Results

1. Parasitological examination

A- *Coprological examination of all buffalo-cows in the farm:*

Faecal samples were collected from 163 female buffaloes having two different age groups, heifers (n=31) and multiparous buffaloes (n=132), and examined for internal parasites. The obtained results revealed that the total number of infected buffaloes in the herd was 42 animals (25.77%). As shown in table (1) and figure (1), the prevalence of parasitic infection was 6.75%, 4.29%, 4.91% and 9.82% for *Fasciola*, *Giardia, Cryptosporidia* and *Eimeria Spp.,* respectively.

The percentage of infection was 22.58% in younger animals (heifers) while, it was 26.5% in multiparous animals. In heifers, the percentage of infection was 6.45% and 16.13% for *Fasciola* and *Eimeria Spp.,* respectively. On the other hand, the percentage of infection in multiparous animals was 6.82%, 5.3%, 6.06% and 8.33% for *Fasciola, Giardia, Cryptosporidia* and *Eimeria Spp.,* respectively (table 1 & figure 1).

From the examined faecal matters, animals shed *Fasciola* eggs were selected for this study. *Fasciola* egg is large-sized, thin-shelled, operculated at one pole, yellow coloured with granular yellowish-brown contents filling whole egg (zygote). Its length is about 130-145 µm and its width is about 70-90 µm (figure A).

B- *Percentage of Fasciola infection using two different diagnostic methods:*

As shown in table (2) and figure (2), the total number of *Fasciola* infected buffalo-cows examined by faecal analysis was 11 animals

(6.75%) whereas, the incidence of infection had increased to 23 animals (14.11%) using ELISA method.

Table (1): Coprological examination of all buffalo-cows in the farm.

Parasite	Infected Buffaloes		
	Heifers (31)	Multiparous (132)	Total (163)
Fasciola Spp.	2 (6.45%)	9 (6.82%)	11(6.75%)
Giardia Spp.	0	7 (5.3%)	7 (4.29%)
Cryptosporidium Spp.	0	8 (6.06%)	8 (4.91%)
Eimeria Spp.	5 (16.13%)	11 (8.33%)	16 (9.82%)
Percentage of infection	22.58%	26.5%	25.77%

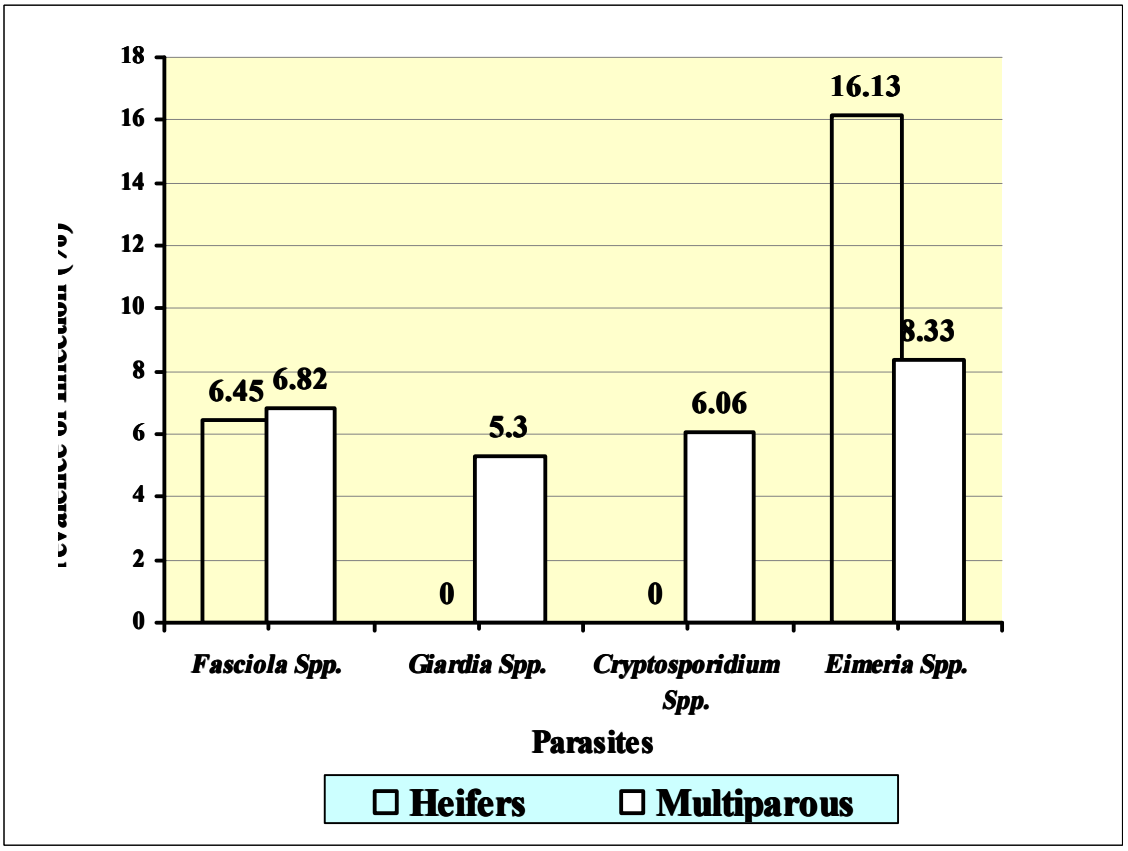


Figure (1): Coprological examination of all buffalo-cows in the farm.

Table (2): Comparison between coprological examination and serological method for the detection of *Fasciola* infection.

Method / Animals	Coprological Diagnosis (Faecal examination)	Serological Diagnosis (ELISA technique)
Total number of examined animals	163	163
Number of *Fasciola* infected animals	11 (6.75 %)	23 (14.11%)

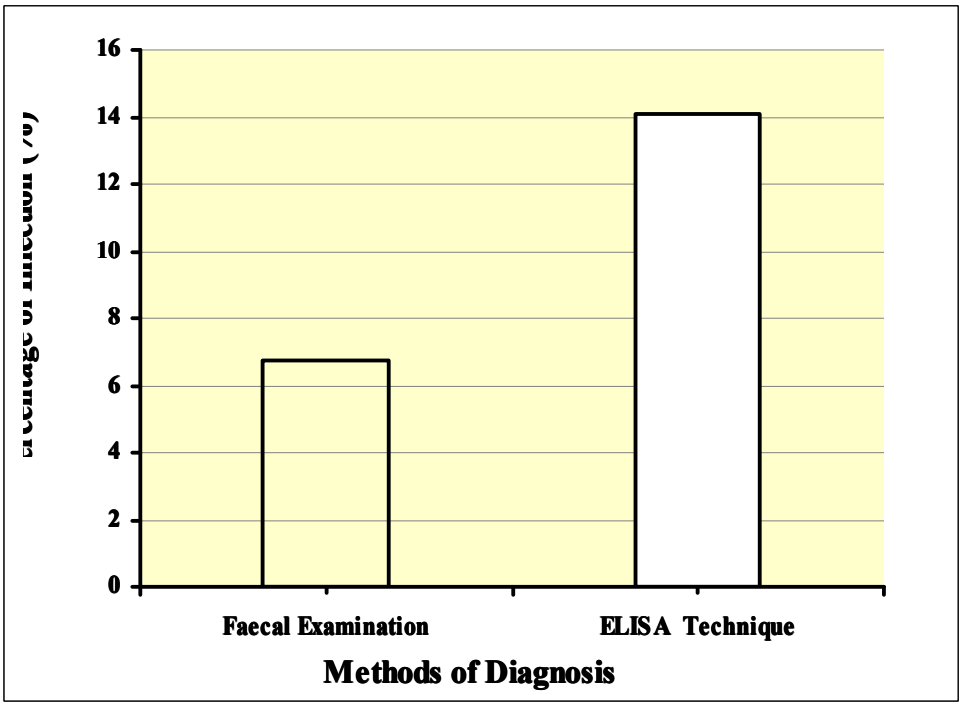


Figure (2): Comparison between coprological examination (Faecal examination) and serological method (ELISA technique) for the detection of *Fasciola* infection.

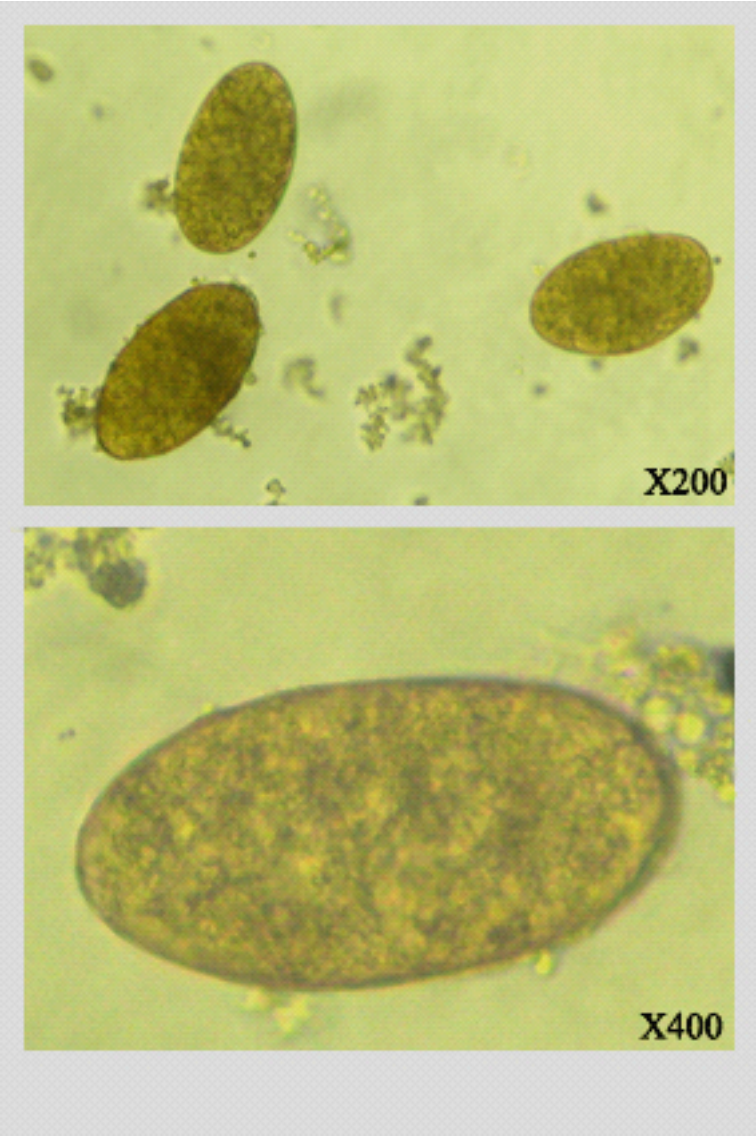


Figure (I): *Fasciola* eggs under microscope.

2. The effect of fasciolosis on length of post partum period (PPP), length of lactation period and the daily milk yield of buffalo-cows.

The obtained data as illustrated in table (3) and figure (3 a, b and c) indicated that the length of post partum period (PPP) increased in the infected group (**156.75 ± 5.9 days**) compared to the healthy one **(112.46 ± 8.27 days).** On the other hand, length of lactation period decreased significantly (P<0.01) in the infected group **(237.43 ± 3.03 days)** compared to the control one **(260.58 ± 3.52 days).** The daily milk yield had decreased significantly (P<0.01) in the infected group compared to the healthy group **(4.93 ± 0.05** and **5.12 ± 0.07 Kg**, respectively**).**

Table (3): Effect of fasciolosis on length of post partum period (PPP), length of lactation period and the daily milk yield of buffalo-cows:

Parameters \ Animals	Healthy Animals	Infected Animals
Length of Post Partum Period (PPP) (Days)	112.46 ±8.27	156.75 ** ±5.9
Length of lactation period (Days)	260.58 ** ±3.52	237.43 ±3.03
Daily Milk Yield (Kg)	5.12 ** ±0.07	4.93 ±0.05

All data expressed as Mean ± Standard Deviation (SD).
** Significant differences at $P < 0.01$.

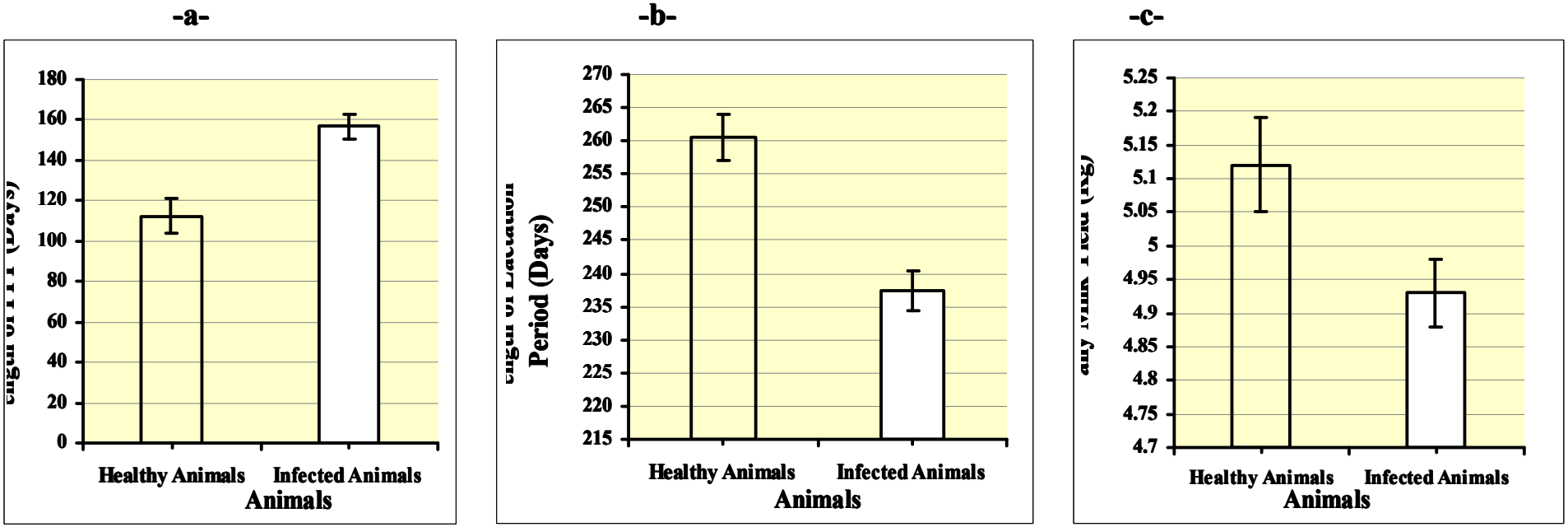


Figure (3 a, b and c): Effect of fasciolosis on the length of post partum period (PPP), the length of lactation period and daily milk yield of buffalo-cows.

• Experiment I:

1. Hormones

A- *Effect of GPG and GPG plus CIDR protocols on Estradiol (E_2) (pg/ml) and Progesterone (P_4) (ng/ml) levels of healthy and Fasciola infected buffalo-cows serum:*

Estradiol and progesterone concentrations showed significant variations between the six groups (P<0.001). As shown in table (4) and figure (4 a), E_2 concentrations decreased significantly in control infected than control healthy group **(2.13 ± 0.05** and **2.93 ± 0.21pg/ml,** respectively**).** There was a significant decrease in estradiol concentrations in the infected group treated with GPG protocol **(1.35 ± 0.31pg/ml)** and the healthy group treated with GPG protocol **(1.95 ±0.14 pg/ml).** Also, there was a significant decrease in estradiol concentration in the infected group treated with GPG plus CIDR protocol **(0.94±0.05pg/ml)** than the healthy group receiving the same treatments **(1.18 ±0.1pg/ml).**

Table (4) and figure (4 b) indicated that P_4 concentrations were increased significantly in the control infected than control healthy group **(0.54 ± 0.09** and **0.3 ± 0.09 ng/ml,** respectively**).** P_4 concentrations were decreased significantly in the infected group treated with GPG protocol **(1.66±0.05 ng/ml)** than the healthy one receiving the same treatments **(1.9±0.1 ng/ml)**. Also, there was a significant decrease in progesterone concentrations in the infected group treated with GPG plus CIDR protocol **(2.09 ± 0.19 ng/ml)** than the healthy group receiving the same treatments **(2.44 ± 0.05 ng/ml).**

Table (4): Effect of GPG and GPG plus CIDR protocols on Estradiol (E_2) (pg/ml) and Progesterone (P_4) (ng/ml) levels of healthy and *Fasciola* infected buffalo-cows serum.

Groups / Parameter	Healthy Animals			Infected Animals			F- Value
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	
E_2 (pg/ml)	2.93 [a] ±0.21	1.95 [b] ±0.14	1.18 [c] ±0.1	2.13 [b] ±0.05	1.35 [c] ±0.31	0.94 [d] ±0.05	161.9***
P_4 (ng/ml)	0.3 [f] ±0.09	1.9 [c] ±0.1	2.44 [a] ±0.05	0.54 [e] ±0.09	1.66 [d] ±0.05	2.09 [b] ±0.19	1101.5***

All data expressed as Mean ± SD.

*** Significant differences at $P < 0.001$.

Means followed by different letters indicated significance but same letters indicated no significance.

- **Group 1: Healthy buffalo-cows.**
- **Group 2: Healthy buffalo-cows injected intramuscularly with G-P-G protocol.**
- **Group 3: Healthy buffalo-cows injected intramuscularly with G-P-G plus CIDR protocol.**
- **Group 4: *Fasciola* infected buffalo-cows.**
- **Group 5: *Fasciola* infected buffalo-cows injected intramuscularly with G-P-G protocol.**
- **Group 6: *Fasciola* infected buffalo-cows injected intramuscularly with G-P-G plus CIDR protocol.**

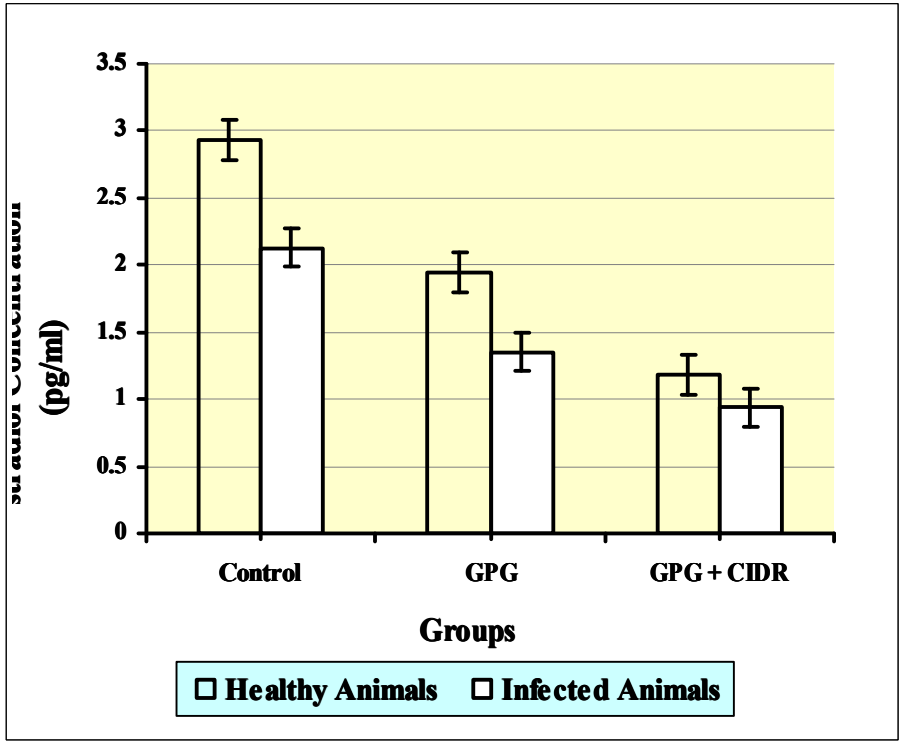


Figure (4 a): Effect of GPG and GPG plus CIDR protocols on Estradiol (E_2) (pg/ml) levels of healthy and *Fasciola* infected buffalo-cows serum.

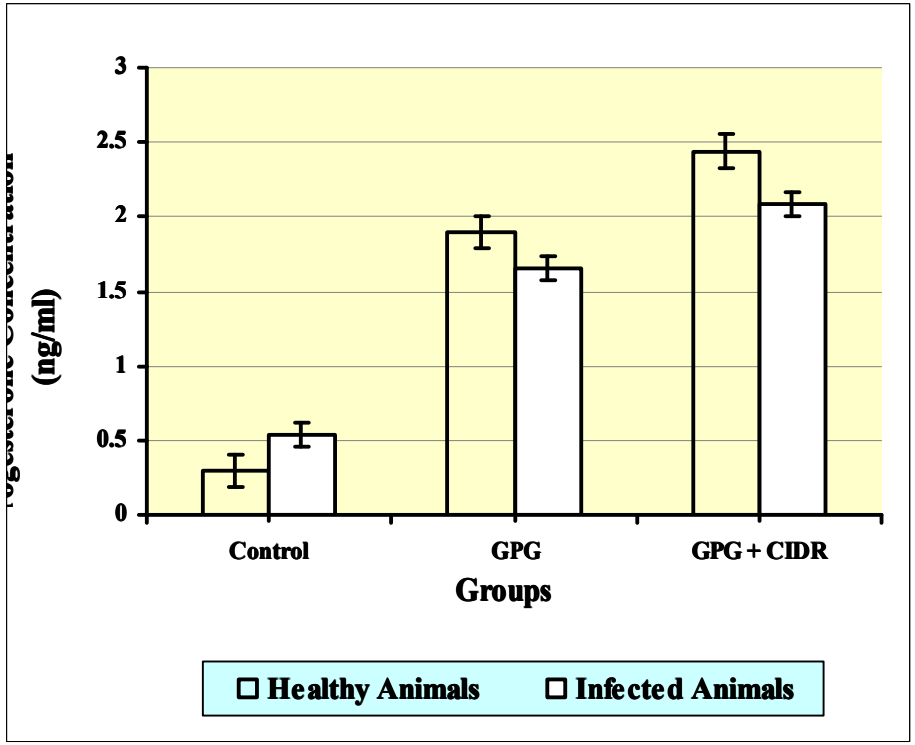


Figure (4 b): Effect of GPG and GPG plus CIDR protocols on Progesterone (P_4) (ng/ml) levels of healthy and *Fasciola* infected buffalo-cows serum.

B. *Effect of GPG and GPG plus CIDR protocols on pregnancy rates in healthy and infected buffalo-cows:*

It could be seen from table (5) and figure (5) that the pregnancy rate in the healthy animals (33.3 %) was decreased to (16.7 %) in the presence of *Fasciola* infection. These percentages increased after injecting GPG and GPG plus CIDR protocols in healthy animals to 75 and 77.8 %, respectively and to 50 and 55.6 %, respectively in infected animals.

2. Haematological parameters:

A. *Effect of GPG and GPG plus CIDR protocols on erythrogram of healthy and Fasciola infected buffalo-cows:*

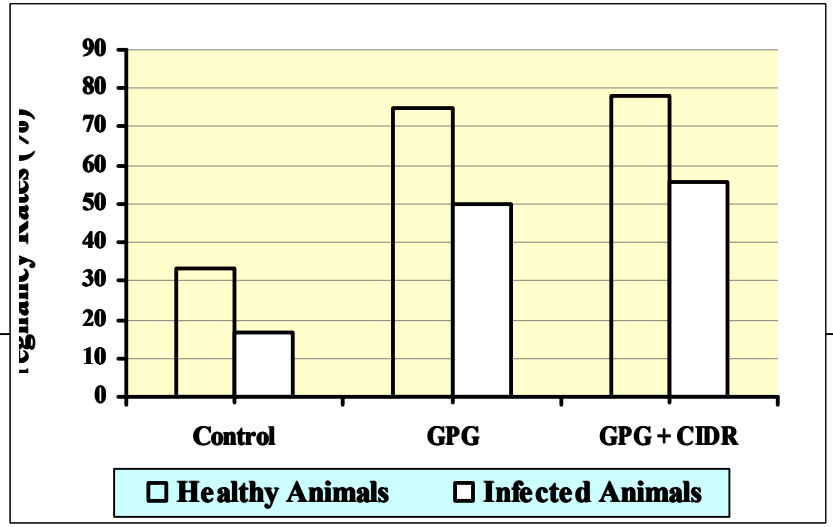
It could be seen from table (6) and figure (6 a) that RBCs counts showed a significant ($P<0.001$) difference between all groups around the experiment. RBCs counts in control infected animals were decreased significantly **($7.11\pm0.52\times10^{12}$/L)** than that of the control healthy animals **($7.76\pm0.3\times10^{12}$/L)**. In contrast to the RBCs count control groups data, the RBCs count in infected animals injected with GPG protocol was increased significantly at **($6.57\pm0.02\times10^{12}$ /L)** than healthy animals injected also with GPG protocol **($5.73 \pm 0.42 \times 10^{12}$ /L)**. Infected animals injected with CIDR protocol showed no significant differences in RBCs counts when compared to healthy animals receiving the same treatments.

Table (6) and figure (6 b) indicated that RDW percentage showed a significant ($P<0.001$) difference between the six groups around the experiment. RDW percentage was elevated significantly in control infected buffalo-cows **(7.24 ± 0.19 %)** than control healthy buffalo-cows **(4.03 ± 0.05 %)**. RDW percentage in infected buffalo-cows treated with GPG protocol **(3.81 ± 0.05 %)** remained elevated significantly than that of healthy animals treated with GPG protocol **(3.06±0.29%)**.

Table (5): Effect of GPG and GPG plus CIDR protocols on pregnancy rates of healthy and infected buffalo-cows.

Groups / Animals	Healthy Animals			Infected Animals		
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Total Number of Animals	6	8	9	6	8	9
Number of Pregnant Animals	2 (33.3%)	6 (75%)	7(77.8%)	1(16.7%)	4(50%)	5(55.6%)

Figure (5): Effect of GPG and GPG plus CIDR protocols on pregnancy rates of healthy and infected buffalo-cows.



Infected buffalo-cows treated with GPG plus CIDR protocol showed a significant increase in RDW percentage than that of the healthy group **(3.84 ± 0.04** and **3.13 ± 0.25%,** respectively**).**

Data displayed in table (6) and figure (6 c) indicated that PCV in all groups showed significant differences (P<0.001). There was a significant decrease in PCV between the infected group **(37.33 ±1.13%)** and the healthy group **(42 ± 1.25%)**. The same as the control groups, there was a significant increase in PCV of the infected groups treated with GPG protocol **(33.67±0.97%)** than the healthy group treated with GPG protocol **(29.71 ± 2.97 %).** There was a significant elevation in PCV of the infected groups injected with GPG plus CIDR protocol **(34.67±2.61 %)** compared to the healthy group treated with GPG plus CIDR protocol **(30.53 ± 3.18%).**

Hb concentrations of the six groups showed a significant variations (P<0.001). There was a significant decrease in Hb concentrations of the infected animals **(11.37 ± 1.12 g/dl)** than that of the healthy animals **(12.77 ± 0.25 g/dl).** Also, there was a significant increase in Hb concentration of the infected groups treated with GPG protocol **(13.87±0.01g/dl)** than the healthy group treated with GPG protocol **(11.01±0.07 g/dl).** There was a significant elevation in Hb concentration of the infected groups injected with GPG plus CIDR protocol **(13.88±0.03 g/dl)** than the healthy group treated with GPG plus CIDR protocol **(11 ± 0.06 g/dl)** (table 6 and figure 6 g).

MCV, MCH and MCHC levels in all groups, they showed significant variations (P<0.001) as shown in table 6 & figure 6 d, e and f. There was a significant decrease of MCV in the infected group **(52.43±2.93 fl)** compared to the healthy one **(54.19 ± 1.11 fl)**. There was a significant increase in MCV of the infected group treated with GPG

protocol **(53.18 ± 0.63 fl)** than the healthy group treated with GPG protocol **(49.1 ± 1.25 fl)**. There was a significant elevation in MCV of the infected group injected with GPG plus CIDR protocol **(53.57 ± 0.36 fl)** compared to the healthy group treated with GPG plus CIDR protocol **(49.02 ± 1.52 fl).** Regarding MCH in the healthy and infected groups, there were no significant differences between the infected group **(16.01±1.33 pg)** and the healthy group **(16.46 ±0.46pg).** There was a significant increase in MCH of the infected group treated with GPG protocol **(21.12 ± 0.1 pg)** than the healthy group treated with GPG protocol **(19.31 ± 1.45 pg).** There was a significant elevation in MCH of the infected group injected with GPG plus CIDR protocol **(21.17 ± 0.43 pg)** than the healthy group treated with GPG plus CIDR protocol **(17.53 ± 1.37 pg).** MCHC showed no significant differences between the infected group **(30.56±2.41 g/dl)** and the healthy group **(30.43 ± 1.18 g/dl).** There was a significant increase in MCHC of the infected group treated with GPG protocol **(41.23 ± 1.14 g/ dl)** than the healthy group treated with GPG protocol **(37.43 ± 3.77 g/ dl)**. There was a significant elevation in MCHC of the infected groups injected with GPG plus CIDR protocol **(40.25 ± 3.12 g/dl)** than the healthy group treated with GPG plus CIDR protocol **(36.5 ±4.29 g/dl)**.

B. Effect of GPG and GPG plus CIDR protocols on leukogram of healthy and Fasciola infected buffalo-cows:

Results illustrated in table (7) and figure (7 a), (7 b), (7 c) and (7 d) indicated that white blood cells count (WBCs), lymphocytes, monocytes and granulocytes percentages varied significantly between the six groups ($P<0.001$). WBCs count was found to increase significantly in the infected group (**7.68 ± 0.25 $\times 10^9$/L**) compared to the healthy one (**4.32 ± 0.22 $\times 10^9$/L**). It was found that WBCs count was elevated significantly in

the infected **(10.61 ± 0.49×10^9/L)** than the healthy group injected with GPG protocol **(8.02 ± 0.75×10^9/L)**. WBCs count was increased significantly in the infected group treated with GPG plus CIDR protocol **(8.78±0.27×10^9/L)** than the healthy group treated with GPG plus CIDR protocol **(7.37±0.41×10^9/L)**. Lymphocyte percentage was increased significantly in the infected group **(46.69±1.2%)** compared to the healthy group **(43.31±2.2%)**. Lymphocytes percentage was elevated significantly in the infected group injected with GPG protocol **(40.88 ± 2.22%)** than the healthy group injected with GPG protocol **(35.58 ± 1.72%)**. Lymphocytes percentage was increased significantly in the infected than the healthy group injected with GPG plus CIDR protocol **(42.18±1.79%** and **39.96±3.93%,** respectively**)**. Monocytes percentage was decreased significantly in the infected group **(6.57 ± 0.34%)** compared to the healthy group **(7.73 ± 0.47%)**. Monocyte percentage didn't show any significant differences between the healthy and infected groups treated with GPG protocol. On the other hand, Monocyte percentage was decreased significantly in the infected than the healthy group treated with GPG plus CIDR protocol **(5.4 ± 0.44%** and **5.87±0.4%,** respectively**)**. Granulocyte percentage showed a significant decrease in the infected and healthy animal groups (**46.75 ± 1.15%** and **48.97 ± 2.42%**, respectively**).** It was diminished significantly in infected group injected with GPG protocol **(53.55 ± 2.02%)** than the healthy group injected with GPG protocol **(58.93 ± 1.85%)**. Granulocytes percentages didn't show any significant differences between healthy and infected groups treated with GPG plus CIDR protocol.

Table (6): Effect of GPG and GPG plus CIDR protocols on erythrogram of healthy and *Fasciola* infected buffalo-cows.

Parameter \ Groups	Healthy Animals			Infected Animals			F- Value
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	
RBCs count (number×10^{12}/L)	7.76 ^{a} ±0.3	5.73 ^{d} ±0.42	6.31 ^{c} ±0.5	7.11 ^{b} ±0.52	6.57 ^{c} ±0.02	6.56 ^{c} ±0.13	52.91 ***
RDW (%)	4.03 ^{b} ±0.05	3.06 ^{d} ±0.29	3.13 ^{d} ±0.25	7.24 ^{a} ±0.19	3.81 ^{c} ±0.05	3.84 ^{c} ±0.04	787.87***
PCV (%)	42 ^{a} ±1.25	29.71^{d} ±2.97	30.53^{d} ±3.18	37.33^{b} ±1.13	33.67 ^{c} ±0.97	34.67 ^{c} ±2.61	49.59***
Hb (mg/dl)	12.77^{b} ±0.25	11.01^{d} ±0.07	11 ^{d} ±0.06	11.37 ^{c} ±1.12	13.87 ^{a} ±0.01	13.88 ^{a} ±0.03	226.1 ***
MCV (fl)	54.19 ^{a} ±1.11	49.1^{c} ±1.25	49.02^{c} ±1.52	52.43^{b} ±2.93	53.18^{ab} ±0.63	53.57^{a} ±0.36	44.37 ***
MCH (pg)	16.46^{d} ±0.46	19.31^{b} ±1.45	17.53^{c} ±1.37	16.01^{d} ±1.33	21.12^{a} ±0.1	21.17^{a} ±0.43	68.39***
MCHC (g/dl)	30.43^{c} ±1.18	37.43^{b} ±3.77	36.45^{b} ±4.29	30.56^{c} ±2.41	41.23^{a} ±1.14	40.25^{a} ±3.12	30.86***

All data expressed as Mean ± SD.

*** Significant differences at $P < 0.001$.

Means followed by different letters indicated significance but same letters indicated no significanc

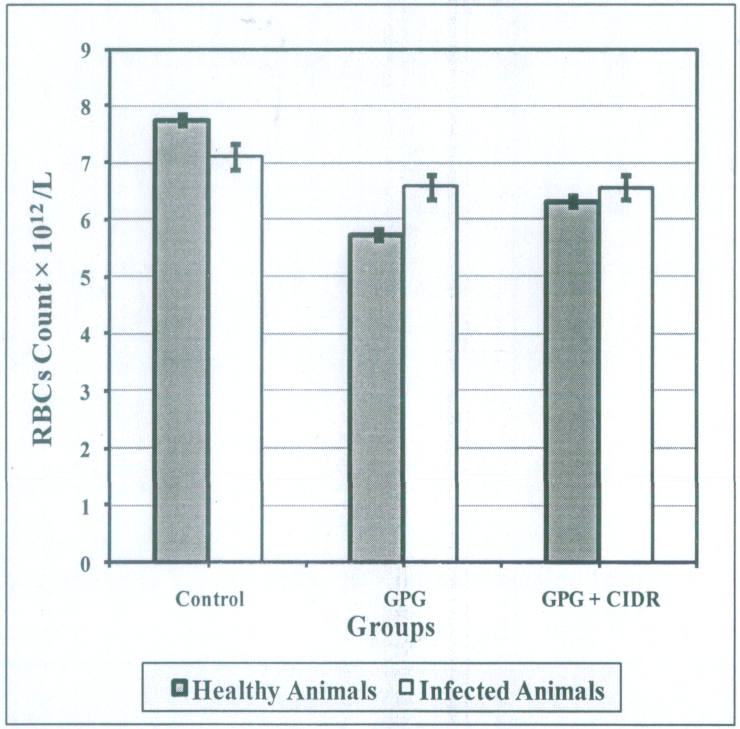


Figure (6 a): Effect of GPG and GPG plus CIDR protocols on RBCs count (number×10^{12}/L) of healthy and *Fasciola* infected buffalo-cows blood.

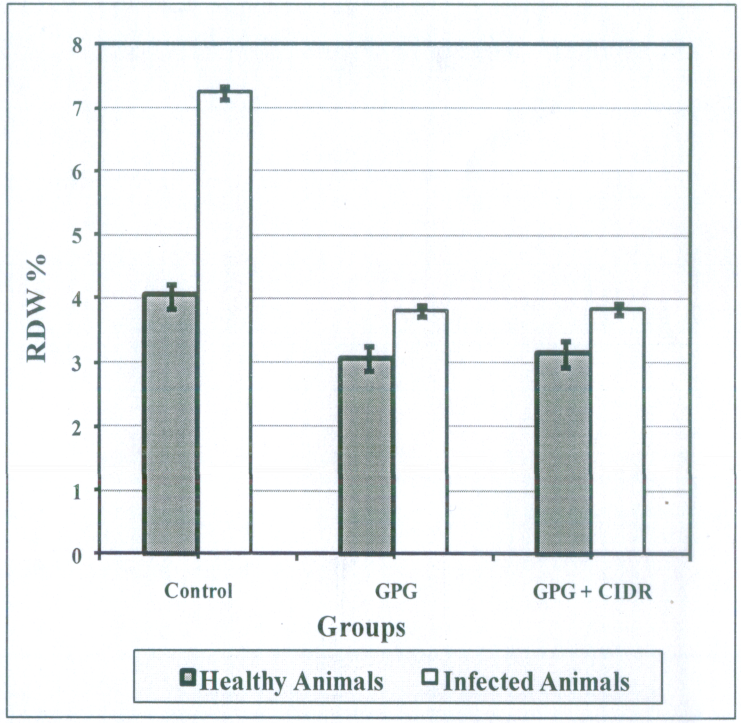


Figure (6 b): Effect of GPG and GPG plus CIDR protocols on RDW percentage (%) of healthy and *Fasciola* infected buffalo-cows blood.

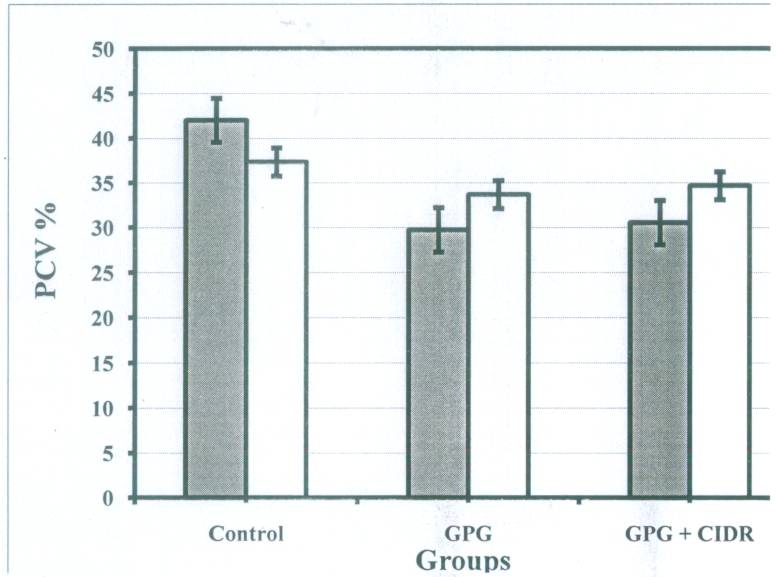


Figure (6 c): Effect of GPG and GPG plus CIDR protocols on PCV percentage (%) of healthy and *Fasciola* infected buffalo-cows blood.

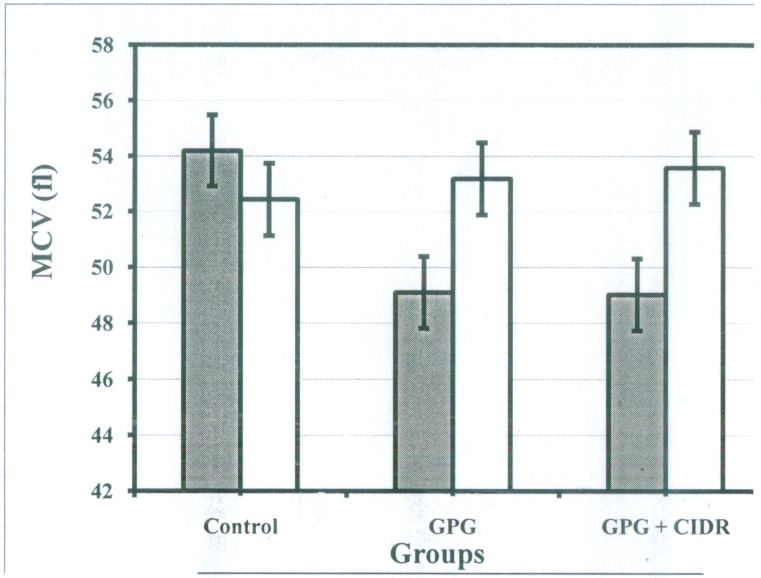


Figure (6 d): Effect of GPG and GPG plus CIDR protocols on MCV level (fL) of healthy and *Fasciola* infected buffalo-cows blood.

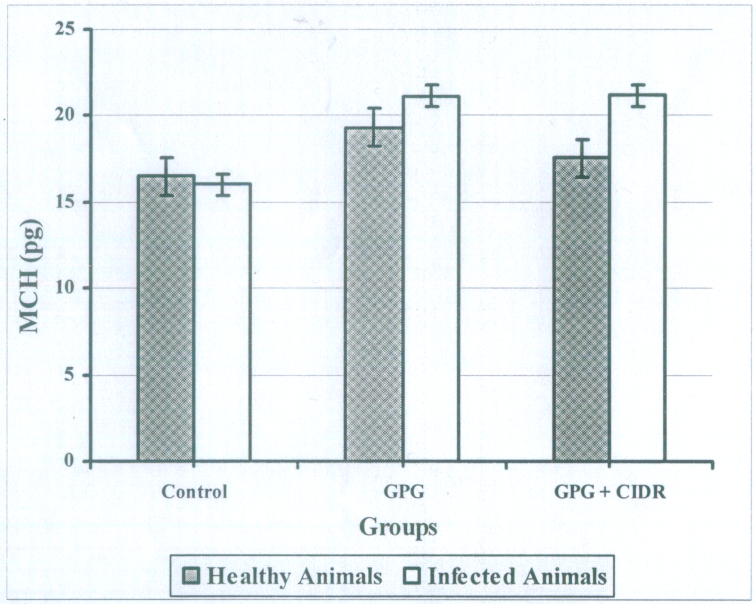


Figure (6 e): Effect of GPG and GPG plus CIDR protocols on MCH (pg) of healthy and *Fasciola* infected buffalo-cows blood.

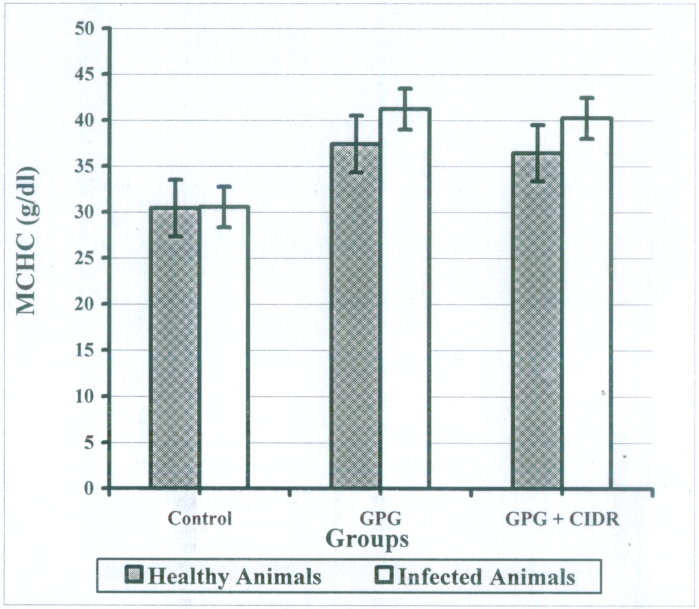


Figure (6 f): Effect of GPG and GPG plus CIDR protocols on MCHC (g/dl) of healthy and *Fasciola* infected buffalo-cows blood.

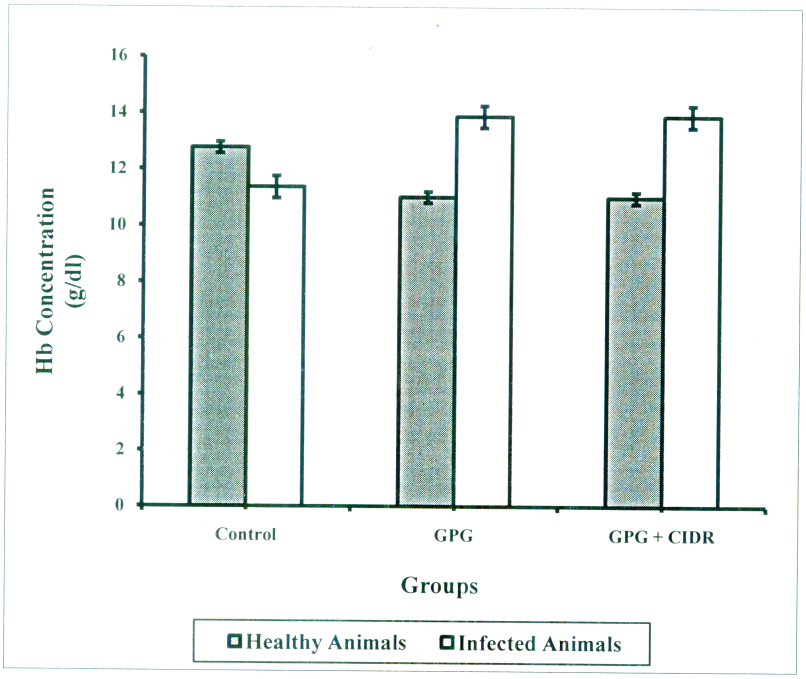


Figure (6 g): Effect of GPG and GPG plus CIDR protocols on Haemoglobin (Hb) concentrations (g/dl) of healthy and *Fasciola* infected buffalo-cows blood.

Table (7): Effect of GPG and GPG plus CIDR protocols on leukogram of healthy and *Fasciola* infected buffalo-cows.

Parameter \ Groups	Healthy Animals			Infected Animals			F- Value
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	
WBCs count (number×10^9/L)	4.32 ^{e} ±0.22	8.02 ^{c} ±0.75	7.37 ^{d} ±0.41	7.68 ^{cd} ±0.25	10.61 ^{a} ±0.49	8.78 ^{b} ±0.27	249***
Lymphocytes (%)	43.31^{b} ±2.17	35.58^{e} ±1.72	39.96^{d} ±3.93	46.69^{a} ±1.18	40.88^{cd} ±2.22	42.18^{bc} ±1.79	36.5 ***
Monocytes (%)	7.73 ^{a} ±0.47	5.5 ^{d} ±0.57	5.87 ^{c} ±0.4	6.57 ^{b} ±0.34	5.57^{cd} ±0.29	5.4 ^{d} ±0.44	51***
Granulocytes (%)	48.97^{c} ±2.42	58.93^{a} ±1.85	54.17^{b} ±3.79	46.75^{d} ±1.15	53.55^{b} ±2.02	52.42^{b} ±1.52	49.5 ***

All data expressed as Mean ± SD.

*** Significant differences at $P < 0.001$.

Means followed by different letters indicated significance but same letters indicated no significance.

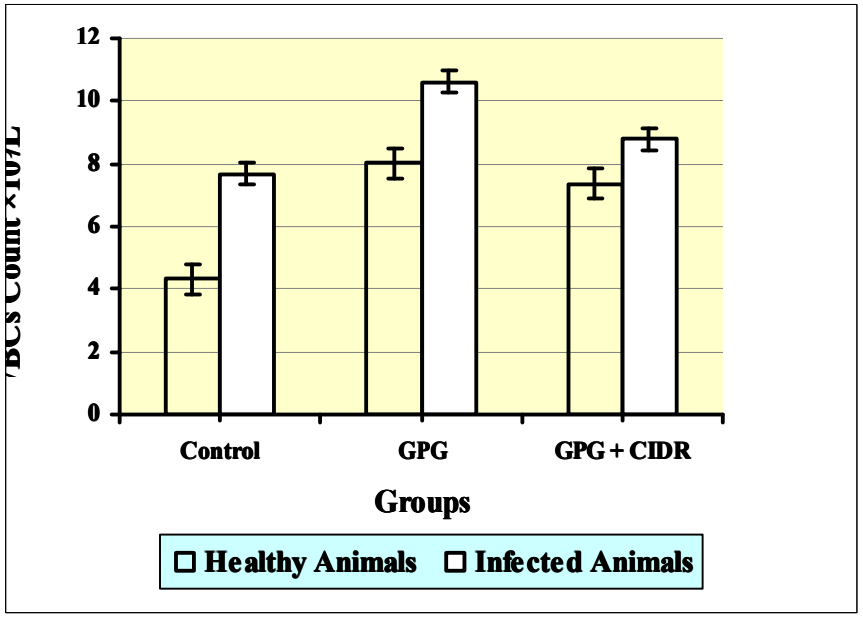


Figure (7 a): Effect of GPG and GPG plus CIDR protocols on WBCs count (number×10^9/L) of healthy and *Fasciola* infected buffalo-cows blood.

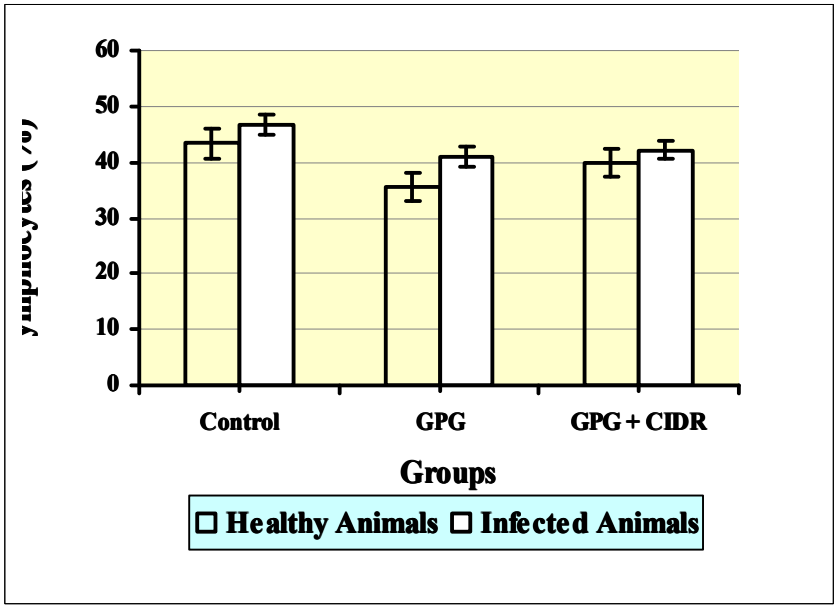


Figure (7 b): Effect of GPG and GPG plus CIDR protocols on Lymphocyte percentage (%) of healthy and *Fasciola* infected buffalo-cows blood.

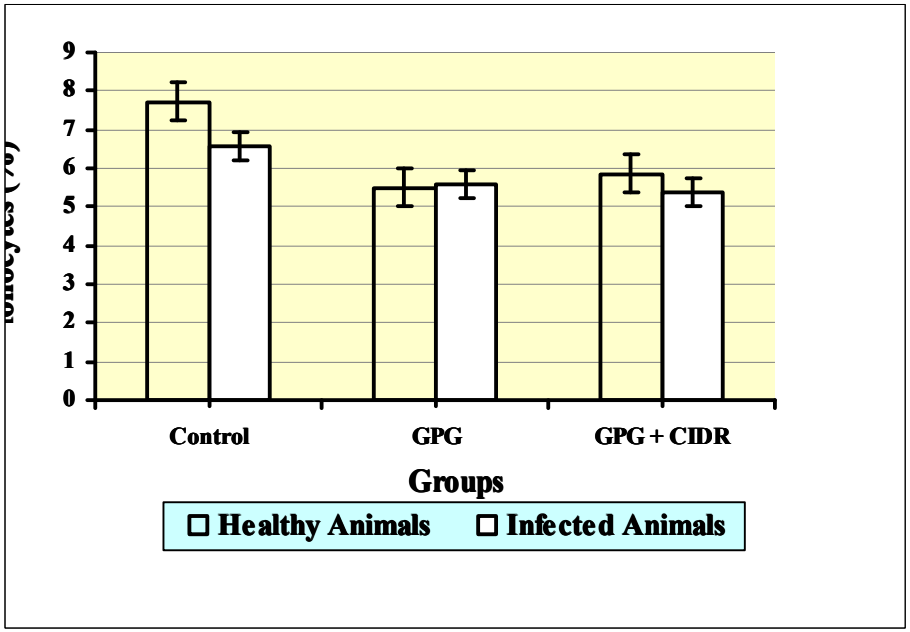


Figure (7 c): Effect of GPG and GPG plus CIDR protocols on Monocyte percentage (%) of healthy and *Fasciola* infected buffalo-cows blood.

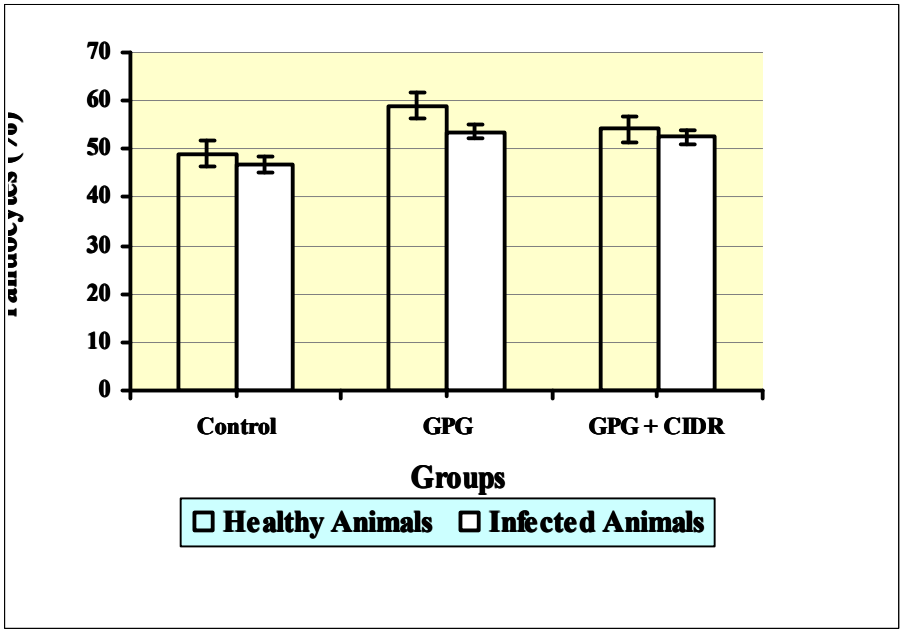


Figure (7 d): Effect of GPG and GPG plus CIDR protocols on Granulocyte percentage (%) of healthy and *Fasciola* infected buffalo-cows blood.

3. Biochemical parameters:

A. *Effect of GPG and GPG plus CIDR protocols on ALT, AST, ALP, Glucose and Bilirubin concentrations of healthy and Fasciola infected buffalo-cows serum:*

Data present in table (8) and figure (8 a), (8 b) and (8 c) indicated that there were significant variations at $P < 0.001$ between the six groups. ALT concentrations were raised significantly in infected animals **(52.9±1.97 units/ml)** than the healthy animals **(42.5 ± 0.99 units/ml)**. ALT level was elevated significantly in infected animals treated with GPG protocol **(46.4 ± 2.3 units/ml)** than the healthy ones receiving the same treatments **(44.57 ± 1.49 units/ml)**. There was a significant decrease in ALT concentrations of the infected animals treated with GPG plus CIDR protocol **(44.65 ± 2.15 units/ml)** compared to the healthy ones treated with the same protocol **(62.14 ± 1.83 units/ml)**. AST concentrations were increased significantly in infected animals **(60.5 ± 1.77 units/ml)** than the healthy animals **(54.57 ± 0.45 units/ml)**. AST level tended to decrease significantly in the infected group treated with GPG protocol **(54.5±2.14 units/ml)** than the healthy one treated with GPG protocol **(63.11±1.1 units/ml)**. AST level increased significantly in the infected group treated with GPG plus CIDR protocol **(67.05 ± 1.39 units/ml)** than the healthy one treated with the same protocol **(60.5 ± 1.77 units/ml)**. ALP concentrations were decreased significantly in the infected **(85.49±4.46 units/L)** than the healthy animals **(181.12±5.58 units/L)**. On the other hand, ALP level tended to increase significantly in the infected group treated with GPG protocol **(197.9±0.55 units/L)** than the healthy one treated with the same protocol **(162.27±0.8 units/L)**. There was a significant decrease in ALP concentrations in the infected animals treated with GPG plus CIDR protocol **(108.29±3.23 units/L)**

compared to the healthy ones treated with the same protocol **(115.33±2.54 units/L)**.

It was clear from table (8) and figure (8 d) that there was a significant difference in glucose concentrations between the six groups. A significant decrease was found in glucose concentrations in the infected animals **(33.72 ± 1.02 mg/dl)** than the healthy ones **(41.6 ± 0.99 mg/dl).** Glucose concentrations were increased significantly in the infected compared to the healthy animals injected with GPG protocol (**45.21 ± 1.24** and **41.29 ± 0.83 mg/dl**, respectively) and GPG plus CIDR protocol (**39.24 ± 4.14** and **36.38 ± 0.71 mg/dl**, respectively).

Total and direct bilirubin concentrations present in table (8) and figure (8 e) and (8 f) indicated that there were significant variations ($P<0.001$) between the six groups. Total bilirubin was increased significantly in the infected **(2.38±0.04 mg/dl)** compared to the healthy group **(2.3±0.05 mg/dl).** On the other hand, there was a significant decrease in total bilirubin levels in the infected animals injected with GPG protocol **(2.44±0.03 mg/ dl)** than the healthy animals injected with the same protocol **(2.52±0.07 mg/dl).** A significant increase was recorded in the total bilirubin concentration of the infected animals treated with GPG plus CIDR protocol **(2.81±0.09 mg/dl)** compared to healthy ones receiving the same treatment **(2.47 ± 0.01 mg/dl).** Direct bilirubin concentration was increased significantly in the infected group **(1.14±0.03mg/dl)** compared to the healthy one **(1.06±0.05 mg/dl).** There was a significant decrease in direct bilirubin levels in the infected animals injected with GPG protocol **(1.18±0.03 mg/dl)** than the healthy animals injected with the same protocol **(1.75±0.04 mg/dl)**. There was a significant increase in the direct bilirubin concentration of the infected

Table (8): Effect of GPG and GPG plus CIDR protocols on ALT (units/ml), AST (units/ml), ALP (units/L), Glucose (mg/dl) and bilirubin (mg/dl) concentrations of healthy and *Fasciola* infected buffalo-cows serum.

Parameter \ Groups	Healthy Animals			Infected Animals			F- Value
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	
ALT (units/ml)	42.5 ^{e} ±0.99	44.57 ^{d} ±1.49	62.14 ^{a} ±1.83	52.9 ^{b} ±1.97	46.4 ^{c} ±2.3	44.65 ^{d} ±2.15	298.79 ***
AST (units/ml)	54.57 ^{e} ±0.45	63.11 ^{b} ±1.1	58.36 ^{d} ±1.3	60.5 ^{c} ±1.77	54.5 ^{e} ±2.14	67.05 ^{a} ±1.39	197.93 ***
ALP (units/L)	181.12 ^{b} ±5.58	162.27 ^{c} ±0.8	115.33 ^{d} ±2.54	85.49 ^{f} ±4.46	197.9 ^{a} ±0.55	108.29 ^{e} ±3.23	2522.93 ***
Glucose (mg/dl)	41.6 ^{b} ±0.99	41.29 ^{b} ±0.83	36.38 ^{d} ±0.71	33.72 ^{e} ±1.02	45.21 ^{a} ±1.24	39.24 ^{c} ±4.14	40.01***
Total Bilirubin (mg/dl)	2.3 ^{e} ±0.05	2.52 ^{b} ±0.07	2.47 ^{bc} ±0.01	2.38 ^{d} ±0.04	2.44 ^{c} ±0.03	2.81 ^{a} ±0.09	147.15 ***
Direct Bilirubin (mg/dl)	1.06 ^{f} ±0.05	1.75 ^{b} ±0.04	1.47 ^{c} ±0.02	1.14 ^{e} ±0.03	1.18 ^{d} ±0.03	1.84 ^{a} ±0.07	736.7 ***

All data expressed as Mean ± SD.

*** Significant differences at $P < 0.001$.

Means followed by different letters indicated significance but same letters indicated no significance.

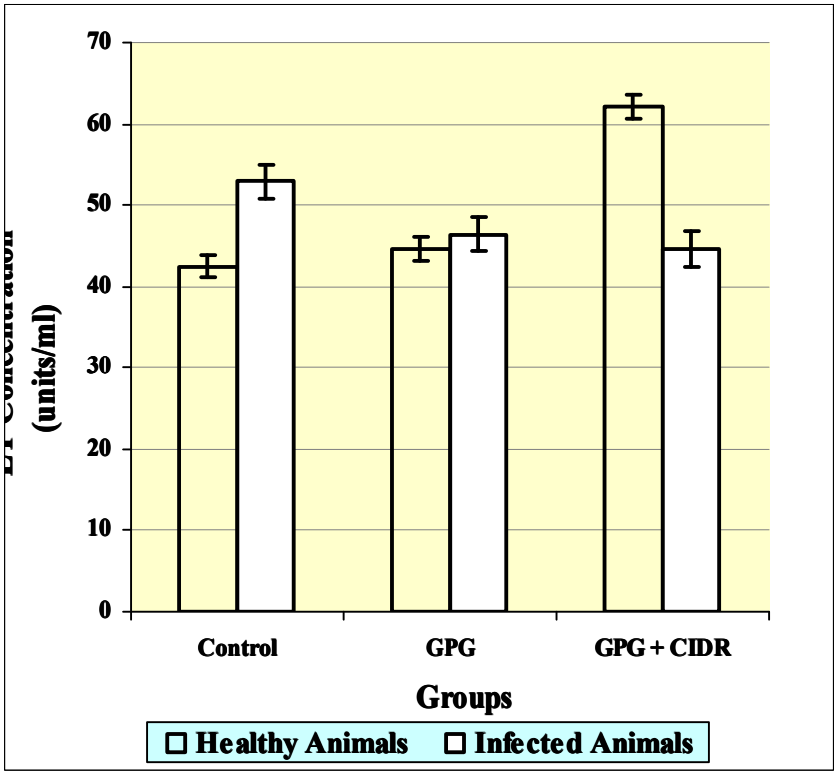


Figure (8 a): Effect of GPG and GPG plus CIDR protocols on ALT concentrations (units/ml) of healthy and *Fasciola* infected buffalo-cows serum.

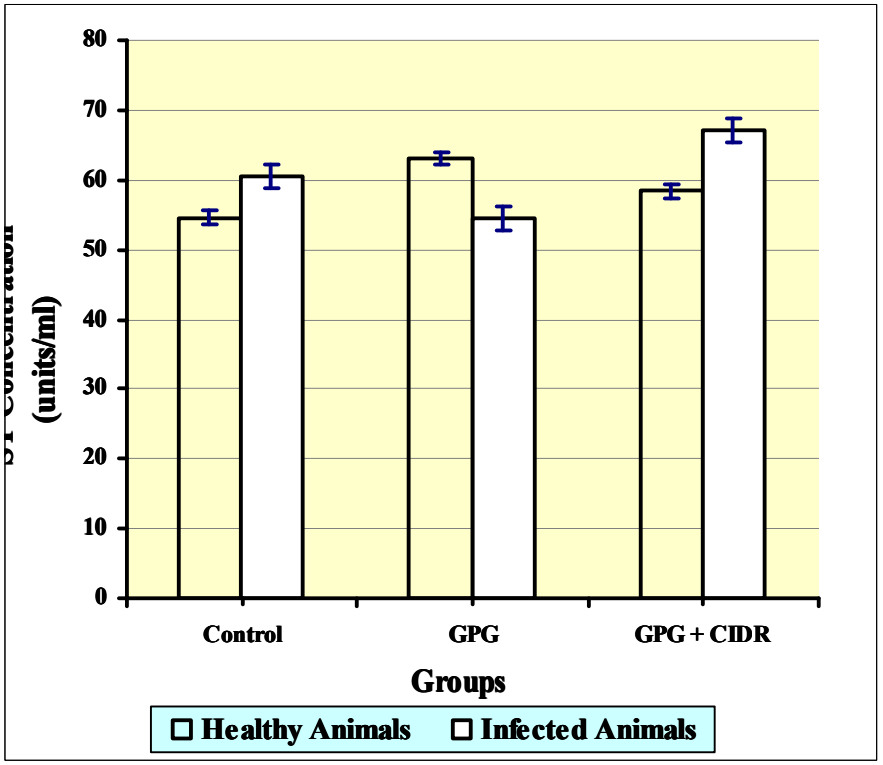


Figure (8 b): Effect of GPG and GPG plus CIDR protocols on AST concentrations (units/ml) of healthy and *Fasciola* infected buffalo-cows serum.

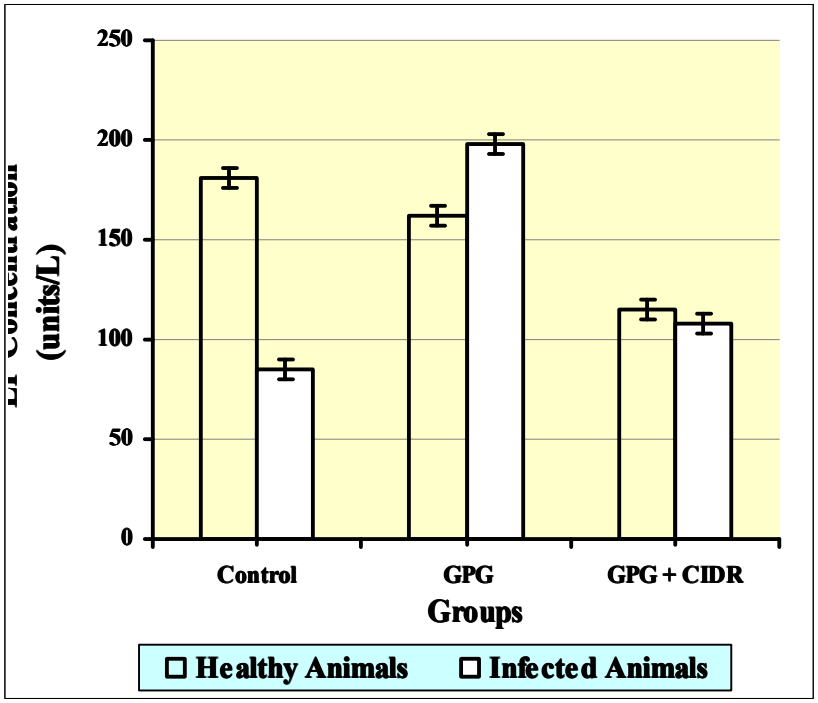


Figure (8 c): Effect of GPG and GPG plus CIDR protocols on ALP concentrations (units/L) of healthy and *Fasciola* infected buffalo-cows serum.

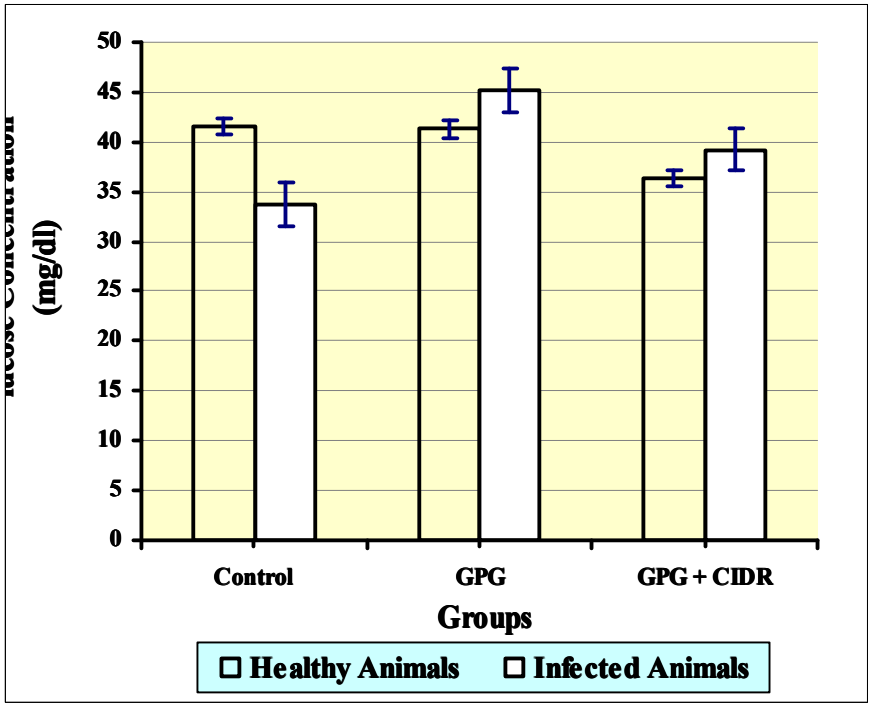


Figure (8 d): Effect of GPG and GPG plus CIDR protocols on Glucose concentration (units/ml) of healthy and *Fasciola* infected buffalo-cows serum.

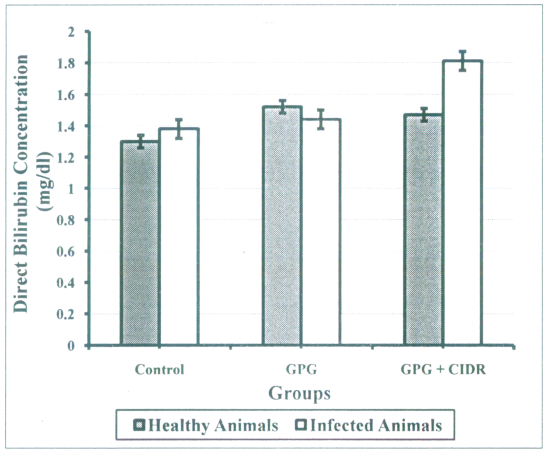


Figure (8 e): Effect of GPG and GPG plus CIDR protocols on Direct bilirubin concentration (mg/dl) of healthy and *Fasciola* infected buffalo-cows serum.

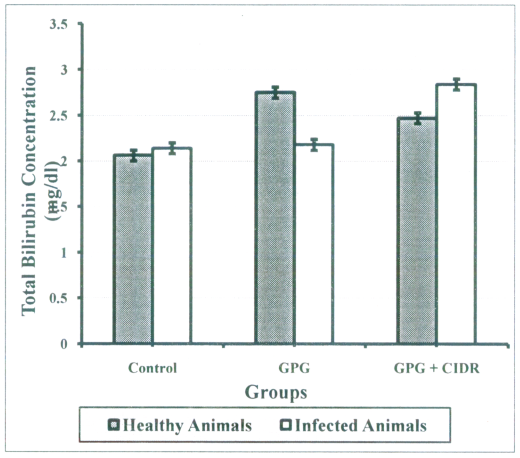


Figure (8 f): Effect of GPG and GPG plus CIDR protocols on Total bilirubin concentration (mg/dl) of healthy and *Fasciola* infected buffalo-cows serum.

animals treated with GPG plus CIDR protocol **(1.84±0.07mg/dl)** than the healthy ones receiving the same treatment **(1.47±0.02mg/dl).**

B. *Effect of GPG and GPG plus CIDR protocols on protein concentrations of healthy and Fasciola infected buffalo-cows serum:*

As recorded in table (9) and figure (9 a), (9 b), (9 c) and (9 d) there was a significant difference in protein concentrations between the six experimental groups. There was a significant increase in the total protein concentrations in the infected animals **(5.95±0.01 g/dl)** than the healthy animals **(5.18±0.11 g/dl)**. Total protein showed a significant increase in its concentration in the infected group treated with GPG protocol **(6.59±0.04 g/dl)** than the healthy group treated with the same protocol **(6.11±0.05 g/dl)**. Total protein showed a significant increase in its concentration in the infected buffalo-cows treated with GPG plus CIDR protocol **(6.35±0.07 g/dl)** than the healthy ones receiving the same hormonal treatments **(6.00±0.36 g/dl)**. There was a significant increase in the globulin concentrations in the infected animals than the healthy animals**(3.31±0.07** and **2.1±0.09 g/dl,** respectively**)**. Also, globulin concentration showed a significant increase in the infected group treated with GPG protocol **(2.27±0.3 g/dl)** than the healthy group treated with the same protocol **(1.61±0.1 g/dl)**. Globulin level showed a significant increase in the infected buffalo-cows treated with GPG plus CIDR protocol **(2.84±0.25 g/dl)** compared to the healthy ones receiving the same hormonal treatments **(2.61±0.36 g/dl)**. Albumin concentration decreased significantly in the infected group **(2.64±0.06 g/dl)** than the healthy group **(3.7±0.04 g/dl)**. Also, it was decreased significantly in the infected group treated with GPG protocol **(4.32±0.27 g/dl)** than the healthy one receiving the same treatments **(4.49±0.06 g/dl)**.

Table (9): Effect of GPG and GPG plus CIDR protocols on protein (g/dl) and glucose (mg/dl) concentrations of healthy and *Fasciola* infected buffalo-cows serum.

Parameter \ Groups	Healthy Animals			Infected Animals			F- Value
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	
Total Protein (g/dl)	5.81 ^{d} ±0.11	6.11 ^{c} ±0.05	6.00 ^{c} ±0.36	5.95 ^{cd} ±0.01	6.59 ^{a} ±0.04	6.35 ^{b} ±0.07	29.33***
Albumin (g/dl)	3.7 ^{c} ±0.04	4.49 ^{a} ±0.06	3.41 ^{d} ±0.15	2.64 ^{e} ±0.06	4.32 ^{b} ±0.27	3.51 ^{d} ±0.23	161.31 ***
Globulin (g/dl)	2.1 ^{d} ±0.09	1.61 ^{e} ±0.10	2.61 ^{c} ±0.36	3.31 ^{a} ±0.07	2.27 ^{d} ±0.30	2.84 ^{b} ±0.25	61.44 ***
Albumin/ Globulin (A/G Ratio)	1.76 ^{c} ±0.08	2.8 ^{a} ±0.20	1.37 ^{d} ±0.22	0.39 ^{e} ±0.02	1.95 ^{b} ±0.42	1.25 ^{d} ±0.19	130.87 ***

All data expressed as Mean ± SD.

*** Significant differences at $P < 0.001$.

Means followed by different letters indicated significance but same letters indicated no significance.

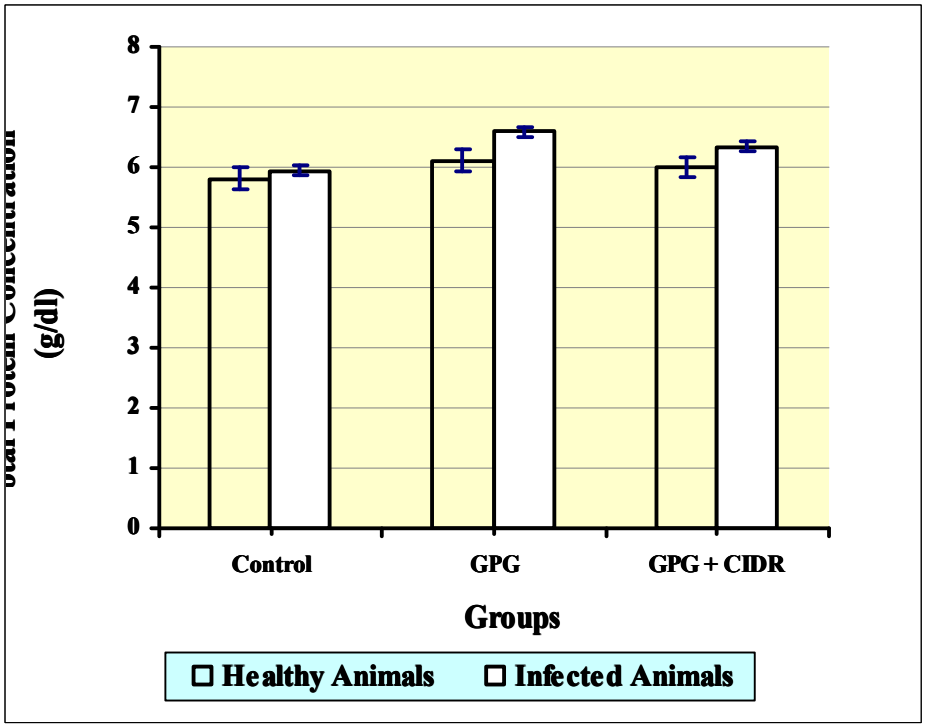


Figure (9 a): Effect of GPG and GPG plus CIDR protocols on Total protein concentrations (g/dl) of healthy and *Fasciola* infected buffalo-cows serum.

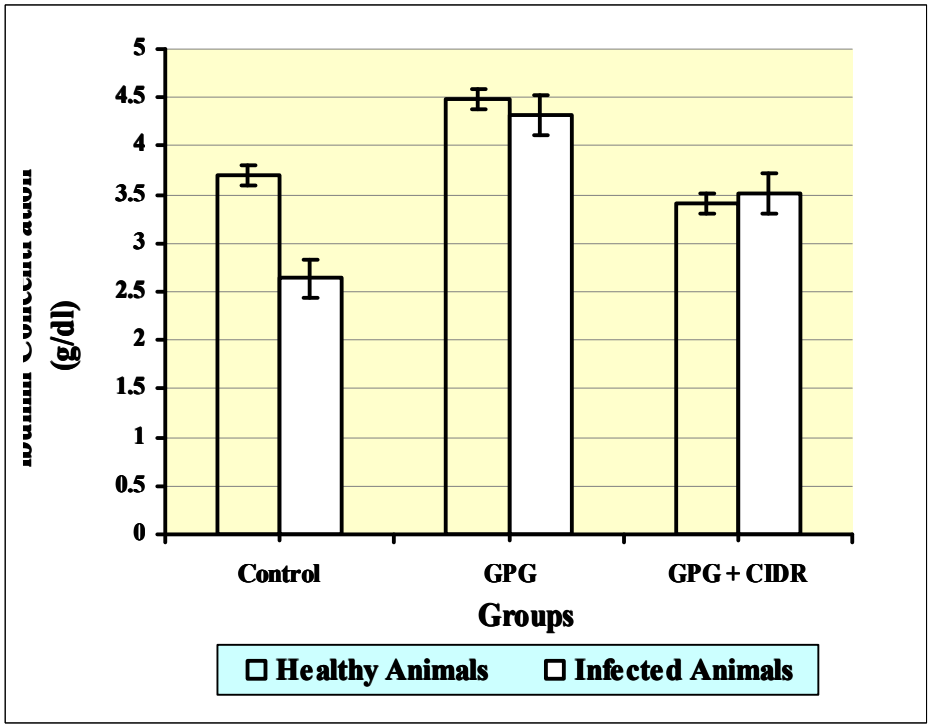


Figure (9 b): Effect of GPG and GPG plus CIDR protocols on Albumin concentrations (g/dl) of healthy and *Fasciola* infected buffalo-cows serum.

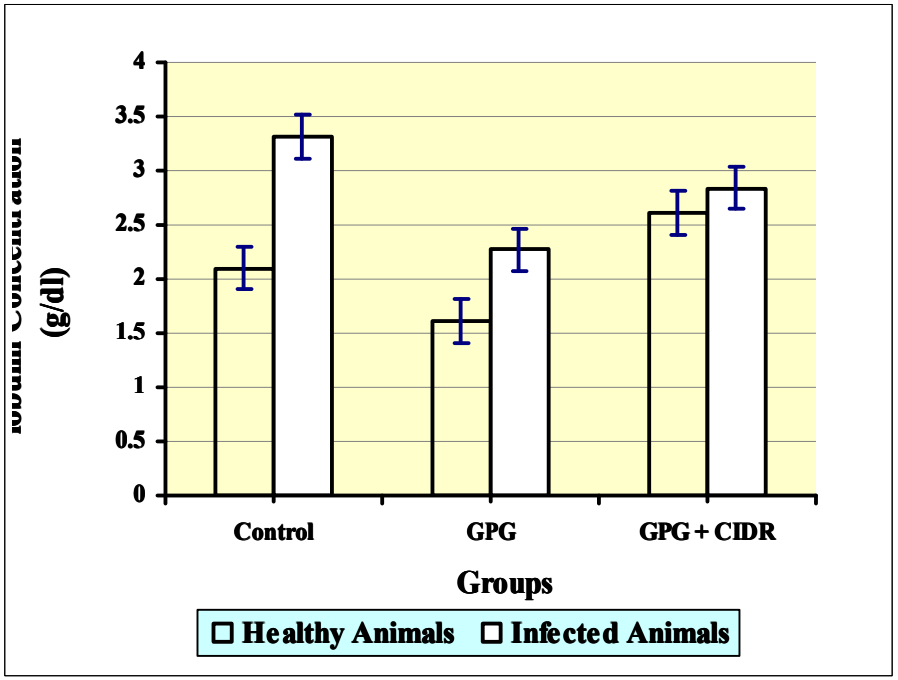


Figure (9 c): Effect of GPG and GPG plus CIDR protocols on Globulin concentrations (g/dl) of healthy and *Fasciola* infected buffalo-cows serum.

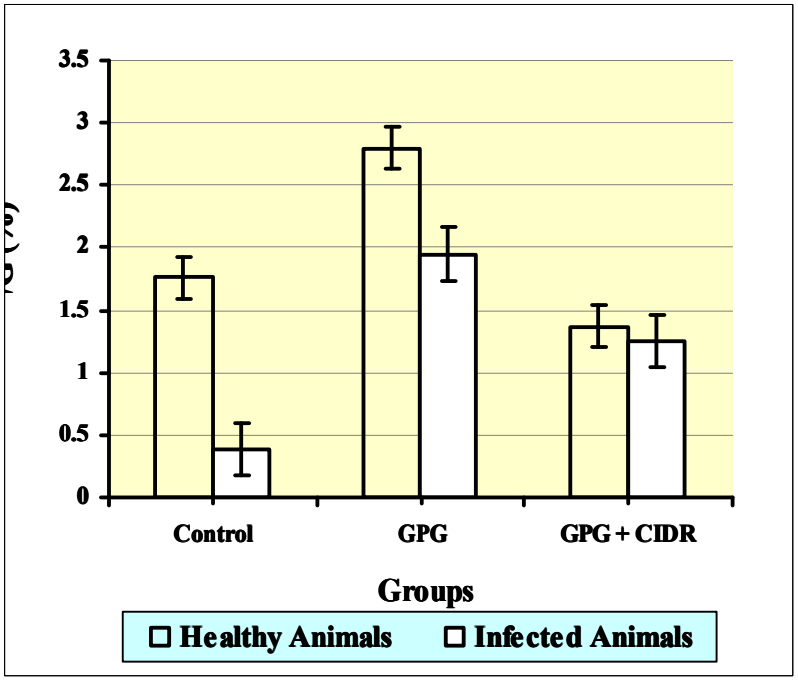


Figure (9 d): Effect of GPG and GPG plus CIDR protocols on A/G ratio of healthy and *Fasciola* infected buffalo-cows serum.

Albumin concentrations didn't show any significance differences between infected and healthy animals treated with GPG plus CIDR protocol. A/G ratio was altered every time there were a change in albumin and globulin concentrations. It was decreased significantly in the infected group **(0.39±0.02)** than the healthy group **(1.76±0.08)**. A/G ratio decreased significantly in the infected group treated with GPG protocol **(1.95±0.42)** than the healthy one treated with the same protocol **(2.8±0.2)**. A/G ratio didn't show any significance differences between infected and healthy animals treated with GPG plus CIDR protocol.

4. Mineral Concentrations:

Effect of GPG and GPG plus CIDR protocols on mineral concentrations of healthy and Fasciola infected buffalo-cows:

Data detected in table (10) and figure (10 a), (10 b), (10 c) and (10 d) showed that there were significant differences at $P<0.001$ in iron, copper and phosphorus concentrations between the six groups. Nevertheless, differences in calcium concentration between groups were statistically non significant. A significant decrease in iron concentrations was detected in the infected animals **(111.23 ± 8.26 µg/dl)** compared to the healthy ones **(135.95±6.89 µg/dl).** Also, there was a significant decrease in iron concentrations in the infected than the healthy group treated with GPG protocol **(105.51 ± 0.97** and **122.71 ± 4.85 µg/dl**, respectively**)** and GPG plus CIDR protocol **(116.14 ± 3.29 µg/dl** and **120.92 ± 4.66 µg/dl**, respectively**).** There was significant decrease in phosphorus concentrations of the infected animals **(5.39 ± 0.01 mg/dl)** than the healthy animals **(5.83 ±0.04mg/dl)**. A significant increase in phosphorus concentrations was detected in the infected compared to the healthy group treated with GPG protocol **(6.95 ± 0.76** and **6.06 ± 0.07 mg/dl**, respectively**).**

Table (10): Effect of GPG and GPG plus CIDR protocols on mineral concentrations of healthy and *Fasciola* infected buffalo-cows.

Groups / Parameter	Healthy Animals			Infected Animals			F- Value
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	
Iron (µg/dl)	135.95 ^{a} ±6.89	122.71 ^{b} ±4.85	120.92 ^{bc} ±4.66	111.23 ^{d} ±8.26	105.51 ^{e} ±0.97	116.14 ^{cd} ±3.29	30.33***
Copper (µg/dl)	66.34 ^{b} ±2.47	77.36 ^{a} ±2.73	43.29 ^{d} ±3.51	51.14 ^{c} ±8.94	74.25 ^{a} ±2.98	38.03 ^{d} ±5.17	69.79 ***
Phosphorus (mg/dl)	5.83 ^{b} ±0.04	6.06 ^{b} ±0.07	5.84 ^{b} ±0.3	5.39 ^{c} ±0.01	6.95 ^{a} ±0.76	5.49 ^{c} ±0.15	25.85***
Calcium (mg/dl)	10.07 ±0.31	9.66 ±0.48	9.56 ±0.44	9.61 ±0.43	9.45 ±0.19	9.39 ±0.44	1.50 N.S.

All data expressed as Mean ± SD.
*** Significant differences at $P < 0.001$.
N.S.: Non Significant.
Means followed by different letters indicated significance but same letters indicated no significance.

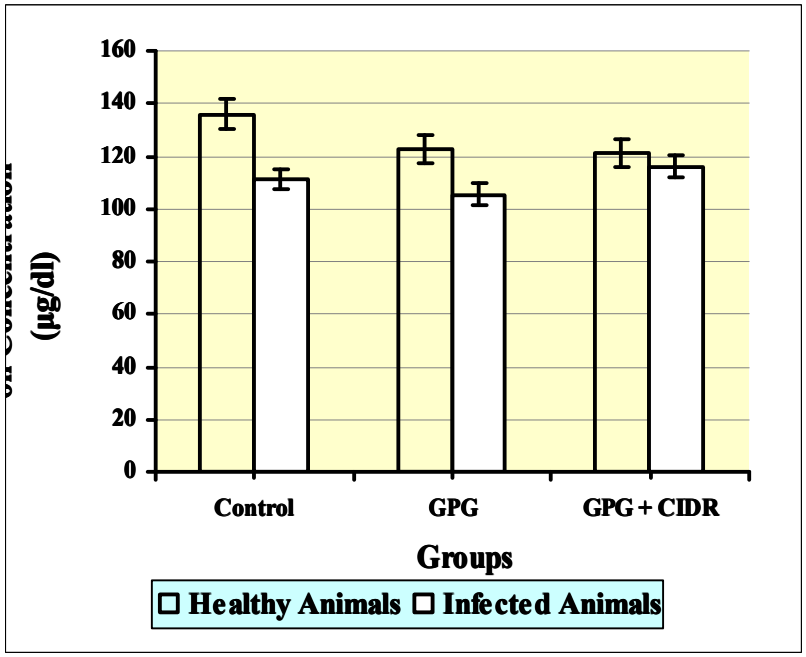


Figure (10 a): Effect of GPG and GPG plus CIDR protocols on Iron concentrations (µg/dl) of healthy and *Fasciola* infected buffalo-cows serum.

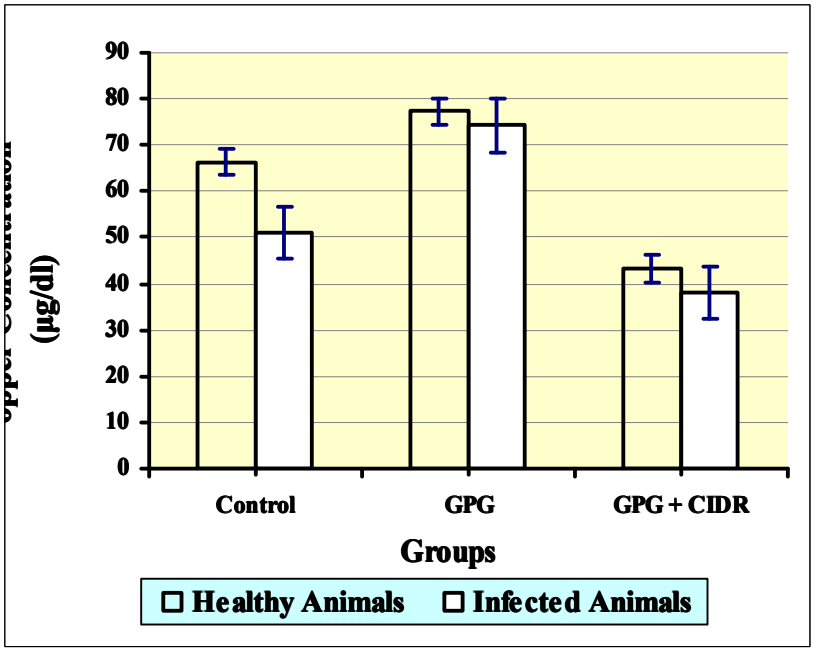


Figure (10 b): Effect of GPG and GPG plus CIDR protocols on Copper concentrations (µg/dl) of healthy and *Fasciola* infected buffalo-cows serum.

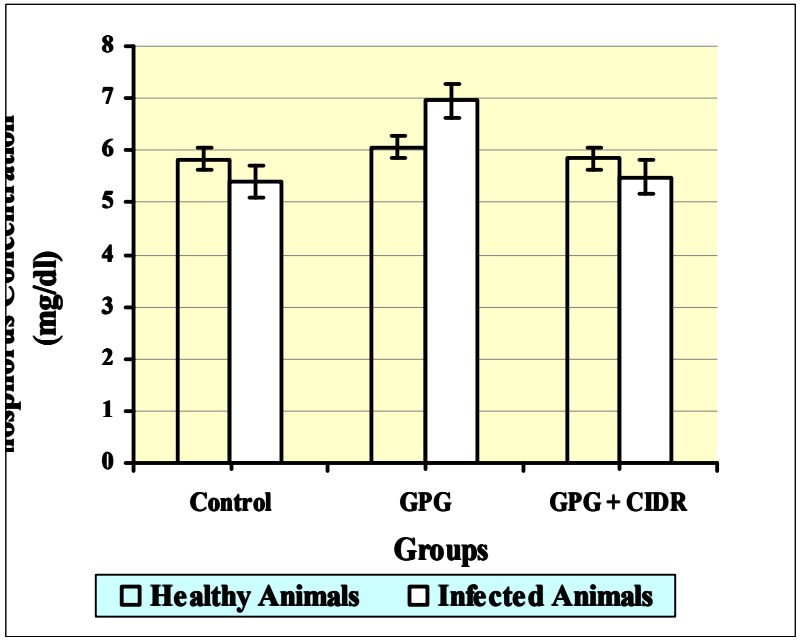


Figure (10 c): Effect of GPG and GPG plus CIDR protocols on Phosphorus concentrations (mg/dl) of healthy and *Fasciola* infected buffalo-cows serum.

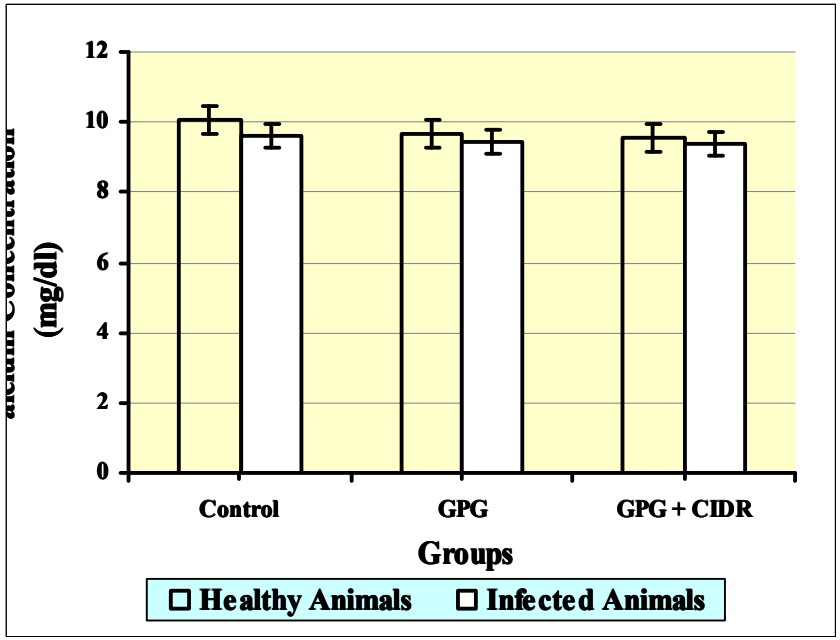


Figure (10 d): Effect of GPG and GPG plus CIDR protocols on Calcium concentrations (mg/dl) of healthy and *Fasciola* infected buffalo-cows serum.

Phosphorus concentrations were decreased significantly in the infected group injected with GPG plus CIDR protocol than the healthy group with GPG plus CIDR protocol (**5.49 ± 0.15 mg/dl** and **5.84±0.3 mg/dl,** respectively). A significant decrease in copper levels was detected in the infected animals **(51.14±8.94µg/dl)** than the healthy animals **(66.34± 2.47 µg/dl).** Differences in copper concentrations between the infected and healthy groups treated with GPG protocol and between the infected and healthy groups treated with GPG plus CIDR protocol were statistically non significant.

• Experiment II:

1. Effect of Avinide® and Fasciontel® anti-*Fasciola* treatments on Estradiol (E_2) and Progesterone (P_4) concentrations of *Fasciola* infected buffalo-cows serum:

The plotted data in table (11) and figure (11 a) and (11 b) showed that E_2 concentrations were decreased significantly ($P<0.001$) in the Avinide® and Fasciontel® treated groups **(1.76 ± 0.09** and **1.79 ± 0.16 pg/ml,** respectively) than the control group **(2.13 ± 0.05 pg/ml)** while, P_4 concentrations increased significantly ($P<0.001$) in the Avinide® and Fasciontel® treated groups **(2.27 ± 0.12** and **2.21 ± 0.01 ng/ml,** respectively) than the control group **(0.54 ±0.09 ng/ml).** E_2 and P_4 concentrations showed no significant differences between the Avinide® and Fasciontel® treated groups.

2. Effect of Avinide® and Fasciontel® anti-*Fasciola* treatments on the pregnancy rates of *Fasciola* infected buffalo-cows:

Concerning pregnancy rates of infected buffalo-cows resulting from anti-*Fasciola* treatments, it could be seen from table (12) and figure

(12) that the pregnancy rates increased from 16.7 to 67.7 % after the anti-*Fasciola* treatments.

Table (11): Effect of Avinide® and Fasciontel® anti-*Fasciola* treatments on Estradiol (E_2) (pg/ml) and Progesterone (P_4) (ng/ml) concentrations of *Fasciola* infected buffalo-cows serum.

Groups / Parameter	Control Infected Group	Avinide® Treated Group	Fasciontel® Treated Group	F-Value
E_2 (pg/ml)	2.13 [a] ± 0.05	1.76 [b] ± 0.09	1.79 [b] ± 0.16	21.02 ***
P_4 (ng/ml)	0.54 [b] ± 0.09	2.27 [a] ± 0.12	2.21 [a] ± 0.01	577.22 ***

All data expressed as Mean ± SD.
*** Significant differences at $P < 0.001$.
Means followed by different letters indicated significance but same letters indicated no significance.

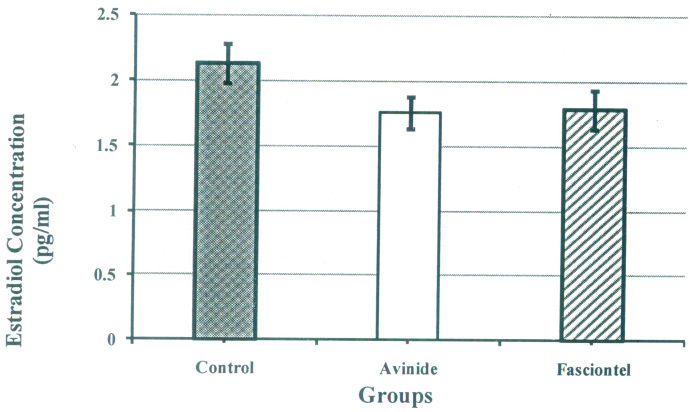


Figure (11 a): Effect Avinide® and Fasciontel® anti-*Fasciola* treatments on Estradiol (pg/ml) concentrations of *Fasciola* infected buffalo-cows serum.

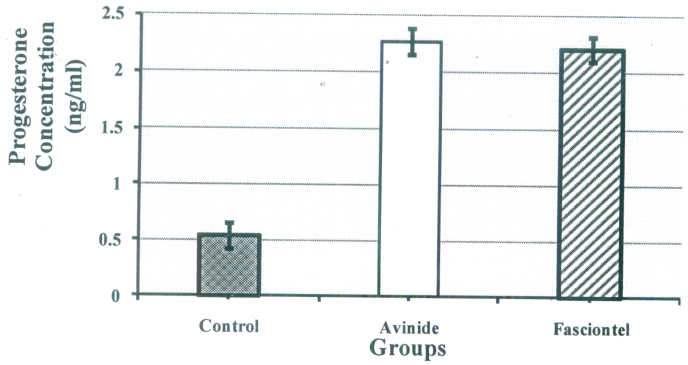


Figure (11 b): Effect Avinide® and Fasciontel® anti-*Fasciola* treatments on Progesterone (ng/ml) concentrations of *Fasciola* infected buffalo-cows serum.

Table (12): Effect of Avinide® and Fasciontel® anti-*Fasciola* treatments on pregnancy rates of *Fasciola* infected buffalo-cows.

Animals	Infected Animals		
	Control	Avinide® Group	Fasciontel® Group
Total Number of Animals	6	6	6
Number of Pregnant Animals	1 (16.7%)	4 (67.7 %)	4 (67.7 %)

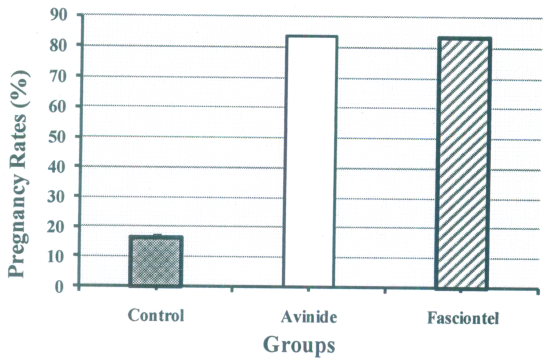


Figure (12): Effect of Avinide® and Fasciontel® anti-*Fasciola* treatments on pregnancy rates of *Fasciola* infected buffalo-cows.