

Comparative Study On The Efficacy Of Watery Extract Of *Artemisia cina*; Semiduramicin And Coccivac-B As Anticoccidial Agents In Broiler Chickens

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ABSTRACT

Evaluation of the efficacy of watery extract of *Artemisia cina* (WA); semiduramicin (Aviax) and Coccivac-B as anticoccidial agents were investigated in broiler chickens infected with mixed field *Eimeria* species. One hundred and sixty Hubbard day-old chicks were divided into 4 groups. The 1st and 2nd groups were medicated with WA and Aviax as anticoccidial on ration respectively from 1st day of age till 42 day of age. The birds in the 3rd group was vaccinated with Coccivac-B at 3rd day-old via eye drop once, while the 4th group left as control. Coccidial infection was initiated at 21 day of age after division of each group into two equal sub groups, one of them was infected with mixed field *E. sporulated* oocysts while the other one kept uninfected as control. Evaluation the efficacy of each trial was based on bird performance, oocysts output and lesion scores. In addition to some biochemical and haematological parameters including aspartate aminotransferase (AST), lactate dehydrogenase (LDH), total protein, uric acid, creatinine and packed cell volume (PCV).

The used anticoccidial programs protect infected birds from *Eimeria* spp. without adverse effect on performance and function of vital organs. WA showed the best results in protection and body performance, followed by Aviax and Coccivac-B.

It could be concluded that using watery extract of *Artemisia cina* proved as safe and effective alternative anticoccidial herbal medication for control of coccidiosis in broiler industry.

INTRODUCTION

Avian coccidiosis is an intestinal disease caused by protozoan parasite of the genus *Eimeria*. It is considered to be one of the most economically important diseases of domestic poultry under intensive rearing industry. It produces tissue damage, resulting in reduced growth and increased susceptibility to pathogens (1). In the UK in 1995, the total cost of coccidiosis to chicken farmers was estimated to exceed GB£38.6 million, of which 98.1% was associated with the 625 million broilers producers 80.6% due to poor performance, and 17.5% due to costs of prophylaxis and treatment (2). For many years, the prophylactic use of anticoccidial feed additives has been the primary means of controlling coccidiosis in the broiler industry and has played a major role to prevent clinical

coccidiosis infection. (1,3). There is a continual need for new products in this area because drug-resistant and banning of many antibiotics (4).

Semiduramicin is polyether ionophore antibiotic, it's mode of action is dependant on its effects on membrane function which had the ability to form lipophylic complexes with alkaline metal cations (Na^+ , K^+ and Ca^{++}) and transport these cations through the cell membrane and then affect arrange of processes that depend upon ion transport such as influx of sodium ions thus causing severe osmotic damage. This drug act against the extracellular stages of the life cycle of the *Eimeria* (5,6).

With the currently increasing problems of drug-resistance and pressures from consumers to ban drugs from animal feeds, there is a pressing need to move away from

chemotherapeutic control of coccidiosis towards vaccination and natural herbal medication. Anticoccidial vaccines have been used for valuable broiler breeders for some years; but now the cost of disease in the burgeoning broiler market makes the need for vaccines specially developed for this class of chicken ever more urgent. Coccivac -B is a live coccidial vaccine including *E. acervulina*, *E. mivati*, *E. maxima* and *E. tenella* that able to induce protective immunity in chickens to prevent clinical coccidiosis (6,7).

Encouraging results of herbal anticoccidial agents including *Artemisia* species (8-11) stimulated us to investigate the efficacy of watery extract of *A. cina* as anticoccidial agent which had anticoccidial, antimicrobial, antitoxic, antiinflammatory and antifungal effects. This results arise an question whether herbal treatment is alternative for usual anticoccidial drugs.

For this reason our study was carried out to compare three different prophylactic programs against *Eimeria* species infection in broiler chickens which included either herbal (WA); chemotherapeutical (Aviax) or immunological (Coccivac-B). The changes induced after administration of these different treatments with or without coccidial infection on the light of body performance; some biochemical parameters and hematocrit value (PCV) were evaluated.

MATERIAL AND METHODS

Birds

One hundred and sixty Hubbard chicks were obtained as day-old from Ommat Company, Egypt. They were floor reared till 49 day of age and fed a balanced commercial ration without any additives. Routinely broiler vaccination program against Newcastle (Intervet), Infectious bronchitis. (IZO S.P.A. Brescia, Italy) and Gumboro disease (Intervet) were applied according to instructions of manufactures.

Anticoccidial agents

Watery extract of *Artemisia cina* (WA)

Artemisia cina plant was purchased and kindly identified and prepared by Prof. Dr

Samih El-Dahmy, Pharmacognosy Dept., Faculty of Pharmacy, Zagazig University. Watery extract of *A.cina* was prepared by soaking *A.cina* dried leaves powder in a suitable amount of distilled water for 24 hours then filtered; freezed and dried using a labconco freeze dryer, Model 18. (10).

Semiduramicin sodium (Aviax)^R: (Pfizer U.S.A). It was used as a feed additive for controlling coccidiosis in broiler chickens at a level of 25 ppm per ton of ration.

Coccidial vaccine (Coccivac-B): It is a live oocysts vaccine for broiler vaccination and comprised four species of the wild type of *Eimeria* (*E. acervulina*, *E. mivata*, *E. maxima*, *E. tenella*) (Schering Plough Animal Health Corp. Millsboro, Delaware, USA). It was administered to chickens at 3rd day of age through eye drops.

Eimeria species

Sporulated oocysts of mixed intestinal and cecal field *Eimeria* spp. isolates were obtained from the Dept. of Parasitology, Faculty of Vet. Med. Zag. Univ. Infection was made at 21 day of age with 7500 sporulated oocysts/bird using crop tube.

Experimental design

One hundred and sixty Hubbard day-old chicks were divided into 4 groups. The 1st group was received WA extract in a dose of 4ml/kg of ration (equivalent to 1% of *A. cina* powder) from 1st day till 42 day-old. The 2nd one was medicated with Aviax at dose level 25 ppm in ration starting from first day till 42 day of age. The 3rd group was vaccinated with Coccivac-B at 3rd day of age via eye drop, while the 4th group was kept as control. Birds were fed only on commercial diet without any additives in ration through the experiment.

On day 21 of age, all groups were subdivided into two equal sub-groups, one of them was infected with suspension of mixed field 7500 sporulated oocysts/bird using crop tube, while the other one was kept as non infected control for each group. Our experiment was done during summer season.

Collected parameters

Body performance data: Mean body weight (MBW); feed intake (FI) and feed conversion ratio (FCR) were calculated weekly till the end of the experiment.

Clinical examination, mortalities, lesion scores and dropping scores

Clinical examination and mortalities were recorded allover the experiment and dead birds were examined for lesions of coccidiosis. At the same time, fecal samples were weekly examined for *E. oocysts* before infection and daily for two weeks post infection for counting oocysts/gm of fecal matter using the MC Master Technique (12). Post mortem examination was carried out on the slaughtered and dead birds. Lesion scores were recorded weekly for 3 weeks post infection on five slaughtered birds based on a graded scale of severity from 0 to 4(13).

Blood samples and Biochemical analysis

Five blood samples were collected from each main and sub groups weekly at 3rd, 4th, 5th and 7th week of age for biochemical analysis of serum aspartate amino transferase (AST) (14); lactate dehydrogenase (LDH) (15); total protein (16); uric acid (17) and creatinine (18). Packed cell volume was determined (19).

Statistical analysis

Analysis of variance (ANOVA) was carried out following the method described for one way classification (20).

RESULTS AND DISCUSSION

As the world's poultry production continues to grow, so do concerns about the control of coccidiosis, which remains one of the most commonly reported diseases of chickens. Keeping small poultry flocks healthy and productive without using of medication requires skilled husbandry practices. The initial hope underlying this experiment was to find an immunological or natural product (*A. cina*) with anticoccidial properties that could be used as vaccination or feed additive with

minimal processing and comparing it with other reliable anticoccidial drugs.

Results concerning the body performance data of non infected treated groups were presented in Table 1. There is no significant difference in MBW between control and different treated groups at 3rd and 4th week of age. While, at 5th week of age, there is a significant increase in MBW of WA treated group when compared with the control or other treated groups which showed percent of difference $\uparrow\uparrow$ (+7.7%) from the control. Meanwhile the other treated groups (Aviax and vaccinated groups) showed non significant decrease when compared with each other or with the control with percent of difference (-4.3 and -5.7% respectively) from the non treated control.

At 7th week of age, WA treated group showed a highly significant increase in MBW with percent of difference $\uparrow\uparrow$ (+26.38%) from untreated control group, followed by Aviax medicated group $\uparrow\uparrow$ (+10.42%) while there is no significant difference between vaccinated group and untreated control (Fig. 1).

The great success of WA extract in improvement of body performance may be related to increase the integrity of the epithelial lining of the GIT which leads to increase absorption of amino acids and other nutrients, in addition to increase feed intake leading to improvement in body performance (21). It may also resulted from the synergistic effect of the chemical constituents of *A. cina* that had anticoccidial, antimicrobial, antitoxic, antiinflammatory and antifungal effects. The performance improvement may be attributed to the biotonic herbal mixture supplementation up to 1% in broiler diet.

Our findings revealed minor growth depression (not significant) of Coccivac-B group along the weeks of experiment when compared with the control, meanwhile there is significant decrease of MBW of this group when compared with the other treated groups which may be due to the vaccine stress.

Table 1. Effect of watery extract of *A. cina*; Semiduramicin and Coccivac-B on body performance in non infected broiler chickens (1st day till 49 day of age).

Week	3 rd				4 th				5 th				7 th			
	Group	MBW	Difference% From negative control	FI	FC	MBW	Difference% From negative control	FI	FC	MBW	Difference% From negative control	FI	FC	MBW	Difference% From negative control	FI
Control N	580 ± 12.61	-	985	1.70	714.6 ± 15.24	-	1725	2.41	924.6 ^{ab} ± 35.53	-	2578	2.79	1535 ^c ± 26.93	-	4578	3.10
WA N	562 ± 25.29	-3.1	960	1.71	721.6 ± 31.69	+1.0	1695	2.34	996 ^a ± 15.06	+7.7	2650	2.66	1940 ^a ± 72.84	+26.38	5660	2.92
Aviax N	558 ± 40.57	-3.8	955	1.71	725 ± 37.90	+1.5	1640	2.30	884.6 ^b ± 43.76	-4.3	2455	2.77	1695 ^b ± 27.84	+10.42	5100	3.01
Coccivac-B N	534 ± 13.73	-7.9	900	1.69	686.2 ± 26.38	-4.0	1700	2.47	872.2 ^b ± 28.79	-5.7	2480	2.84	1484 ^c ± 62.93	-3.32	4743	3.21
Significance	N.S				N.S				H.S				H.S			

All results are mean ± S.E., Statistical analysis using F test.

Means within a column followed by different letters are significantly different ($P \leq 0.05$); ($P \leq 0.001$)

Values which have different letters (in the same row) are significantly different from each other and vice versa.

WA: watery extract of *Artemisia cina*. MBW: mean body weight FI: feed intake

FC: feed conversion ratio N: non infected N.S.: non significant H.S.: highly significant

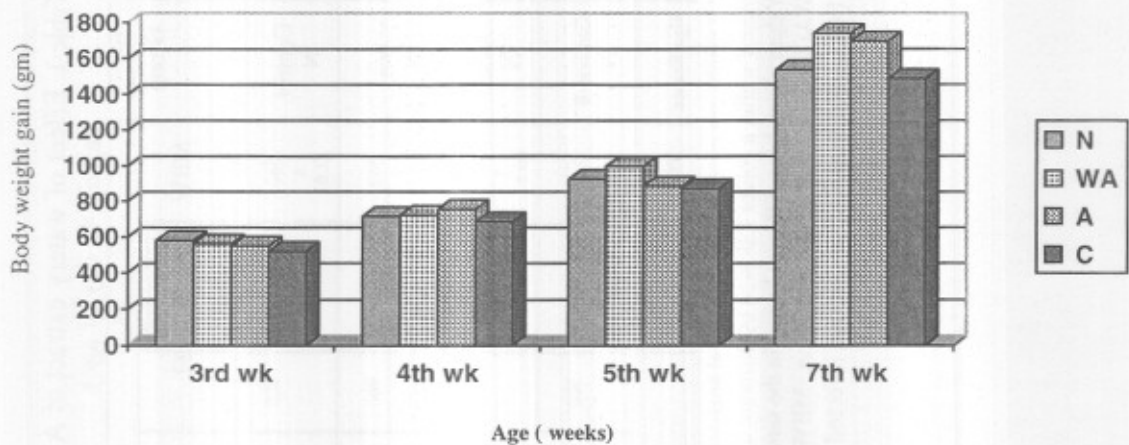


Fig. 1. Percent of difference of body weight gain of all anticoccidial treated groups from non infected control. N: non infected non treated control. WA: watery extract of *A. cina* non infected treated group. A: Aviavax non infected treated group. C: Coccivac-B non infected treated group.

Post-infection (PI) growth performance data of all treated groups are presented in Table 2. Significant growth depression was observed during the first two weeks PI (4th and 5th week of age) in the infected birds when compared with non infected group.

At the 1st week PI (4th week of age), WA treated infected group showed significant increase in MBW with percent of difference $\uparrow\uparrow$ (+17.6%) followed by Aviavax infected group $\uparrow\uparrow$ (+14.2%) while the vaccinated infected group showed the lowest percent of difference which was $\uparrow\uparrow$ (+4.32%) when compared with control infected group.

Meanwhile, at 5th and 7th week of age, WA and Aviavax infected and treated groups grew significantly faster than the infected control with percent of difference $\uparrow\uparrow$ (+23.4%; 19.8% and 10.7%; 5.8% respectively). While vaccinated infected group showed the lowest percent of difference $\uparrow\uparrow$ (+1.0%; 2.2%) from infected control group (Fig. 2).

These results agree with the results reported by *Levander* (22) who attributed this improvement to the mode of action of the active principles of *A. cina* (Artemisinin) and its potential to induce a state of oxidative stress through the free radical cascade, generated by the endoperoxide function and to

the ability of the free radical to alkylate protein of the *Eimeria*. Also with the results by *Koinarski*, (5) who found that, semduramicin exhibited a high anticoccidial activity in broiler chickens experimentally infected with *E. tenella*.

An initial depression of body performance followed by compensatory weight gain has been reported in Coccivac-B infected group when compared with the infected control or other infected treated groups which may not be surprising because Coccivac-B vaccine included 4 *Eimeria* species only meanwhile, in our experiment we challenged the different treated groups with mixed field strains of *E. sporulated* oocysts other than those included in the vaccine. These results are in agreement with the studies reported previously (23,24). Also *Rose*, (25) reported that, the immunological protection against *Eimeria* was strongly species specific so antigenic variability between the *Eimeria* species present in the vaccine and those in the field restricts the effectiveness of commercial vaccines.

Table 2. Effect of watery extract of *A. cina*; Semiduramicin and Coccivac-B on body performance in infected broiler chickens (21→49 day of age).

Week Group	3 rd				4 th				5 th				7 th			
	MBW	Difference % From Infected control	FI	FC	MBW	Difference% From Infected control	FI	FC	MBW	Difference% From Infected control	FI	FC	MBW	Difference% from infected control	FI	FC
Control N	580 ± 12.61	-	985	1.70	714.6 ^a ± 15.24	+ 21.90	1725	2.41	924.6 ^{ab} ± 35.53	+ 16.1	2578	2.89	1535 ^a ± 26.93	+ 12	4578	3.10
Control I	580 ± 12.61	-	985	1.70	558.4 ^c ± 31.64	-	1573	2.82	796.6 ^c ± 42.11	-	2507	3.15	1370 ^c ± 73.1	-	4309	3.14
WA I	562 ± 24.52	- 3.1	960	1.71	656.8 ^a ± 30.88	+ 17.6	1660	2.53	982.8 ^a ± 38.55	+ 23.4	2603	2.65	1641 ^a ± 55.68	+ 19.8	5252	3.20
Aviax I	550.6 ± 15.76	- 5.1	955	1.73	637.6 ^{ab} ± 18.61	+ 14.2	1735	2.72	882 ^b ± 37.48	+10.7	2507	2.84	1450 ^b ± 20.98	+ 5.8	4600	3.17
Coccivac-B I	520 ± 8.37	- 10.3	900	1.73	582.6 ^{bc} ± 15.27	+ 4.3	1500	2.57	789 ^c ± 4.97	+ 1.0	2591	3.30	1400.4 ^{bc} ± 22.12	+ 2.2	4593	3.28
Significance	N.S				H.S				H.S				H.S			

All results are mean ± S.E., Statistical analysis using F test.

Means within a column followed by different letters are significantly different ($P \leq 0.05$); ($P \leq 0.001$)

Values which have different letters (in the same row) are significantly different from each other and vice versa.

AW: *Artemisia cina* watery extract MBW: mean body weight FI: feed intake

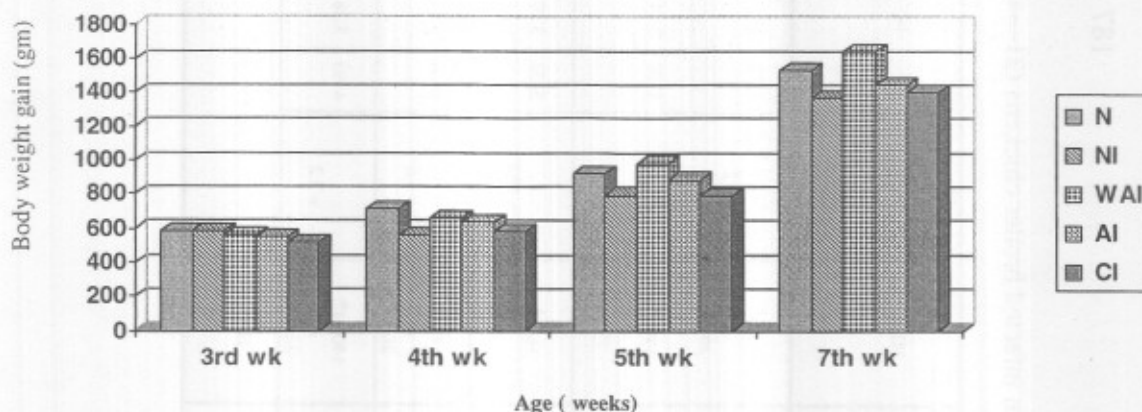


Fig.2. Percent of difference of post-infection body weight gain of all anticoccidial treated groups from infected control.

N: non infected non treated control. NI: infected non treated control.

WA: watery extract of *A. cina* infected treated group.

A: Aviax infected treated group. C: Coccivac-B infected treated group.

Our finding revealed that there is no significant decrease in MBW of groups treated with either Aviax or vaccine when compared with control group all over the experimental period. No adverse effect were observed in the final performance for semiduramicine alone or in combination with Tiamulin (26,27).

The oocyst out put, lesion scores, morbidity and mortality rates are presented in Table 3. There is a marked decrease in oocysts out put in all treated groups WA (6.0×10^5 with a percent of differences -78.9%) followed by semiduramicin (11.0×10^5 with a percent of differences -61.4%) and Coccivac-B (19.0×10^5 with a percent of differences 33.3%) when compared with infected non treated control (28.50×10^5) (Fig 3).

Also a highly reduction in the lesion score at the 1st week PI in WA treated group followed by Aviax and Coccivac-B (0.6; 1.3 and 1.6) respectively when compared with control infected group (2.8). While at 2nd week PI, all treated groups showed no lesion score when compared with the control infected group (lesion score, 3.0) which indicated that all treated groups are promote protective effect that protect chickens from challenge with wild-type parasites during the experiment.

Concerning to morbidity and mortality rates, they were similarly in all treated groups which varies from 6.6 and 6.8% respectively when compared with control infected group (16.6 and 10%) respectively. Chickens medicated with WA herbal extract showed the best protection against the experimental challenges with mixed field sporulated oocysts at day 21 of age followed by Aviax and Coccivac-B vaccine.

The effect of different anticoccidial programs on serum biochemistry of non infected chickens are represented in Table 4. All treatment programs in this study showed no adverse effect on liver function all over the weeks of the experiment where serum AST, as clinical test of liver function, not exceed the level of control group except for the birds that scarified three weeks after treatment where serum AST levels showed significant elevation in WA and Aviax treated groups which may be due to mild degenerative changes of hepatocytes. But this elevation return to control level in 4th and 5th weeks of experiments as well as Coccivac treated group. This improvement continued till after drug withdrawal (7th week) moreover WA & Aviax treated groups showed levels significantly less than that of control.

Table 3. Effect of watery extract of *A. Cina*; Semiduramicin and Coccivac-B on oocysts shedding, lesion score, morbidity and mortality rate in broiler chickens infected with different field *Eimeria* spp. sporulated oocysts.

Group	Oocysts/bird x 10 ⁵ (5 → 11) days post infection	Difference% From Infected control	PM lesion score			Total Morbidity %	Total Mortality %
			Week post infection				
			1	2	4		
Control Infected	28.50	100	2.8	3.0	0.0	16.6	10
WA Infected	6.00	78.9	0.6	0.0	0.0	6.6	6.6
Aviax Infected	11.00	61.4	1.3	0.0	0.0	6.7	6.8
Coccivac-B Infected	19.00	33.3	1.6	0.0	0.0	6.7	6.6

WA: watery extract of *Artemisia cina*.

PM: postmortem.

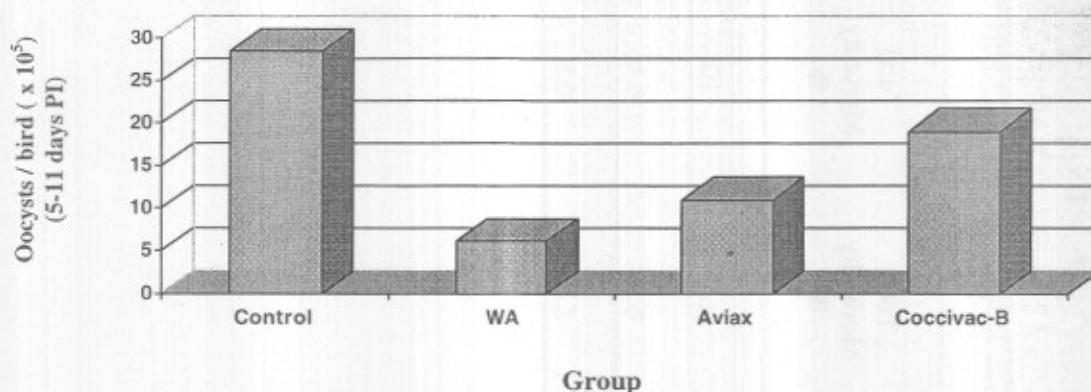


Fig. 3. Effect of different anticoccidial treatments trials on oocysts shedding in broiler chickens challenged with field *Eimeria* sporulated oocysts at day 21 of age.

Gehan, (28) recorded that alcoholic extract of *Artemisia inculata* when added to the water (2ml of alcoholic extract/20 birds) as prophylactic lead to decreasing the clinical signs, lesion due to coccidiosis and has mild degenerative changes on parenchymatous organs including liver and kidneys. In contrast she added that the dried powder (5%) not affect the coccidia and has severe degenerative toxic effect on heart, spleen, liver and kidneys. Also *Saber*, (29) revealed that Semiduramicin induced many effects on liver and kidneys of chickens. The opposite results that obtained by other authors on *Artemisia* may be due to using different genus of *Artemisia* in addition to the difference of form, dose and/or the duration of *Artemisia* administration. Also we must pointed out that no available cited literatures particularly study *Artemisia cina* as anticoccidial.

Serum total protein showed no significant changes between groups at 3rd week. While Aviax and vaccine treated groups at 4th week recorded significantly lower level of total protein when compared with control and WA group. This adverse effect, improved at 5th week and WA treated group recorded the higher level. The increase in the level of total protein in WA treated group may be related to increase the amino acid absorption (21). On the other hand, at 7th week of age there were significant decrease in all treated groups when compared with control with no adverse effect on MBW (Table 1).

Statistically, serum uric acid level not exceeded the level of control group under the

effect of all tested medications all over the period (3rd, 4th and 5th weeks). The best one is WA treated group in (3rd and 5th weeks) as it recorded level significantly less than that of control group. In spite of normal uric acid concentration do not guarantee that the kidneys are healthy, as the avian kidneys have the ability to compensate for damage before uric acid levels are elevated, hyperuricemia is good indicator of renal disease (30). At the last week (7th) and after drug withdrawal, all tested treatments (with no significant difference in between) recorded higher levels over the control with no effect on body performance.

Also the creatinine level not exceeded the level of control all over the period of this study with one exception only for WA group (5th week). Our results are partially agreed with the results of *Marrif*, (31) who reported that the extract of *Artemisia herba-alba* produce hydropic degenerative changes in the proximal convoluted tubules but not affect the urea and creatinin level in plasma. Contradictory, *Adam* (32) studied the effect of 2% and 10% dried leaves of *Artemisia herba-alba* for 6 weeks and reported that it have nephropathy effect. We can concluded that all tested medications (WA; Aviax and Coccivac-B) have no adverse effect on kidney function when administrated for 35 day for broiler chickens. Our results for Aviax group similar to result obtained by *Schuhmacher et al.*, (27) they reported that semiduramicine have no adverse effect on serum protein, PCV and uric acid at 35 day of age of growing broiler chickens.

Table 4. Effect of watery extract of *A. cina*; Semiduramicine and Coccivac-B on some serum parameters in non infected broiler chickens.

week	3 rd				4 th				5 th				7 th			
Group	AST	T.P	U.A	Cr.	AST	T.P	U.A	Cr.	AST	T.P	U.A	Cr.	AST	T.P	U.A	Cr.
Control N	139.8 ^c ± 6.44	3.08 ± 0.27	11.99 ^a ± 0.15	0.74 ^a ± 4.15 E-02	196.4 ± 14.86	3.2 ^a ± 0.19	9.36 ^a ± 1.17	0.51 ^{ab} ± 2.1 E-02	220 ± 5.97	3.1 ^b ± 0.19	7.52 ^a ± 0.54	0.57 ^{bc} ± 3.35 E-02	156.5 ^a ± 11.32	4.12 ^a ± 0.21	3.14 ^b ± 4.00 E-02	0.66 ^{ab} ± 1.1 E-02
WA	205.02 ^{ab} ± 25.45	3.14 ± 0.31	6.54 ^c ± 0.86	0.56 ^b ± 4.12 E-02	193.20 ± 14.78	3.42 ^a ± 0.12	6.88 ^{ab} ± 0.35	0.58 ^a ± 2.54 E-02	180.16 ± 13.18	3.90 ^a ± 0.3	4.42 ^b ± 0.41	0.78 ^a ± 6.74 E-02	115.20 ^b ± 13.02	3.24 ^b ± 0.13	5.72 ^a ± 0.29	0.46 ^c ± 3.33 E-02
Aviax	246.8 ^a ± 13.78	2.98 ± 0.33	9.04 ^b ± 1.06	0.82 ^a ± 5.96 E-02	237.2 ± 20.36	2.72 ^b ± 6.63	5.98 ^b ± 0.99 E-02	0.48 ^b ± 2.76 E-02	230.0 ± 26.25	2.96 ^b ± 0.15	7.12 ^a ± 0.63	0.67 ^{ab} ± 4.83 E-02	92.4 ^b ± 5.05	3.34 ^b ± 0.20	5.70 ^a ± 0.39	0.75 ^a ± 4.99 E-02
Coccivac-B	180.6 ^{bc} ± 14.67	2.34 ± 0.26	7.92 ^{bc} ± 0.63	0.56 ^b ± 1.94 E-02	225.2 ± 8.22	2.40 ^b ± 0.14	6.72 ^b ± 0.81	0.46 ^b ± 3.96	185.8 ± 13.74	3.46 ^{ab} ± 0.20	8.24 ^a ± 0.59	0.50 ^c ± 5.83 E-02	129.6 ^{ab} ± 17.62	3.10 ^b ± 7.07 E-02	5.00 ^a ± 0.38	0.60 ^b ± 6.99 E-02
Significance	H.S	N.S	H.S	H.S	N.S	H.S	S	S	N.S	S	H.S	H.S	S	H.S	H.S	H.S

All results are mean ± S.E., Statistical analysis using F. test.

Means within a column followed by different letters are significantly different ($P \leq 0.05$) ; ($P \leq 0.001$)

Values which have different letters (in the same row) are significantly different from each other and vice versa.

AST= Aspartate amino transferase enzyme

T.P= Total protein

U.A.= Uric acid

N.S.= Non significant

S = Significant

H.S = Highly significant

Control N = Non infected control

WA = Watery extract of *A. cina*

Cr= Creatinine

The effect of coccidial infection on serum level of AST, total protein, LDH (lactate dehydrogenase), uric acid, creatinine and PCV are represented in Table 5. The infected non treated groups showed significant increase in AST and LDH levels when compared with the control group or other infected and treated groups. The increased level of AST (4th & 5th weeks) and LDH (4th week) in the infected untreated group may be due to some degenerative changes and focal necrosis involving the hepatic cells post infection (28, 33, 34, 35). Smith, (36) recorded that AST is a more sensitive index of hepatocellular damage.

The obtained result of AST levels under the effect of WA, Aviax and Coccivac proved that they succeeded to challenge coccidial infection (Table 3 & Fig 3). Where AST of all treated groups not exceed the level of control at the 1st and the 2nd weeks PI. They recorded levels not only less than the infected control but also reaching the level of non infected control. The superiority was for WA at 1st week PI (acute stage of coccidial infection) and for Aviax at 2nd week PI. The observed hepato-protective effect of WA against coccidiosis may attributed to its anticoccidial effect in addition to antioxidant constituents of *Artemisia cina* "flavonoids" (37).

The levels of serum total protein are not affected by infection in both 1st and 2nd weeks PI where, there are no significant differences between infected and non infected group as well as other treated groups except for Coccivac-B treated group. Where it showed an initial minor decrease at 3rd week followed by significant decrease at 4th week, the same significant lowering effect on total protein level are observed without infection as showed in Table 4. So birds treated with vaccine either with or without infection suffered from significant lower level of serum total protein. This adverse effect in such critical growing stage may explain the lower MBW (Tables 1,2) that observed in vaccinated group.

The infection with coccidia did not elevated uric acid level over the non infected group as well as all treated groups. While creatinine significantly increased one week PI in infected non treated group as well as during the use of Aviax and Coccivac-B. However WA treated group was the best, it recorded lower level reaching the level of non infected group. Such elevation of creatinine recorded also for all treated groups 2 weeks PI. So in this study we observed that creatinine is more affected than uric acid. Although creatinine, in birds, not provide an accurate assessment to avian renal function (30), many authors explained its elevation as a result of renal failure post coccidial infection (33, 34, 38). Because of the toxin that released from the protozoa which circulating in the blood together with lack of detoxifying of the liver (39). In the light of the previous concept, WA of *Artemisia cina* in our study showed higher renal protective effect.

The results of PCV revealed a significant decrease in all infected groups when compared with control at the end of 1st and 2nd week PI. Except for WA group, significant improvement of PCV was recorded at 2nd week PI. Coccidial infection caused a significant decrease in the PCV, this decrease was presumably caused by hemorrhage associated with *Eimeria tenella* infection (40,41). The improvement of PCV in the group treated with WA may be partially attributed to the antihemorrhagic activity of *Artemisia* (21) in addition to its anticoccidial effect as proved in this study and showed in Fig. 3.

In conclusion, our results revealed that all the three anticoccidial treatments vary in their ability to promote protective effect against coccidiosis infection in broiler chickens. The watery extract of *A. cina* as a herbal medication is safe and effective anticoccidial promising alternative way for controlling coccidiosis in broiler industry than the used Semiduramicin and Coccivac-B in this study .

Table 5. Effect of watery extract of *A. cina*; Semiduramicine and Coccivac-B on some serum parameters in experimentally infected broiler chickens.

week	4 th (1 st week post infection)						5 th (2nd week post infection)					
Group	AST	LDH	T.P	U.A	Cr	PCV	AST	LDH	T.P	U.A	Cr.	PCV
Control N	196.4 ^b ±14.86	728.46 ^c ± 22.03	3.2 ^a ± 0.19	9.36 ± 1.17	0.51 ^d ± 2.1 E-02	33.80 ^a ± 0.86	220.0 ^c ±5.97	768.0 ± 19.85	3.1 ±0.19	7.52 ^{ab} ± 0.54	0.57 ^b ± 3.35 E-02	33.80 ^b ± 0.80
Control I	308.4 ^a ± 23.72	929.33 ^a ± 12.13	2.78 ^a ±0.31	8.28 ± 0.98	0.83 ^{ab} ± 7.11 E-02	30.20 ^b ± 0.49	330.40 ^a ± 23.43	789.64 ± 34.26	3.08 ± 0.25	7.24 ^{ab} ± 1.32	0.69 ^b ± 2.01 E-02	30.40 ^c ± 0.51
WA I	100.20 ^c ± 10.85	585.44 ^d ± 42.87	3.12 ^a ±0.16	9.30 ± 1.02	0.63 ^{cd} ± 4.20 E-02	31.0 ^b ± 0.84	283.2 ^b ± 19.68	773.32 ± 10.51	3.56 ± 0.13	6.52 ^b ± 0.97	0.97 ^a ± 8.55	35.60 ^a ± 0.51
Aviax I	183.0 ^b ±12.21	734.86 ^c ± 32.03	2.64 ^{ab} ± 0.17	6.96 ± 0.25	0.71 ^{bc} ± 4.99	28.40 ^b ± 1.21	168.20 ^d ± 7.77	793.93 ± 14.77	3.0 ± 0.24	9.90 ^a ± 0.50	0.94 ^a ± 4.04 E-02	31.0 ^c ± 0.71
Coccivac-B I	149.0 ^b ± 16.50	829.71 ^b ± 25.92	2.10 ^b ± 0.16	7.74 ± 0.65	0.92 ^a ± 1.72 E-02	30.40 ^b ± 0.51	312.8 ^{ab} ± 8.85	807.61 ± 14.78	3.08 ± 0.21	6.20 ^b ± 0.68	1.02 ^a ± 4.78 E-02	30.20 ^c ± 0.37
Significance	H.S	H.S	S	N.S	H.S	H.S	H.S	N.S	N.S	S	H.S	H.S

All results are mean ± S.E., Statistical analysis using F. test.

Means within a column followed by different letters are significantly different ($P \leq 0.05$); ($P \leq 0.001$)

Values which have different letters (in the same row) are significantly different from each other and vice versa.

AST= Aspartate amino transferase enzyme T.P= Total protein U.A.= Uric acid

Cr.= Creatinine

LDH = Lactate dehydrogenase.

PCV = packed cell volume

N.S.= Non significant

S = Significant

H.S = Highly significant

Control N = Non infected control.

Control I = Control infected with *Eimeria* spp

WA = Watery extract of *A. cina*

I = infected treated groups

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المخلص العربي

دراسة مقارنة لكفاءة المستخلص المائي للشاي الخراساني و عقار السيميديوراميسن ولقاح الكوكسيديا (الكوكسيفاك-ب) كمضادات للكوكسيديا في بداري التسمين

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أجريت هذه الدراسة لمقارنة كفاءة بعض البرامج المختلفة لمضادات الكوكسيديا سواء كعلاج عشبي طبيعي (المستخلص المائي للشاي الخراساني) أو مضاد للكوكسيديا شائع الاستخدام (عقار السيميديوراميسن) أو كلقاح (لقاح الكوكسيديا الحي الكوكسيفاك-ب) - ودراسة الآثار الجانبية المحتملة لأي منهم في تربية أرضية لبداري التسمين من عمر يوم حتى 49 يوم سواء كانت مصابة أو غير مصابة بعدوى الكوكسيديا.

تم عدوى الكتاكيت المعالجة بالبرامج السابق ذكرها ضد عدوى الكوكسيديا عند اليوم 21 من عمر الكتاكيت كما تم تقييم هذه البرامج على أساس تأثيرها على وزن الطائر ومعدل استهلاك العليقة ومعامل التحويل الغذائي وكذلك منع أو تقليل العدوى في صورة نسبة النفوق والصفة التشريحية ودرجة الإصابة وتقليل عدد حويصلات الكوكسيديا في زرق الكتاكيت؛ وكذلك دراسة تأثيرها على وظائف الكبد والكلية بإجراء بعض القياسات البيوكيميائية في مصل الطيور مثل تركيز أنزيمات الأسبارتات أمينوترانسفيريز (AST) واللاكتيت ديهيدروجينيز (LDH) والبروتينات الكلية وحمض اليوليك والكرياتينين. وفي دم الطيور تم دراسة تأثير هذه العلاجات المختلفة على نسبة حجم كرات الدم المضغوطة (PCV).

أسفرت النتائج عن تفوق المستخلص المائي للشاي الخراساني كمضاد للكوكسيديا. في صد العدوى وتحسين الأوزان و التحويل الغذائي و حماية وتحسين وظائف الكبد والكلية في الكتاكيت بدون آثار غير مرغوب فيها سواء كانت مصابة أو غير مصابة مما يرشحه كعلاج عشبي من مصدر طبيعي ذو كفاءة عالية وأمن ليكون بديلا واعداد لعقار السيميديوراميسن ولقاح الكوكسيفاك-ب في مقاومة مرض الكوكسيديا في بداري التسمين كما أتضح من خلال هذه الدراسة.