trail. The blood samples were taken from the jugular vein in dry clean glasses tubes using heparin as anticoagulant and then centrifuged for 15 minutes at 4000 rpm to obtain plasma. Biochemical of blood plasma constituents were determined by using commercial kits, total protein and creatinine as described by Tietz (1986 and 1990), albumin was determined according to Doumas *et al*., (1971), blood plasma urea was determined according to Patton and Grouch (1977). Alanin amino transferase (ALT) and activity of aspartate transfearse

(AST) were determined by the methods of Young (1990). Glucose (g/dl) was executed by using kits of Stanbio Laboratory Inc, procedure No. 1070. (San Antonio, Texas, USA). Total lipids, triglycerides and total Cholesterol (mg/dl) were quantified by using colorimetric method by using kits of Bio diagnostic company.

**Statistical analysis**

Data were analyzed using the general liner model procedure of SAS (2000). One way ANOVA procedure was used to analyze the feed intake, digestibility, growth performance and blood parameter data following the next model; $y_{ij} = \mu + T_{ij} + E_{ij}$ ,were: $\mu$ is the overall mean of $y_{ij;}$ $T_{ij}$ is the treatments effect; $E_{ij}$ is the experimental error. The differences among means were separated according to Duncan's New Multiple Range Test (Duncan's 1955).

**3. Results and discussion**

**Digestion coefficients and nutritive values**

Data concerning nutrients digestibility and nutritive values are presented in Table (2). The results indicated that dry matter and organic matter digestibility was significantly lower (P<0.05) with control ration (C, 71.85%, 74.31) than rations with ZADO® supplementation with insignificant differences between R20 and R40 (73.34%, 75.87 and 76.56, 79.10 %). Also, data refers to 40 g supplementation gives best results in DM and OM digestibility, same trend reported by Gado *et al.* (2009). ZADO® addition did not appear any significant (P<0.05) effect on crude protein and ether extract digestibility. Carbohydrate results showed significantly effects of ZADO® supplementation on crude fiber and Nitrogen free extract in R40 being, 78.23 %, 80.60% and R20 being, 75.56%, 77.23%, respectively with insignificant difference between R20 and C ration. There were insignificant (P<0.05) differences in results related to fiber fractions digestibility among control and experimented groups in ADF, cellulose and hemicelluloses digestibility. But NDF digestibility was significantly with R40 (75.77%) followed by R20 (72.99%) and C (71.17 %). Exogenous enzyme in ZADO® product, rich in xylanolytic, cellulase, α-amylase and protease activity, had positive effects on digestion of NDF in TMR, agreed with Krause et al. (1998), who suggested that enzymes can improve nutrient degradation in high concentrate diets. Perhaps the net effects of fibrolytic enzyme mixtures are not limited to the dietary component to which the enzymes are applied, which may explain why fibrolytic enzymes can be effective in improving digestibility of the non-fiber carbohydrates in addition to increasing digestibility of fiber when enzymes are added to the concentrate portion of a diet, or to high-concentrate diets (Beauchemin *et al*., 2003).

The nutritive values of tested rations presented in Table (2) indicated that the TDN of experimental rations were significantly differ 68.25, 69.90 and 72.79% with C, R20 and R40, respectively. The corresponding values of digestible crude protein were 9.09, 9.21and 9.73 % for rations C, R20 and R40 with significant difference of R40 than other groups. In this study, this is in harmony with Kholif (2008) when goats fed on rumen content with 20 g ZADO® addition.

**Table 2. Effect of ZADO® additive on digestion coefficients and nutritive values**

| Item | Experimental rations | | | ±SE |
|---|---|---|---|---|
| | C | R20 | R40 | |
| Digestibility, % | | | | |
| DM | 71.85b | 73.34ab | 76.56a | 1.23 |
| OM | 74.31b | 75.87ab | 79.10a | 1.13 |
| CP | 69.16 | 70.06 | 74.07 | 1.47 |
| EE | 75.84 | 79.50 | 79.94 | 1.47 |
| CF | 73.14b | 75.56ab | 78.23a | 1.20 |
| NFE | 75.63b | 77.23ab | 80.60a | 1.23 |
| NDF | 71.17b | 72.99ab | 75.77a | 1.17 |
| ADF | 62.66 | 63.38 | 68.48 | 1.86 |
| Cellulose | 68.02 | 68.41 | 74.16 | 1.71 |
| Hemicelluloses | 82.84 | 85.11 | 85.78 | 1.28 |
| Nutritive values, % | | | | |
| TDN | 68.25b | 69.90ab | 72.79a | 1.01 |
| DCP | 9.09b | 9.21b | 9.73a | 0.19 |

Means in the same row with different superscript are significantly different (P<0.05).

**Blood parameters**

Results concerning the effect of feeding camel on ZADO® product on some blood parameters are shown in Table (3). The average values of plasma total proteins of the experimental groups were 9.21, 9.35 and 9.01 g/dl for C, R20 and R40, respectively. Plasma albumin and globulin concentration in the showed similar trend of total plasma proteins, which indicated slight variations among tested groups of camel. Al-Busadah (2007) investigated that, total protein and albumin in different breeds of camels ranged from 4.9-10.2 g/dl and 3.1-6.2 g/dl. Triglycerides values showed significantly (P<0.05) effect of ZADO® addition, R40 had a higher value (111.51) than R20 (104.84) and C (79.27). In the same context, Mohamed, (2008) found that triglycerides in Egyptian camels ranged from 0.71 to 1.02 mmol/l. On contrast, total lipid data appeared lower significant values with R40 (873.22) than R20 and control ration. In the same trend, Nazifi *et al*., 2000 noticed that concentration of lipid in camels less than 6 years old 3.19-4.18 g/l.

Blood glucose concentration was highly significant with R20 (57.97) than other experimental rations with insignificant effect between C and R40. In this area, Bhatia (1986) reported the range 75-120 mg/dl and concluded that concentration of glucose in the blood of camels is generally higher than that in other ruminants. Urea and creatinine concentration in blood plasma was insignificantly (P<0.05) with control ration and supplemented rations. Chiericato et al. (1986a) found that urea in male camel may be up to 39.9 g/dl. Also, Patodkar *et al*., (2010) reported that adult male and female blood creatinine being; 1.87 and 2.37 mg/dl.

There was significant difference (P<0.05) in blood AST concentration among camels fed on C , R20 and R40 ration being, 69.05, 77.24 and 59.11 IU/L, respectively. In this respect, Mohamed and Hussein (1999) showed that AST concentration ranged between 34 – 148 IU/l. On the other side, the values of ALT ranged from 6.86 to 7.68 IU/L without significant differences among groups. Aichouni *et al.,* (2010) stated that the ALT content in blood of different camel breeds were 3.01 – 6.91 IU/l. Also, Sarwar and Majeed (1997) reported that serum ALT activity was positively correlated with serum globulin and total protein levels. Blood plasma transaminase enzymes activity (ALT and AST) are the most important indicators of liver cells activity where increasing the concentration of these enzymes indicate that the tissue activity are destroyed (Clifton Blincoe and Dye, 1958).

**Table 3. Effect of ZADO® additive on blood parameters of camel fed the experimental rations.**

| Item | Treatments | | | ±SE |
|---|---|---|---|---|
| | C | R20 | R40 | |
| Total proteins, g/dl | 9.21 | 9.35 | 9.01 | 0.15 |
| Albumin, g/dl | 5.58 | 5.41 | 5.74 | 0.18 |
| Globulin, g/dl | 3.63 | 3.94 | 3.27 | 0.23 |
| Triglyceride, mg/dl | 79.27b | 104.84ab | 111.51a | 9.12 |
| Total lipid, mg/dl | 900.00ab | 932.79a | 873.22b | 15.73 |
| Glucose, mg/dl | 38.11b | 57.97a | 55.31ab | 5.84 |
| Urea, mg/dl | 34.85 | 42.25 | 26.34 | 7.64 |
| Creatinine, mg/dl | 0.97 | 1.08 | 1.09 | 0.05 |
| AST, IU/L | 69.05ab | 77.24a | 59.11b | 4.92 |
| ALT, IU/L | 6.86 | 7.68 | 6.87 | 0.47 |

Means in the same row with different superscript are significantly different (P<0.05).

**Growth performance**

Daily gain, feed intake and feed conversion of camels fed two levels of additives and control group were measured. The results of live body weight values are shown in Table (4). There were insignificant differences (P<0.05) among the camels at the beginning of the experiment, being; 268.37, 286.62 and 269.50 kg. Final body weight gain was slight significant between supplemented groups (353.45, 358.15 kg with R20 and R40, respectively) and control group (330.25 kg) without insignificant differences between R20 and R40. In the same context, total body gain and average daily gain (ADG) significantly differed among experimental groups being 61.87, 84.82 and 88.65 kg and 0.69, 0.94 and 0.98, in C, R20 and R40 kg, respectively. Nutritive values of the experimental rations as TDN (68.25, 69.90 and 72.79 %) and DCP (9.09, 9.21. and 9.37 %), significantly differed, which may elaborate the former results concerning total or daily gain in difference. Daily growth rates for camels vary widely between regions, breeds and within the same breed. The limited work carried out on improving camel nutrition demonstrated significant relationships between daily gain and daily intake of concentrates for dromedary camels. The present data agreed with Wardeh, (2004), who recorded that Maghreby camel generally responds to feeding and might gain about

700-1000 grams per day during the first year under intensive conditions. Growing Maghraby camel which fed two different rations (control ration and Nigella sativa ration) at 3% of body weight for 98 day that ADG was 886 – 950 g/d respectively (Mohamed, 2007).

So, this study appeared when camel fed on good quality feeds and improved rumen ecosystem by feed additives for instance exogenous enzyme gives the best results with that promise animal. In this respect, Kamoun (1993) reported that ADG of Magraby dromedary camels kept on pastures of the Mediterranean type were 760 g up to 5 months of age, 605 up to 10 months of age and 353g from 12 up to 18 month of age. Also, Kamoun, 1995 investigated that, camels fed a diet with high dietary protein and energy gained more weight (550 g/d) than non-supplemented camels fed only on mangroves (260 g/d). A commercial exogenous enzymemixture (ZADO®), prepared from anaerobic bacterium, has been shown to improve live weight gain and feed conversion of wheat straw in sheep and goats (Gado and Salem, 2008; Salem et al., 2007).

Data related to feed intake as DM, TDN showed insignificant difference among groups of camels. However, DCP intake was significantly lower with control group (54.41 g) than experimental groups (57.29 and 58.71 g in R20 and R40). On the other hand, results of feed conversion indicated that supplementation of ZADO® in camel ration gives best results with feed conversion as DM (8.68 g DM/g gain). Consistent with El-Badawi and Yacout (1999) found that, camels and steers fed concentrate mixture (14%CP) at level 2% of body weight and rice straw *ad lib* showed ADG 810g and 770g for camels and steers respectively. On contrast, feed conversion (kg DM/kg gain) was nearly similar for both species (10.01 and 10.76 kg for camels and steers respectively).

**Table 4. Average live body weight, feed intake and feed conversion of growing camels fed ZADO® additive.**

| Item | | Experimental rations | | | ±SE |
|---|---|---|---|---|---|
| | | C | R20 | R40 | |
| Body weight change | Initial live body weight, kg | 268.37a | 268.62a | 269.50a | 14.31 |
| | Final live body weight, kg | 330.25b | 353.45a | 358.15a | 14.51 |
| | Total live weight gain, kg | 61.87b | 84.82ab | 88.65a | 7.38 |
| | Average daily gain, kg | 0.69b | 0.94ab | 0.98a | 0.08 |
| Feed intake, h/d. As fed, kg | CFM | 4.29 | 4.46 | 4.50 | --- |
| | CH | 1.40 | 1.46 | 1.47 | --- |
| | RS | 0.95 | 0.99 | 1.00 | --- |
| Feed intake, h/d. on DM basis | DM, kg. | 5.99 | 6.22 | 6.27 | 0.57 |
| | TDN, kg | 4.08 | 4.34 | 4.56 | 0.57 |
| | DCP, g. | 54.41b | 57.29a | 58.81a | 1.52 |
| Feed conversion (g feed/ g gain) | DM, g. | 8.68a | 6.62b | 6.39b | 2.49 |
| | TDN, g. | 5.19 | 4.62 | 4.65 | 0.59 |
| | DCP intake, g. | 0.8 | 0.6 | 0.6 | 0.06 |

Means in the same row with different superscript are significantly different (P<0.05).

## Conclusion

It could be concluded that the exogenous enzyme product (ZADO®), sourced from anaerobic bacterium and added to the camel rations, increased daily gain due to enhanced nutrient intake, and nutrient digestibility, as well as increased feed conversation.

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