COMPARATIVE STUDIES OF CLOSANTEL, TRICLABENDAZOLE AND NITROXYNIL ON NATURALLY INFECTED SHEEP WITH FASCIOLA

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ABSTRACT

The present study was planned to fortitude the effects of the Closantel, Triclabendazole and Nitroxynil on the percent of Fasciola gigantica eggs, some hematological and biochemical profiles of the naturally infected sheep. Forty mature sheep of both sex naturally infected with Fasciola gigantica were classified into four groups (10 animals for each). The first group (G1) was kept as non treated control. The second group (G2) was injected (S/C) with Closantel (5 mg/kg B.W). While the third one (G3) received Triclabendazole at 12 mg/kg B.W at once orally, the last group (G4) injected at once (S/C) with Nitroxynil (10 mg/kg B.W).

Closantel (5 mg/kg B.W) , Triclabendazole (12 mg/kg B.W and Nitroxynil (10 mg/kg B.W) induced significant decrease on total Fasciolla hepatica eggs compared to control group with non significant different between the effect of tested drugs on Fasciola giganticaeggs at 7, 14 and 21. The efficacy percent of Closantel, Triclabendazole and Nitroxynil were 90%, 100% and 100% respectively after 21 days post treatment

Closantel (5 mg/kg B.W), Triclabendazole (12 mg/kg B.W) and Nitroxynil (10 mg/kg B.W) produced a significant increase in haemoglobin level and RBCs counts and a significant decrease in total leukocytic count. The differential leukocytic count of treated groups revealed a significant decrease in neutrophils % and eosinophils %, with a significant increase in lymphocyte % and monocytes % (G3) at third week post treatment.

The tested drugs induced a significant increase in serum total proteins , albumin, total lipids, triglycerides, Phospholipids and HDL-c with significant decrease of LDL-c and total cholesterol at the third week post dosing in treated groups compared with control group.

The effects of Closantel (5 mg/kg B.W), Triclabendazole (12 mg/kg B.W) and Nitroxynil (10 mg/kg B.W) on liver and kidney functions revealed a significant decrease

in liver enzymes (ALP, ALT and AST) and urea formation in treated groups judged against the infected non treated group.

INTRODUCTION

Closantel is a salicylanilide, synthetic antiparasitic agent with high efficacy against liver fluke, haematophagous nematodes and larval stages of some arthropods. Closantel and other salicylanilides interfere with energy metabolism by uncoupling oxidative phosphorylation in the fluke **(Fairweather and Boray 1999)**.

Closantel (CLS), a long-acting narrow-spectrum salicylanilide derivative, is reported to have a persistent anthelmintic activity against haematophagous nematodes for several weeks (6, 7, 8, 9) in goats (10), possibly owing to its strong binding to plasma protein and prolonged plasma half-life (11, 12). This allows the frequency of treatments with broad-spectrum anthelmintics to be reduced **Waruiru (2002)**.

The strategic use of closantel, a narrow-spectrum salicylanilide anthelmintic against Fasciola and of albendazole, a broad-spectrum benzimidazole anthelmintic, in the control of gastrointestinal nematodes of sheep was investigated by **Maingi et al., 1997**. They concluded that worm control strategies based on the epidemiology of the parasites and the sustained anthelmintic action of closantel in combination with broad-spectrum anthelmintics can provide effective control of gastrointestinal nematodes of sheep in the study area.

To evaluate the efficacy of fasciolicide compounds in clinical trial under the natural infection situation. The most recommended course of action is to evaluate egg and parasite reduction between 14 to 21 days post treatment **(Wood, et al. 1995)**.

The present study was performed to study the efficacy of Closantel, Triclabendazole and Nitroxynil on the percent of Fasciola gigantica eggs on naturally infected sheep. Moreover, this investigation was designed to assess the effect of tested drugs on some haematological and biochemical profiles on the naturally infected sheep.

MATERIAL AND METHODS

Drugs :

1: Closantel : Fasciontel (5%) injectable solution is a ready- to - used, pale yellow color and sterile solution (Laboratorios Tornel, Co. Mexico).

2: Triclabendazole : Fasinex (10%) a white color suspension prepared for oral uses (Novar-

tis. Co. Switzerland).

3: Nitroxynil: Dovenix (25%) injectable solution, is a ready- to - use, sterile orange color solution (Merial. Co. France.

Animals:

This work was conducted on 40 mature sheep of both sex naturally infected with Fasciola gigantica in private farms. Thier relative body weight ranged between 50- 60 kg. They were fed on green fodder (Barseem), wheat straw and concentrate ration ad-libitum. These animals were previously examined for determination of fluke eggs. They were classified into four groups (Gs) (10 animals for each). The first group (G1) was kept as non treated control. The second group (G2) was injected (S/C) at once with Closantel (5 mg/kg B.W) **(Vera Montenegro, et al., 2003)**. While the third one (G3) received Triclabendazole at 12 mg/kg B.W at once orally, the last group (G4) injected (S/C) with Nitroxynil (10 mg/kg B.W) at once **(Boulard, et al., 1995)**.

Sampling :

Fecal samples :

All animals were sampled for feces to count the Fasciola gigantica eggs. Individual egg count was carried out by the method of British Ministry Of Agriculture, **Fisheries and Food (1977)** at the first day then after one week, two weeks and three weeks post dosing.

Blood samples :

At first day, one week, two weeks and three weeks post dosing two blood samples were collected from the jugular vein of each animal. The first one was collected in heparinized tubes for haematological investigation. The second one was collected in clean centrifuge tube without anticoagulant and used for separation of clear serum. The sera were separated by centrifugation at 3000 r.p.m for 15 minutes and kept frozen at -20°C until used for biochemical and hormonal studies.

Efficacy Evaluation:

The criteria used to evaluate the efficacy of tested drugs in treated groups, with respect to the non treated (control) group were based on the percentage of positive samples obtained on a days 7 , 14 and 21 using the formula described by **(Besvior, et al., 1986)** in which:

$$\text{Efficacy } \% = \frac{\text{Mean number of eggs of control group} - \text{Mean number of eggs of treated group}}{\text{Mean number of eggs of control group}} \times 100$$

Analysis :

The whole blood samples were used for determination of haemoglobin (Hb) **(Wintrobe et al., 1967)**, total erythrocytic (R.B.Cs) and total leukocytic counts (W.B.Cs) **(Schalm, 1986)** and differential leukocytic count was performed using Giemsa stained blood films **(Coles, 1980)**.

The serum samples were assayed for total proteins (TP) & Albumin (Doumas, 1975), Total lipids **(Frings and Dunn 1970)**, triglycerides (TAG) **(Bucolo and David, 1973)**, HDL-c **(Clark et al., 1983)**, LDL-c **(Friedwald et al., 1972)**, Urea **(Putton and Crouch 1977)**, phospholipids (PL) **(Zilversmit and Davis, 1950)**, alkaline phosphatase (ALP) **(John, 1982)**, creatinine (Cr) **(Young et al., 1975)**, alanine aminotransferase (ALT) (King, 1965), aspartate aminotransferase (AST) **(Reitman and Frankel, 1957)**, Total cholesterol (TC)**(Mellattini, 1978)**.

Statistical analysis: The data subjected to ANOVA analysis according to **Senedecor and Cochran (1989)** by using a computer program (SPSS, Version 10).

RESULTS AND DISCUSSION

Efficacy of tested drugs on Fasciolla gigantica:

Our study revealed that Closantel (5 mg/kg B.W) , Triclabendazole (12 mg/kg B.W and Nitroxynil (10 mg/kg B.W) provoked significant decrease on total Fasciola gigantica eggs compared with control group with non significant difference between the effect of tested drugs on Fasciola gigantica eggs at 7, 14 and 21 days (Table, 1). Moreover, our data denoted that, the efficacy percent of Closantel, Triclabendazole and Nitroxynil were 90, 100 and 100 respectively after 21 days post treatment (Table, 2). **Powers et al., (1982)** mentioned that the most suitable time to evaluate the efficacy of faciolicidal compound was 14 or 21 days after treatment which gives greater relevance to the data. Our results were supported by that obtained by **(Romaniuk et al., 1995)**. They recorded that, Closantel (5 mg/kg B.W) evoked 97.5% reduction in Fasciola hepatica eggs after 21 days in treated cattle.

Meanwhile, **Lee et al., (1996)** found that, orally administration of closantel 10 mg/kg body weight elicited 80.3, 97.8 and 92.7% efficacy in goats with naturally-acquired fasciollasis at the second, third and fourth week post-treatment, respectively. It elicited a 100% efficacy in goats experimentally infected with F. hepatica metacercariae and treated at 18 weeks post-infection. In keeping with these lines our data revealed that closantel produce 86.11, 90.62 and 90 % efficacy in sheep naturally infected with Fasciollasis at first, second and third week after administration.

On the other hand, **Ibarra and Vera (1991)** have pointed out that triclabendazol at oral doses of 12 mg/Kg B.W. did not eliminate the fasciola eggs on naturally infected cattle. In another

study **Guiroz (1997)** suggested that triclabendazole at oral doses of 12 mg/Kg induced 75% efficacy in naturally infected animals. Moreover, our results were supported by that obtained by Vera Montenegro et al.,(2003) they concluded that, the efficacy percent of triclabendazole at the same dose was 98.7% on day 14 and 97.9% on day 21.

The faecal egg count fell to zero two weeks after treatment with nitroxynil (10 mg/kg B.W) and remained so for the next 30 weeks in experimentally and naturally infected cattle **(Boulard, et. al., 1995)**. Our data reflected the efficacy percent of nitroxynil (10 mg/kg B.W) on naturally infected sheep that evoked 91.66, 96.87 and 100% at the first, second and third week post treatment respectively.

The effects of tested drugs on some haematological parameters in naturally infected sheep :

Our result revealed that Closantel (5 mg/kg B.W) and Nitroxynil (10 mg/kg B.W) produced a significant increase in haemoglobin level at the first and second week post treatment. While Closantel (5 mg/kg B.W), Triclabendazole (12 mg/kg B.W) and Nitroxynil (10 mg/kg B.W) evoked a significant increase in haemoglobin level at the third week post dosing (Table: 2). Triclabendazole (12 mg/kg B.W) and Nitroxynil (10 mg/kg B.W) induced a significant increase in RBCs counts at 7 days post treatment. Meanwhile the tested drugs produced significant increase in RBCs counts at the second and third week post treatment (Table: 2). This increase may be attributed to treatment of the flukes which result in blood loss from direct blood feeding and from haemorrhage into the parenchyma, bile duct and the abdominal cavity as a result of flukes activities Jennings, 1976. It has been estimated that blood is lost at a rate of 0.2-0.5 ml per day per fluke **(Berry and Dargie., 1976)**. The treatment of flukes also enhanced the erytheropoiesis specially with the good iron and protein supply **(Dargie., 1981)**.

The tested drugs elicited a significant decrease in total leukocytic count at the first, second and third week post treatment (Table: 2). The differential leukocytic count of treated groups revealed also a significant decrease in neutrophils % (at the second and third week post treatment) and eosinophils % (at the first, second and third week after treatment) compared to non treated group. The data also indicated a significant increase in lymphocyte % (at the second and third week) and monocytes % in Nitroxynil treated group (at the first, second and third week) with non significant change in basophil % compared to control group. These results might be attributed to treatment of fasciolla by tested drugs (Table: 2). There are many studies which discuss the increase of total leucocytic count during the Fasciola hepatica infection in all host species by induction of eosinophilia which appears soon after infection, and increase rapidly during the parenchymal stage and persist at a high level after fluke entery to the bile ducts (**Poitou, et al.,**

1992). Other white blood cell population that have often been observed to increase are lymphocyte and neutrophils and occasionally monocyles and basophils **(Jemli, et al., 1993)**.

The effects of tested drugs on some biochemical parameters in naturally infected sheep:

The present study reflected that Closantel (5 mg/kg B.W), Triclabendazole (12 mg/kg B.W and Nitroxynil (10 mg/kg B.W) induced a significant increase in serum total proteins and albumin levels (Table, 5) after the first, second and third weeks post treatment judged against the non treated group. This increase could be attributed to the curative effects of tested drugs on liver flukes that results in increase albumin biosynthesis **(Muller., 1976)**. Another studies proved that the liver damage caused by migration of flukes decline the plasma albumen concentrations that could be attributed partly to reduction the rate of synthesis and partly to an expansion of plasma volume **(Symons, 1989)**. This result is supported by significant decrease in liver function enzymes.

Closantel (5 mg/kg B.W) , Triclabendazole (12 mg/kg B.W) and Nitroxynil (10 mg/kg B.W) induced a significant increase in total lipid and triglycerides levels (Table, 5) after the first, second and third weeks post treatment compared to the non treated group. This increase in total lipid could be explained by significant increase in triglycerides levels.

Our result demonstrated that, Triclabendazole (12 mg/kg B.W) and Nitroxynil (10 mg/kg B.W) evoked significant increase in phospholipids at the first week after administration. Phospholipids was significantly increase in the second, third and fourth groups at the second and third week post treatment matched up to the control group (Table, 5). Many studies suggested that, both microsomal and mitochondrial fractions exhibited significant decline in phospholipids **(Lenton et al., 1995)** and it appears likely that other membrane fractions would also be affected. In both the mitochondrial and microsomal fractions the decline in phospholipids was accompanied by an increase in degradation products or precursors including, in particular, large increases in the concentration of non-esterified fatty acids, suggesting the possibility of elevated phospholipase activity in infected livers **(Maffei Facino et al., 1993)**. Keeping with this line, the significant decrease in phospholipids found in our data may be resulted from reduction of liver flukes in treated groups.

The effect of tested drugs on lipoprotein fractions demonstrated that Triclabendazole (12 mg/kg B.W) evoked a significant increase in HDL-c at the first week. Moreover, the tested drugs induced a significant increase in HDL-c at the second and third week post treatment. On the other side, the LDL-c was significantly decreased at the first, second and third week post dosing in treated groups compared to the control group (Table, 5).

Total cholesterol level was significantly reduced at 7, 14 and 21 days in second, third and forth group compared to the first group (Table, 5). The decrease of LDL-c level could be reasoned to the reduction of cholesterol level since LDL-c is the main reservoir of cholesterol **(Hussein & Azab 1998)**.

Regarding the effects of tested drugs on liver and kidney functions, our data revealed a significant decrease in some liver function enzymes. At the first week ALP in G2 and AST in G3 &G4 is significantly decrease compared to the other groups. Meanwhile, the present data, revealed a significant decrease in ALP, ALT and AST at second and third weeks in Closantel , Triclabendazole and Nitroxynil treated groups compared to the infected one (Table, 4). These enzymes were released into the blood as a result of liver tissue damage which is used to monitore the progress of fasciola infection in various animals **(Marley, et al., 1996)**. The activities of serum ALP, ALT and AST increase during the early infection and reaching the peak at the end of parenchymal stage **(Ferri, et al., 1996)**. The present data also reflected the significant decrease in urea levels at the 7, 14 and 21 days after treatment with Closantel (5 mg/kg B.W) , Triclabendazole (12 mg/kg B.W) and Nitroxynil (10 mg/kg B.W). That might be attributed to the decrease in protein catabolism that mirrored by increase in total protein levels and improvement of renal function after treatment by tested drugs

Table (1): The effect of tested drugs on the Fasciola gigantica egg count in naturally infected sheep.

Mean ± S.E n=10

Time (Days)	F. gigantica egg count			
	G1	G2	G3	G4
0	330 ± 83.06	280 ± 41.63	380 ± 46.66	310 ± 52.59
7	360 ± 42.68^a	50 ± 16.66^b	80 ± 20^b	30 ± 15.27^b
14	320 ± 38.87^a	30 ± 15.27^b	40 ± 16.32^b	10 ± 10^b
21	200 ± 33.3^a	20 ± 13.3^b	0 ± 0^b	0 ± 0^b

The different letters in the same raw means that there was a significant change (P<0.05).
The same letters in the same raw means that there was a non significant change (P>0.05).

Table(2): The efficacy % of tested drugs in naturally infected sheep.

Time (Days)	Closantil (5 mg/kg B.W)	Triclabendazole (12 mg/kg B.W)	Nitroxynil (10 mg/kg B.W)
7	86.11	77.7	91.66
14	90.62	87.5	96.87
21	90	100	100

Table (3): The effect of tested drugs on some haematological parameters in naturally infected sheep.

Mean ± S.E **n=10**

Parameter	Time (days)	G 1	G 2	G 3	G 4
Hb (gm/dl)	0	8.91 ± 0.44 ^{a}	9.32 ±0.49^{a}	7.31 ± 0.28 ^{b}	8.85 ± 0.35 ^{a}
	7	8.10 ± 0.28 ^{b}	9.77 ± 046 ^{a}	7.91 ± 0.22 ^{bc}	9.00 ± 0.29 ^{ad}
	14	8.16 ± 0.29 ^{c}	10.2 ± 0.45 ^{a}	8.77 ± 0.24 ^{bc}	9.66 ± 0.29 ^{ab}
	21	8.14 ± 0.28 ^{b}	10.91±0.45 ^{a}	9.21 ± 0.21 ^{c}	10.62± 0.39^{ad}
R.B.Cs (10^{6}/ml)	0	3.80± 0.23^{b}	3.87± 0.25^{ab}	4.54± 0.19^{a}	4.46 ±0.21^{ab}
	7	3.73 ± 0.26^{b}	4.21 ± 0.25^{ab}	4.73 ± 0.15^{a}	4.80 ± 0.17^{a}
	14	3.56 ± 0.25^{b}	4.93 ± 0.12^{a}	4.81 ± 0.17^{a}	5.20 ± 0.19^{a}
	21	3.31 ± 0.18^{b}	5.41 ± 0.12^{a}	5.03 ± 0.14^{ac}	4.93 ± 0.19^{c}
W.B.Cs (10^{3}/ml)	0	7.01 ± 0.29 ^{a}	6.67 ± 0.23 ^{a}	6.75 ± 0.24 ^{a}	5.88 ± 0.3 ^{b}
	7	7.19 ± 0.27 ^{a}	5.81 ± 0.19 ^{b}	5.91 ± 0.22 ^{bc}	5.13± 0.21 ^{d}
	14	6.81 ± 0.25 ^{a}	4.97 ± 0.15 ^{b}	5.13 ± 0.21^{b}	4.96 ± 0.19 ^{b}
	21	6.63 ± 0.29 ^{a}	5.21 ± 0.2^{b}	5.15 ± 0.17 ^{b}	4.77 ± 0.16^{b}
Neutrophils %	0	52.2 ± 1.22	51.8 ± 0.83	53.4 ± 0.70	50.9 ± 0.84
	7	50.9 ± 0.72	49 ± 1.0	50.3 ± 0.49	48.2 ± 0.80
	14	52.4 ± 0.89^{a}	47.6 ± 0.85^{b}	48.4 ± 0.47^{b}	47.8 ± 0.82^{b}
	21	52.7 ± 1.32^{a}	45.7 ± 0.84^{b}	46.9 ± 0.48^{b}	47.1 ± 1.08^{b}
Lymphocytes %	0	44.2± 1.01^{a}	42.5± 0.63^{ac}	39.3 ± 0.90^{b}	40.5± 1.14^{bc}
	7	44.7 ± 0.57	45.9 ± 0.76	43.6 ± 1.17	43.7±1.19
	14	42.5 ± 0.78^{b}	47.4 ± 0.67^{a}	45.5 ± 0.80^{a}	45.7 ± 1.01^{a}
	21	41.8 ± 1.19^{b}	46.1 ± 3.0^{ab}	47.8 ± 0.97^{a}	46.9 ± 1.13^{a}
Eosinophils %	0	2.6 ± 0.27^{d}	2.3 ± 0.26^{cd}	3.4 ± 0.16^{b}	4.4 ± 0.30^{a}
	7	2.5 ± 0.26^{b}	1.8 ± 0.25^{b}	2.0 ± 0.14^{b}	3.3 ± 0.3^{a}
	14	3.2 ± 0.46^{a}	1.6 ± 0.22^{b}	1.4 ± 0.16^{bc}	2.4 ± 0.17^{d}
	21	2.7 ± 0.39^{a}	1.2 ± 0.13^{b}	1.1 ± 0.17^{bc}	1.9 ± 0.18^{d}
Monocytes %	0	2.3 ± 0.21	2.5 ± 0.26	2.7 ± 0.36	2.9 ± 0.23
	7	2.4 ± 0.22^{c}	2.5 ± 0.27^{bc}	3.3 ± 0.26^{ab}	3.4 ± 0.27^{a}
	14	2.9 ± 0.31^{c}	2.7 ± 0.3^{bc}	3.6 ± 0.31^{ac}	4.2 ± 0.29^{a}
	21	2.2 ± 3.8^{c}	3.1 ± 2.7^{bc}	4.0 ± 2.9^{ac}	4.3 ± 0.34^{a}
Basophil %	0	0.4 ± 0.01^{bc}	0.1 ± 0.01^{c}	0.5 ± 0.02^{b}	1.1 ± 0.01^{a}
	7	0.5 ± 0.17	0.3 ± 0.15	0.4 ± 0.16	0.7 ± 0.15
	14	0.4 ± 0.11	0.6 ± 0.16	0.3 ± 0.15	0.7 ± 0.15
	21	0.7 ± 0.21	0.6 ± 0.16	0.4 ± 0.15	0.7 ± 0.15

The different letters in the same raw means that there was a significant change ($P<0.05$).
The same letters in the same raw means that there was a non significant change ($P>0.05$).

Table (4): The effect of tested drugs on some liver and kidney functions in naturally infected sheep.

Mean ± S.E n=10

Parameter	Time (Days)	G 1	G 2	G 3	G 4
Creatinin	0	2.89 ± 0.22	3.34 ± 0.22	2.99 ± 0.24	2.78 ± 0.20
	7	2.29 ± 0.18	2.21± 0.17	2.63 ± 0.23	2.15 ± 0.25
	14	2.0 ± 0.12	1.68 ± 0.16	1.95 ± 0.17	1.80 ± 0.17
	21	1.94 ± 0.13	1.57 ± 0.19	1.59 ± 0.14	1.62 ± 0.11
Urea	0	59.63 ± 2.43	53.45 ± 2.42	57.87 ± 2.81	52.97 ± 4.38
	7	62.41± 2.19^{a}	46.82 ± 1.85^{b}	48.62 ± 1.75^{b}	49.34 ± 2.80^{b}
	14	58.32 ± 2.08^{a}	42.21 ± 1.79^{b}	46.31 ± 1.55^{b}	47.18 ± 2.52^{b}
	21	57.73± 1.35^{a}	40.02 ± 1.24^{b}	43.51± 1.44^{bc}	44.64±2.10^{cd}
ALP	0	27.05 ± 3.10	26.46 ± 2.60	32.09 ± 1.55	32.00 ± 2.03
	7	28.64± 3.08^{a}	21.70 ± 1.57^{b}	25.65± 1.40^{ab}	26.97± 1.74^{ab}
	14	29.19± 2.90^{a}	18.43 ± 1.15^{b}	21.52 ± 1.20^{b}	23.05 ± 1.50^{b}
	21	30.56± 2.46^{a}	16.12 ± 0.88^{b}	18.18± 1.05^{bc}	20.80 ± 1.17^{c}
ALT	0	34.35 ± 1.90	33.29 ± 2.06	33.7 ± 1.63	32.96 ± 1.14
	7	44.73± 2.14^{a}	26.32 ± 1.19^{b}	30.62± 1.47^{b}	30.56 ± 1.16^{b}
	14	46.21± 1.96^{a}	23.41 ± 0.83^{b}	28.91 ± 1.31^{c}	27.89± 0.90^{cd}
	21	43.49± 2.36^{a}	21.18 ± 0.69^{b}	26.65 ± 1.28^{c}	26.12± 0.93^{cd}
AST	0	42.54 ±1.80^{a}	41.94± 0.90^{ab}	40.28 ± 1.40^{b}	41.64 ± 1.27^{b}
	7	41.52± 2.20^{a}	38.69± 0.91^{ab}	35.20 ± 1.56^{b}	36.61 ± 1.20^{b}
	14	42.54± 1.92^{a}	36.57 ± 1.01^{b}	31.88 ± 1.35^{c}	33.27± 1.02^{bc}
	21	43.54 ± 2.07^{a}	33.69 ± 1.03^{b}	27.54 ± 1.09^{c}	30.95± 1.00^{bc}

The diffcrent letters in the same raw means that there was a significant change (P<0.05).
The same letters in the same raw means that there was a non significant change (P>0.05).

Table (5): The effect of tested drugs on some biochemical parameters in naturally infected sheep.

Mean ± S.E **n=10**

Parameter	Time (Days)	G 1	G 2	G 3	G 4
Total Protein (gm/dl)	0	5.34 ± 0.15	5.47 ± 0.18	5.78 ± 0.11	5.68 ± 0.17
	7	5.42 ± 0.21^{a}	6.32 ± 0.17^{b}	6.24 ± 0.10^{b}	6.16 ± 0.14^{b}
	14	5.46 ± 0.20^{d}	7.08 ± 0.15^{a}	6.46 ± 0.12^{b}	6.66 ± 0.10^{bc}
	21	5.18 ± 0.25^{c}	7.64 ± 0.18^{a}	6.76 ± 0.15^{b}	7.23 ± 0.12^{ab}
Albumin (gm/dl)	0	3.18 ± 0.17	3.12± 0.11	3.29 ± 0.13	3.30 ± 0.11
	7	3.19 ± 0.15^{c}	3.43 ± 0.16^{bc}	3.64 ± 0.13^{ab}	3.79 ± 0.12^{a}
	14	3.02 ± 0.12^{d}	3.82 ± 0.0.9^{bc}	3.93 ± 0.08^{ab}	4.18 ± 0.12^{a}
	21	3.08 ± 0.14^{a}	4.26 ± 0.12^{b}	4.24 ± 0.09^{b}	4.57 ± 0.14^{b}
Total Lipids (TL) (mg/dl)	0	437.6±20.19^{a}	408.1±11.38^{ab}	390.3 ±13.8^{b}	388.5 ± 10.1^{b}
	7	433.6±16.37^{a}	487.6±10.10^{b}	483.7±15.89^{b}	452.3±10.29^{ab}
	14	421 ± 15.9^{c}	552.8± 8.79^{ab}	555.7±12.88^{a}	517.7± 13.1^{b}
	21	436 ± 21.45^{c}	612.6± 7.38^{a}	593.1± 4.48^{ab}	567.3±16.11^{b}
Triglycerides (TAG) (mg/dl)	0	137.5± 2.61	140.7±2.74	138.1±1.53	141.8±1.83
	7	183.1± 1.85^{a}	152.8±3.40^{b}	154.5± 2.57^{b}	156.5± 2.25^{b}
	14	140.8 ± 1.82^{a}	163.8 ± 2.48^{b}	162.7± 1.86^{b}	162.3± 1.96^{b}
	21	139.8 ± 2.33^{d}	177 ± 3.29^{ac}	166.5 ± 2.51^{b}	174.8 ± 2.31^{a}
HDL-c (mg/dl)	0	37.39± 1.38^{ab}	35.61 ± 1.06^{b}	39.81± 1.09^{a}	36.99 ± 1.34^{ab}
	7	39.93 ± 1.38^{b}	41.51±0.99^{ab}	43.89± 1.43^{a}	41.43± 1.32^{ab}
	14	41.05± 0.92^{a}	45.76± 0.80^{b}	47.36±1.49^{b}	45.11± 1.25^{b}
	21	40.79 ± 0.86^{d}	49.81± 0.98^{a}	49.25±1.66^{ab}	46.17± 0.73^{c}
LDL-c (mg/dl)	0	40.67 ± 1.07	43.65 ± 1.23	42.84 ± 1.44	42.55 ± 1.22
	7	42.42 ± .15^{a}	40.45±1.49^{ab}	38.2± 1.38^{bc}	36.86±0.88^{cd}
	14	41.33± 1.55^{a}	36.15± 1.26^{b}	34.10±0.94^{b}	33.13± 0.93^{b}
	21	40.10 ± 1.04^{a}	32.83± 1.15^{b}	29.67 ± 0.96^{c}	29.28± 0.53^{cd}
phospholipids (PL) (mg/dl)	0	143.42 ±3.08	140.8 ± 1.20	142.4 ± 1.66	138.2 ± 1.42
	7	145.34 ± 3.0^{a}	148.6 ± 2.09^{ab}	153.0 ± 1.30^{b}	147.8 ± 0.81^{ab}
	14	149.73 ±3.82^{a}	163.7 ± 3.86^{b}	157.8± 2.28^{bc}	156.3±1.44^{abc}
	21	149.1 ± 3.95^{c}	169.1± 2.87^{a}	166.3±1.89^{ab}	159.3 ± 1.75^{b}
Cholesterol (mg/dl)	0	140.1 ± 297^{b}	149.6 ± 3.48^{a}	146.6± 3.59^{ab}	150.2± 2.92^{a}
	7	153.6 ± 202^{a}	126.7 ± 2.24^{b}	129.6± 3.22^{b}	132.2 ± 2.25^{b}
	14	151.6 ± 3.85^{a}	109.4 ± 1.96^{b}	115.2± 3.56^{b}	116.9 ± 1.64^{b}
	21	147.5 ± 5.22^{a}	96.8 ± 2.09^{b}	103.2± 2.42^{b}	101.1 ± 2.79^{b}

The different letters in the same raw means that there was a significant change ($P<0.05$).
The same letters in the same raw means that there was a non significant change ($P>0.05$).

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الملخص العربى

دراسات مقارنـــة للكلوسانتيل، الترای كلابنـــدازول والنيتروكساتيل على الأغنـــام المصابـــة بالديـــدان الكبديـــة

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أجريت هذه الدراسة على عدد ٤٠ حيوان من الأغنام المصابة بالدودة الكبدية والتى قد تم فحصها مسبقاً وذلك لدراسة نسبة فاعلية الكلوسانتيل، الترای كلابندازول والنيتروكسانيل على الدودة الكبدية وكذلك تأثير هذه الأدوية على بعض الأوجه الدموية، المؤشرات البيوكيميائية.

تم تقسيم الحيوانات إلى أربع مجموعات (١٠ حيوانات لكل مجموعة) أستخدمت المجموعة الأولى كمجموعة ضابطة بينما تم إعطاء المجموعة الثانية دواء الكلوسانتيل (٥ مليجرام / كجم) بالحقن تحت الجلد فى حين أعطيت المجموعة الثالثة دواء الترای كلابندازول (١٢ مليجرام / كجم) عن طريق الفم وأعطيت المجموعة الرابعة دواء النيتروكسانيل (١٠ ميلجرام / كجم) بالحقن تحت الجلد فى حين أعطيت المجموعة الثالثة دواء الترای كلابندازول (١٢ مليجرام / كجم) عن طريق الفم وأعطيت المجموعة الرابعة دواء النيتروكسانيل (١٠ ميلجرام / كجم) بالحقن تحت الجلد. تم أخذ عينات براز ودم ومصل بعد إسبوع، إسبوعين وثلاثة أسابيع من الحقن وذلك لإجراء بعض القياسات.

وقد أوضحت النتائج أن الكلوسانتيل (٥ مليجرام / كجم)، الترای كلابندازول (١٢ مليجرام/كجم) والنيتروكسانيل (١٠ مليجرام / كجم) قد أحدثت إنخفاض معنوى فى عدد بويضات الديدان الكبدية فى المجموعة المعالجة مقارنة بالمجموعة المصابة وذلك بعد ٧ و ١٤ و ٢١ يوم من إعطاء الدواء. وقد بينت الدراسة أن نسبة فاعلية الأدوية فى اليوم ٢١ هى ٩٠ و ١٠٠ و ١٠٠٪ على التوالى.

وقد أوضحت النتائج أن الكلوسانتيل (٥ ميلجرام / كجم) والترای كلابندازول (١٢ ميلجرام / كجم) والنيتروكسانيل (١٠ ميلجرام / كجم) قد أحدثت زيادة معنوية فى نسبة الهيموجلوبين، عدد كرات الدم الحمراء فى حين حدث إنخفاض معنوى فى عدد كرام الدم البيضاء وذلك بعد الإسبوع الثالث من إعطاء الدواء.

وكذلك أوضحت النتائج أن الأدوية قد أحدث زيادة معنوية فى نسبة الهيموجلوبين وعدد كرات الدم الحمراء فى حين حدث إنخفاض معنوى فى عدد كرات الدم البيضاء وذلك بعد الإسبوع الثالث من إعطاء الدواء.

وكذلك أوضحت النتائج أن الأدوية قد أحدث زيادة معنوية فى نسبة البروتينات الكلية والزلال ومستوى الدهون الكلية والجليسريدات الثلاثية والدهون الفوسفورية والدهون عالية الكثافة وكذلك أحدثت إنخفاض معنوى فى الدهون منخفضة الكثافة والكليستيرول ونسبة البولينا والالنين أمينو ترانس فيريز والفوسفاتيز القاعدى واسبرتات أمينو ترانس فيريز فى الإسبوع الثالث من إعطاء الأدوية.