

## The Influence of Some Nematode Parasitism on Lipid Metabolism and Lipoprotein Profile in Dromedary Camel (*Camelus dromedarius*)

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### Abstract

The goal of the present study was to investigate the influence of enteric parasitism on adaptation system of traveling dromedaries from Sudan to Egypt under diverse nutritional conditions with special reference to lipoprotein profile. Up on coprological examination, three nematode species; *Strongyloides species*, *Trichuris species*, and *Trichostrongylidae species* were recovered from examined camels. Three camel groups, 10 animals each, were selected with single infestation with one of the three recovered nematodes, in addition to a forth control group of parasitic infestation-free animals. Serum level of total cholesterol, triglycerides, high-density lipoproteins, low-density lipoproteins and very low-density lipoproteins were measured in all animals. Significant reduction of total cholesterol ( $P<0.01$  and  $P<0.05$ ), and LDL ( $P<0.001$  and  $P<0.01$ ) levels, and significant increase of triglyceride ( $P<0.001$  and  $P<0.001$ ), and VLDL ( $P<0.001$  and  $P<0.001$ ) levels were found only in *Trichuris species* and *Trichostrongylus species*-infested camels, respectively. Non significant changes of HDL level were found in all parasitized animals. These findings suggest that enteric parasitism intensifies negative energy balance in dromedaries traveling under diverse nutritional conditions and results in compensatory increase of lipolysis as an alternative energy source. This is expected to hinder the ability of camels to survive long term starvation and affect their production and burden capabilities.

Key word: Dromedary Camels, Nematodes, Cholesterol, Triglyceride, Lipoproteins.

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### 1. Introduction

Dromedary camels have a unique physiology which enable them to travel for long distances under poor nutritional condition and to convert poor pasture into milk and meat (Jasra and Aujla, 1998). Sudan and Somalia are considered the main markets that provide Egypt with camels. Imported camels from these regions are used to travel long trips that last for several days to weeks under diverse nutritional conditions. As dietary carbohydrate is the main source of glucose, deprivation of food during long distance traveling along with the continuous energy demands are expected to result in a considerable negative energy balance that

would affect the animal health (Wensvoort *et al.*, 2004). However, the unique adaptation system of camels enable them to maintain their body energy requirement during long traveling through energy production from glycogen and fat stores (Guerouali and Filali, 1992).

Studies on cholesterol, triglyceride and lipoproteins in domestic animals have made it clear that species variations exist (Nazifi *et al.*, 2000). However, little information are available about serum lipids and lipoprotein profiles in camels.

Internal parasitism is one of the major causes of ill-thriftiness in animals and cause losses through morbidity and hidden effects on feed intake and efficiency of

nutrient utilization (Rutagwende, 1985). In camels, given the nature of their life in harsh environment, internal parasitism are expected to have a considerable adverse effect of their health, through affecting intestinal absorption of dietary carbohydrate and lipid, which may affect their special adaptation to scarce food and water during traveling.

The aim of the study was to investigate the effect of enteric parasitism of dromedary camels on their lipids metabolism as an alternative energy source during traveling and also to reveal the nature of camel lipoproteins profile as compared to other animals.

## 2. Materials and methods

### 2.1. Animals.

A total number of 85 male, 5-9 years old, dromedaries from Shalteen area were subjected to the study during April, 2005. Based on coprological examination, 4 group of animals, 10 animals each, were selected for further investigation of their lipoprotein profiles. The first 3 group were selected with single infestation with one of the recovered nematode species, while the fourth group were selected free from internal parasitic infestation and were used as a control for the study.

#### 2. 1. Samples and Adopted methods.

**2.1. 1. Fecal sample:** fecal samples were collected from all camels directly after arrival to Shalateen area in a clean plastic bags and were subjected to coproscopic examination as previously described (Hendrix, 2002).

**2.1.2 Serum samples.** Blood samples were collected from all camels directly after their arrival to Shalateen area before receiving any food and were used for separation of serum that were stored at -20°C until used.

### 2.1.3. Biochemical study.

Serum samples were analyzed for total cholesterol (mmol/l), triglyceride (mmol/l), HDL-cholesterol (mmol/l), and LDL-cholesterol (mmol/l) by quantitative enzymatic colorimetric method using test kits supplied by STANBIO Laboratories, Boerne, TX, USA. All reactions were measured using Digital VIS/Ultraviolet Spectrophotometer (CE 292, series 2, Cecil instruments, Cambridge England, Series No. 52.232.). VLDL-cholesterol was estimated as one fifth of the triglycerides concentration (Friedewald *et al.*, 1972).

### 2.2. Statistical analysis.

All data were assessed for normal distribution using the normal probability plot before applying parametric or non-parametric analysis where appropriate. For detection of differences between Groups one-way ANOVA was used. When values of F-tests were significant, means were compared using independent sample T-test. The level of statistical significance was set at 0.05%. Correlations between differences of total cholesterol, triglyceride, LDL, and HDL in different groups were also carried out using Pearson's correlation coefficients. Statistical analysis was carried out with SPSS software 8.0 for windows; SPSS Inc. and Predictive analysis, Chicago, USA.

## 3. Results

Out of the 85 examined dromedaries, 67 animals were found harbouring nematode eggs with a mean EPG of 2035 and the range was 900 to 2700 EPG. Three different types of enteric nematodes were recovered from infested camels. Out of infested camels, 21 animals (31.3%) were found infested with *Strongyloides* species, 15 animals (22.3%) with *Trichuris* species and 11 animals (16.4%) with

*Trichostrongylidae* species (Table 1). Twenty animals showed mixed infestation with different nematode species.

The biochemical study showed the presence of variation in serum lipids and lipoprotein profiles in parasitic infested camels as compared to non parasitic-infested camels that were exposed to the same diverse traveling conditions (Table 1). The results of the study have showed significant reduction of total cholesterol ( $P<0.01$ ) and ( $P<0.05$ ), and LDL ( $P<0.001$ ) and ( $P<0.01$ ) levels in *Trichuris species* and *Trichostrongylidae species*-

infested camels, respectively, while non significant changes were found in the *Strongeloides species*-infested camels. On the other hand, significant increase of triglyceride ( $P<0.001$ ) and ( $P<0.001$ ), and VLDL ( $P<0.001$ ) and ( $P<0.001$ ) levels were recorded in *Trichuris species* and *Trichostrongylidae*-infested camels, respectively, while non significant changes were found in *Strongeloides species*-infested camels. HDL has showed non significant changes in all nematodes-infested camels.

Table 1. Mean values  $\pm$  standard deviation of lipids and lipoproteins levels (mmol/l) in nematode-infested dromedaries under traveling and fasting conditions as compared to that of healthy ones under the same conditions.

Infestation rate <sup>Tn</sup>	Control group <sup>n</sup>	<i>Strongeloides species</i> infested group <sup>n</sup>		<i>Trichuris species</i> infested group <sup>n</sup>		<i>Trichostrongylidae species</i> infested group <sup>n</sup>	
		No.	%	No.	%	No.	%
		21	31.3	15	22.3	11	16.4
<b>T. Cholesterol</b>	1.45 $\pm$ 0.29	1.15 $\pm$ 0.30		0.81 $\pm$ 0.11		0.98 $\pm$ 0.03	
<b>Triglycerides</b>	0.16 $\pm$ 0.08	0.22 $\pm$ 0.05		0.46 $\pm$ 0.04		0.42 $\pm$ 0.05	
<b>HDL</b>	0.38 $\pm$ 0.21	0.36 $\pm$ 0.16		0.39 $\pm$ 0.05		0.39 $\pm$ 0.16	
<b>LDL</b>	1.03 $\pm$ 0.24	0.75 $\pm$ 0.21		0.22 $\pm$ 0.09		0.24 $\pm$ 0.09	
<b>VLDL</b>	0.033 $\pm$ 0.012	0.044 $\pm$ 0.008		0.090 $\pm$ 0.009		0.084 $\pm$ 0.011	

Tn = 85, total number of studied camels, n = 10 animals per each group

(\* =  $P<0.05$ , \*\* =  $P<0.01$ , \*\*\* =  $P<0.001$ )

The correlation study has revealed the presence of significant positive correlation between total cholesterol and LDL levels and significant negative correlation between triglyceride and LDL levels. No correlation was found between the levels of cholesterol and HDL or triglyceride and HDL.

#### 4. Discussion

Dromedary helminthiosis is considered the third most important production constraint in camels (Bekele 2002). In the present study, out of 29 dromedaries examined, 69% were found infested with nematodes. This indicates the extent of the problem in areas of Sudan and Somalia from which studied camels came from. In Ethiopia, which share the same pastoral

area with Sudan and Somalia, Abebe (1991) and Bekele (2002) has reported prevalence rates of 91.5% and 87%, respectively, which were higher than the present finding. This may be attributed to the difference in sampling period of the year and duration of the study.

The results of the current study revealed the presence of significant reduction of total cholesterol level ( $P < 0.01$ ) in camels infested with *Trichostrongylus species* and *Trichuris species*, while a non-significant change was recorded in those infested with *Strongyloides species*. Considering the pathogenicity variation between the more pathogenic nematodes, *Trichostrongylus species* and *Trichuris species*, and the less pathogenic one, *Strongyloides species* (Partani et. al. 1996, Sharrif et. al. 1997), these findings could be attributed to the interference of the more pathogenic gastrointestinal nematodes with the lipid absorption in parasitized camels. This results are in agreement with previous study <sup>(1)</sup>, which attributed the adverse effect of gastrointestinal nematodes to their hidden effects on feed intake and efficiency of nutrient utilization in parasitized camels.

On the other hand, a significant increase of the triglyceride levels ( $P < 0.001$ ) were recorded in both *Trichuris species* and *Trichostrongylus species*-infested camels, while a non-significant change was recorded in *Strongyloides species*-infested camels. This is attributed to the increased rate of lipolysis as an alternative energy source due to the inadequate carbohydrate absorption in parasitized camels <sup>(1)</sup>, and the shortage of glycogen storage during traveling and fasting <sup>(2)</sup>. The increased

lipolysis results in liberation of triglyceride and non-esterified fatty acids which is processed by the liver into acetylCoA in the tricarboxylic acid (TCA) cycle for energy production (Wensvoort et al., 2004).

Large species differences in lipoproteins profiles and the percentage of total cholesterol and triglycerides carried by each lipoprotein class were recorded in different animals. Whereas in human and pigs, the majority of cholesterol is transported as LDL, in cattle, cholesterol is equally divided between LDL and HDL, while in sheep and horses, the majority of cholesterol circulates as HDL (Latimer et. al. 2003). However, little information are available about the lipoprotein profile in camels. The results of the correlation study between total cholesterol, triglyceride, LDL and HDL levels revealed that the significant reduction of total cholesterol and the significant increase in triglyceride levels in all parasitized camels were accompanied by a significant reduction in LDL, and a non significant change in HDL. These findings suggest that the majority of cholesterol in dromedary camels circulates as LDL, which apparently has more cholesterol and less triglyceride, and that HDL has almost equal amounts of cholesterol and triglyceride. The majority of the triglyceride is probably circulate as VLDL, but the current study was unable to make this assumption due to the used calculation method for determination of the VLDL level as described by (Friedewald et al., 1972). Obviously, further investigations are required before the assumption of this study can be assessed.

In conclusion, pathogenic camel nematodes, *Trichostrongylus species* and *Trichuris species*, have intensified the negative energy balance, increased the rate of lipolysis as an alternative energy source and accelerated the consumption of fat depots in camels under traveling and food

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<sup>1</sup> Rutagwende, T., 1985. The control of important camel disease in the integrated project of arid lands study area. Camel disease and productivity in the arid lands of northern Kenya. Integrated Project in Arid Lands (IPAL). Technical Report No. E-7, Germany, pp. 9-70.

deprivation conditions. This could have a subsequent negative impact on the unique adaptation system of camels to adverse condition

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