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Field Trial to Control Tick Infestation in Foreign Breed Cattle using Different Acaricides in Egypt and Its Impact on Haemo-Biochemical Parameters

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Abstract

This study was carried out to evaluate the alterations in haemobiochemical parameters in suspected infected cattle and the efficacy of different acaricides in control of tick infestation in some private cattle farms in Egypt. A herd of forty cattle were used and divided into 2 groups: first group (10 apparent healthy), second group (30 suspected diseased) which sub divided equally (10 each) Angas, Simmental and Holstein. Stained thin blood smears were taken from suspected diseased cattle for the identification of blood parasites .Two blood samples were collected from each animal in both groups, one for evaluating hematological parameters and the other for estimating selected biochemical parameters. Hematological results from diseased cattle revealed significant decrease ($p \leq 0.001$) in values of PCV, Hb and erythrocytic count (Angus, Simmental and Holstein) in comparison with control group which indicated anemia. Biochemical results showed significant increase ($p \leq 0.001$) in total protein, total bilirubin and ALP in diseased group cattle. Regarding to therapeutic trials for all suspected diseased cases and accordance to hemogram analysis, biochemical panle analysis and average tick number before and after treatment. we can concluded that using Deltamethrine 5% with herbal mixtures as chemical acaricides showed a great effect in competing tick infestation and recovery of animals to state nearly to healthy state animals .

Key words: (Tick infestation, Acaricides, Deltamethrine, Haemobiochemical parameters, Cattle)

Introduction

Parasitic diseases are worldwide problems that have adverse effect on health and performance of animals. Ecto-parasites as ticks are important and harmful blood sucking external parasites of mammals throughout the world especially tropical and sub-tropical zone (Furman and Loomis, 1984). Haemoprotozoa like Anaplasma is considered to be the most important blood parasite of cattle. A sporadic case of the diseases caused by this parasite is throughout the year (Muhammad et al., 1999). However, their outbreak in exotic and crossbred cattle is reported during the hot and humid months (July-September) of the year. Occurrence of this parasite has been reported by (El-Metenawy, 2000) in apparently healthy cattle. Ticks cause great economic losses to livestock in the world and have adverse effect on livestock host in several ways. Ticks parasitize a wide range of vertebrate hosts and transmit a wider variety of pathogenic agents than any other group of arthropods (Barker and Murrell, 2004). Anaplasmosis is an infectious , non-contagious tick borne diseases caused by obligate intraerythrocyte parasite belong to genus Anaplasma , order Rickettsiales and characterized clinically by progressive hemolytic anemia , icterus , fever ,weight loss and in some cases death of infected cattle (Abdel Hamid , et al 2014). The conventional parasitological methods like Giemsa-stained thin blood smear always remains gold standard for diagnosis of bovine Anaplasmosis for clinically suspected animals, but it is not applicable for detection of subclinical cases (Ashuma et al 2013). Further haematobiochemical alteration in infected animals as compare to healthy control were analyzed to arrive at the end to pathogenicity of A. marginals. There are various ways to control ticks, but every method of tick control has certain short comings. Chemical control with acaricides was considered as one of the best methods, but it was shown recently that ticks have developed resistance against a range of acaricides (Martins et al., 1995.(

A wide range of acaricides, including arsenical, chlorinated hydrocarbons, organophosphates, carbamates and synthetic pyrethroids are being used for controlling ticks on livestock. The performance of an acaricides in the control of ticks depends not only on the activity of a product, but on the quality and quantity of active ingredient deposited on cattle or delivered internally (George, 2000). The development of new acaricides is a long and expensive process, which reinforces the need for alternative approaches to control tick infestations (Graf et al., 2004). Certain herbal mixtures with 70% efficacy for tick control have also been reported by Regassa (2000). Globally, four main TBDs, namely Anaplasmosis, babesiosis, theileriosis,

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and cowdriosis (heart water) affect bovines. (Abdul Jabbar et al, 2015).

This study was designed to determine the prevalence of these parasites in cattle, study the alterations in haemobiochemical parameters in infected cattle and evaluation of the efficacy of different acaricides in control of tick infestation in some private cattle farms in Egypt.

Materials and methods

1. Animals

The cattle in this study were divided into: 2 groups, first group (10 apparently healthy cattle) Second group (30 clinically suspected cattle) and subdivided into three each 10 (Angas, Simmental and Holistein). The suspected groups were having history of tick infestation and reported febrile and non-responsive to antibiotic therapy during August to November 2015. These cattle were belonging to Elsaf farms in Giza governorate and their age were ranged between 12 to17month. The animals were fed on rice hay and concentrated ration usually 2.5 to 3 % from body weight and the bedding hygienically managed and removed weekly. Farm was disinfected regular with Virkon S (Pot. per oxy mono sulfate oxidizing agent) and disinfested with acaricides once per week.

2. Microscopic examination:

Thin blood smears by puncturing jugular vein for each cattle were prepared. Smears were then fixed with methanol and stained with Giemsa's stain and examined under microscope (100x) with immersion oil for the identification of blood parasites as described by Coetzee et al (2005).

3. Hematological and biochemical analyses

Two blood samples were collected from each animal in both groups , one was collected in EDTA coated tubes for evaluating hematological parameters as white blood cells (WBC), hemoglobin (HB) ,packed cell volume (PCV) according to Schalm (1986) and blood indices , mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC). The other blood sample in plain test tubes for estimating biochemical parameters after collecting of sera from blood by centrifugation at 5000 rpm for 10 min and further stored at -20 $_0$C until use for estimation of aspartate aminotransferase (AST) , alanine aminotransferase (ALT) , alkaline phosphatase (ALP) , glucose (GLU), blood urea nitrogen (BUN) , total protein (TP) , albumin (ALB) , Creatinine and total bilirubin using specific kits from Bio diagnostic company , Egypt on a specific spectrophotometer (Apple 302, USA).

The suspected diseased cases were treated for about 2 months with fixed therapeutic regime in change of acaricides each month. Two blood samples were taken from each animal every month for estimation of the alteration in hematological and biochemical parameters.

4. Therapeutic regime

All suspected diseased cases were received fixed therapeutic regime for 3 months as following:

a-Long acting Panterramycine® 1ml / 10kg body weight I/M, Arsenal® 10 - 15 ml to each animal S/C, Imizole® 1.5 ml/100kg body weight I/M and AD3E® 15 - 20 ml to each animal I/M.

b- Chemical acaricides: Firstly, during infection, Diazianone 60® with dilution 1/1000 was used once weekly for 3 weeks with Ivomec® once 1ml/50kg S/C Secondly, in 1st month Bytox® with dilution 1/1000 was used once weekly for 3 weeks with Ivomec® once 1ml/50kg s/c. thirdly, in 2nd month Deltamethrin5% and herbal mixtures® used once weekly for 3 weeks and Ivomec® injection two times with interval 2 weeks 1ml /50kg S/C

Statistical analysis:

The obtained data were expressed as mean and standard error (mean ±SE) and analyzed statistically by using SPSS program Version 16. Significant differences in the values between the suspected diseases group and apparent healthy group were indicated by P *≤0.05, P** ≤0.01and P*** ≤0.001 and repeated measures ANOVA to estimate the alterations in haemobiochemical parameters after treatment of suspected cases. Means with different super script are significant at P≤ 0.05

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Results

Table (1) Alterations in hematological parameters in apparently healthy cattle and suspected diseased cases.

Parameters / groups	Apparently healthy cattle (N=10)	Suspected diseases cattle		
		Angus breed (N=10)	Simmental breed (N=10)	Holstein breed (N=10)
PCV %	29.75±0.30	21.10± 1.73***	14.10± 2.31***	14.10± 1.54***
Hb (g/dl)	14.92± 0.51	10.98± 0.70***	7.75 ± 0.93***	8.48 ± 1.07***
RBCs (x10⁶/µl)	7.96 ± 2.83	4.65 ± 3.09***	3.35 ± 4.84***	3.11 ± 4.50***
MCV (fl)	37.79± 1.36	46.79 ± 4.29	48.84 ± 9.39	50.99 ± 7.28
MCH (pg)	18.80 ± 0.49	24.63 ± 1.97*	26.68 ± 4.59	28.13 ± 2.47**
MCHC (g/dl)	50.17 ± 1.73	54.22± 1.67	68.51 ± 12.56	64.91 ± 10.18
WBCs (x10³/µl)	9.48 ± 0.24	1.75 ± 2.75***	2.32±36.33***	2.74± 24.72***

Denote means values significant at P≤0.05, P*≤0.01 and P***≤0.001.

Table (2) Alterations in hematological parameters in suspected diseased cases during treatment with different acaricides within 3months

Parameters' groups	Angus			Simmental			Holstein		
	Diseased (N=10)	1month treatment	2month treatment	Diseased (N=10)	1month treatment	2month treatment	Diseased (N=10)	1month treatment	2month treatment
PCV %	21.10±1.73[a]	29.50±1.08[b]	28±0.73[b]	14.10±2.31[a]	26.10±2.01[b]	29.30±0.81[b]	14.10±1.54[a]	28.40±1.03[b]	27.90 ± 0.56[b]
Hb (g/dl)	10.98±0.70[a]	11.52±0.65[a]	13.40±0.37[b]	7.75 ± 0.93[b]	10.56 ± 0.65[a]	13 ± 0.41[c]	8.48 ± 1.07[a]	12.17 ± 0.43[b]	13.48 ± 0.24[c]
RBcs (x106/µl) (x10⁶/µl)	4.60 ± 0.31[a]	5.57 ± 0.33[a]	7.30±0.20[b]	3.35 ± 4.84[b]	4.65 ± 6.14[a]	6.14 ± 3.44[c]	3.11 ± 4.56[a]	5.88 ± 4.48[b]	6.06 ± 9.09[c]
MCV(fl)	46.79 ± 4.29[ab]	55.46± 5.06[a]	38.46±1.00[b]	48.84 ± 9.39[a]	61.55 ± 7.00[a]	49.03 ± 3.12[a]	50.99 ± 7.28[a]	50.51 ± 3.55[a]	123.33± 57.16[b]
MCH(pg)	24.63 ± 1.97[c]	21.54± 2.0[c]	18.57± 0.86[b]	26.68 ± 4.59[a]	24.36 ± 1.94[a]	21.68 ± 1.21[a]	28.13 ± 2.47[a]	22.08 ± 2.23[a]	59.19 ± 27.22[a]
MCHC(g/dl)	54.22± 4.67[ab]	39.86±3.22[a]	48.23± 2.04[b]	68.51± 12.56[a]	42.55 ± 3.66[a]	44.58 ± 1.52[a]	64.91± 10.18[a]	43.23 ± 1.87[a]	48.56 ± 1.60[a]
WBcs (x10³/µl)	1.75 ± 2.75[a]	1.24± 4.58[b]	1.1± 5.83[b]	2.32 ± 36.33[a]	13.63± 17.3[b]	9.8 ± 7.14[b]	2.74 ±24.72[a]	10.03± 3.95[b]	10.31 ± 4.67[b]

-Means with different super script are significant at p≤0.05

Table (3) Alterations in biochemical parameters in apparently healthy cattle and suspected diseased cases

Parameters/ groups	Apparently healthy cattle (N=10)	Suspected diseases cattle		
		Angus breed	Simmental breed	Holstein breed
Creatinine (mg/dl)	0.78 ± 0.01	0.96 ±0.28***	0.92 ± 0.01***	0.90 ± 0.16***
BUN(mg/dl)	13.65 ± 0.55	17.39± 0.57***	15.28 ± 0.62*	13.66 ± 0.67
ALP (U/L)	58.88 ± 0.63	74.90 ±1.58***	72.55 ± 1.89***	69.68 ± 1.97***
Glucose (mg/dl)	40.68 ± 0.77	42.22 ±0.44**	40.06 ± 0.54	38.42 ± 0.61**
AST (U/L)	70.20 ± 1.88	117.92± 1.66***	113.17± 2.06***	110.7 ±2.15***
ALT(U/L)	29.07 ±0.83	38.73 ± 1.00***	36.49 ± 1.08***	35.55 ± 1.16***
Total protein (g/dl)	6.78 ± 0.21	7.72 ± 0.08***	7.39 ± 0.09***	7.12 ± 0.10*
Albumin (g/dl)	2.83 ± 0.09	3.18 ± 0.10**	2.94 ± 0.11	2.72 ± 0.13
Total bilirubin (mg/dl)	0.50 ± 0.16	0.97 ± 0.004***	0.95 ± 0.005***	0.93 ± 0.10***

Denote means values significant at P≤0.05, P*≤0.01 and P***≤0.001.

**Number of each suspected group =10

Table (4) Alterations in biochemical parameters in suspected disease cases during treatment with different acaricides within 3months

Parameters/ groups	Angus			Simmental			Holstein		
	Diseased (N=10)	1month treatment	2month treatment	Diseased (N=10)	1month treatment	2month treatment	Diseased (N=10)	1month treatment	2month treatment
Creatinine (mg/dl)	0.96 ± 0.29[a]	0.94 ± 0.20[b]	0.78± 0..7[c]	0.92 ± 0.01[a]	0.91± 0.01[a]	0.76 ± 0.009[b]	0.905± 0.017[a]	0.904±0.014[a]	0.74± 0.011[b]
BUN(mg/dl)	17.39± 0.57[a]	15.00 ± 0.91[b]	11.33± 0.45[c]	15.28± 0.62[a]	14.45 ± 0.95[a]	11.06 ± 0.26[b]	13.66 ± 0.67[a]	14.33 ±0.99[a]	11.78± 0.26[b]
ALP (U/l)	74.90 ± 1.58[a]	73.93± 1.59[a]	61.74± 1.48[b]	72.55 ± 1.89[a]	72.75± 1.81[a]	60.12 ± 1.57[b]	69.68± 1.98[a]	72.62 ± 2.00[b]	59.85 ± 1.41[a]
Glucose(mg/dl)	42.22± 0.44[a]	40.76± 0.616[b]	42.17 ± 0.460[a]	40.06 ± 0.54[a]	39.45 ± 0.63[a]	40.05 ± 0.41[a]	38.42 ± 0.61[a]	39.03 ± 0.61[a]	38.83± 0.43[a]
AST (U/L)	117.92 ± 1.66[a]	113.16± 2.03[b]	80.16 ± 1.04[c]	113.17± 2.07[a]	111.82 ±2.35[a]	78.10 ± 0.93[b]	110.72 ± 2.1[a]	110.73± 2.1[a]	77.6± 0.68[b]
ALT(U/L)	30.73 ± 1.00[a]	36.20 ±1.14[a]	30.25± 0.44[b]	36.49 ± 1.08[a]	34.53 ± 0.98[a]	25.74 ± 1.12[b]	٢٥.٠٠± 1.16[a]	35.06± 1.07[a]	25.03± 0.84[b]
Total protein (g/dl)	7.72 ± 0.08[a]	7.06 ± 0.04[b]	6.73 ± 0.04[c]	7.39 ± 0.09[a]	6.83 ± 0.06[b]	6.50± 0.06[c]	7.12 ± 0.10[a]	6.78 ± 0.05[b]	6.76 ± 0.11[b]
Albumin (g/dl)	3.18 ± 0.10[a]	2.88 ± 0.11[b]	2.55± 0.06[c]	2.94 0.11[a]	2.80 ± 0.11[a]	2.28 ± 0.06[b]	2.72 ± 0.13[a]	2.78 ±0.13[a]	2.24 ± 0.04[b]
Total bilirubin (mg/dl)	0.97 ± 0.005[a]	0.93± 0.006[b]	0.67 ± 0.01[c]	0.95 0.005[a]	0.91 ± 0.009[a]	0.65 ± 0.01[b]	0.93± 0.01[a]	0.89 ± 0.01[a]	0.65 ± 0.01[b]

*Means with different super script are significant at P≤ 0.05

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Table (5) Efficacy of used acaricides on the average tick number on infested animal with interval 3 months:

Animal	Average tick number on infested animal						
	Before treatment	After treatment					
		1st month (Diazinone1/1000)	Reduction %	2nd month (Bytox 1/1000)	Reduction %	3th month (Deltamethrin5% and herbal mixtures)	Reduction %
Angas	200	180	10	100	44.44	50	50
Holstein	230	120	47.83	90	25.00	30	66.67
Simmental	190	100	47.37	18	82.0	0	100

Discussion

Diagnosis of Anaplasma in cattle depends on case history of disease and clinical signs appear on animals as anorexia, fever and severe anemia. Microscopically examination of current blood smears stained with Giemsa , revealed presence of *A.marginals* in erythrocytes (**Radwan et al , 2013**) .These results were in agreement with (**Kocan Km et al 2003**) who recorded that erythrocytes are carefully examined for presence of *A.marginals* in each blood smears 100 microscopic field were examined per slide found 10-50% infected blood cells . **Gale et al (1996)** stated that only level of 106 infected erythrocytes / ml could be detected by Giemsa staining. Traditional Giemsa staining method is not used for ideal diagnosis of carrier cattle and in contact animals.

Regarding to statistical analysis of hematological data in suspected disease and control groups as shown in **table (1)** revealed significant decrease ($p \leq 0.001$) in values of PCV , Hb and erythrocytic count in diseased cases (Angus , Simmental and Holstein) in comparison with control group which indicated anemia that may be due to immune mediated destruction of non-parasitized erythrocytes besides parasitized erythrocytes, the same results were recorded by (**Ashuma et al (2013) , Radwan et al (2013) , Abdel Hamid et al (2014), Singh et al (2014) and Bernardo et al (2016)** in infected cattle . In my opinion , increasing in number of WBCs in diseased cases may be attributed to response of animal body to combat of parasites in its body.

Biochemical profile panel as shown in table (3) revealed significant increase ($p \leq 0.001$) in total protein, total bilirubin and ALP in diseased cattle in comparison with control group cattle, this may be due to liver dysfunction and hemolysis as reported by the **Ashuma et al (2013) and Bernardo et al (2016)** in infected cattle. In my opinion, significant increase ($p \leq 0.001$) in BUN and Creatinine levels in diseased cattle may be attributed to decrease in water consumption in infected animal which lead to decrease renal blood flow .Results in table (2&4) which express hemogram and biochemical analysis under therapeutic trial in diseased cattle revealed improvement in all parameters with using deltamethrine 5% and herbal mixtures as chemical acaricides, this improvement nearly to values in apparent healthy cattle. Results in table (5) illustrated the average number of ticks on infested different cattle breeds before and after three months treatment. The reduction % of average tick number after treatment with selected acaricides for one month was approximate the same for Holistein and Simmental breeds (47.83& 47.37 respectively) , while Angas was the lowest reduction (10%).Post 2nd month treatment , Simmental breed was positively responded to the treatment and achieved highest reduction % of tick number (82.0) followed by Angas (44.44) while Holistein regressed to lowest response (25.00).Post 3rd month treatment , Simmental breed achieved 100% reduction in tick number followed by Holistein (66.67) while Angas proved lowest reduction % 50 . These results must be considered on establishing a new cattle farm and selecting the breeds that can positively respond to selected acaricides in case of attracting tick infestation and consequent socioeconomic impact of improper breed selection. **Bayer et al., (2004)** reported that Imported breeds, such as, Angus, Hereford, Simmental, Holstein and Brown Swiss, were differed in tick infestation and control than indigenous cattle.

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Conclusion

Regarding to therapeutic trials for all suspected diseased cases for three months with fixed regime as mentioned before with changing chemical acaricides substance every month and accordance to hemogram, biochemical panle analysis and average tick number before and after treatment, we can concluded that using Deltamethrine 5% and herbal mixtures as chemical acaricides has a great effect in competing tick infestation and recovery of animals to state nearly to healthy state animals.

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الملخص العربى

محاولة حقنيه للسيطره علي الاصابه بالقراد في الابقار المستورده باستخدام مضادات الحشرات المختلفه ودراسه تاثيرها علي بعض قياسات الدم والكيمياء الحيوية لمصل الدم

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اجريت تلك الدراسه بهدف استبيان التغيرات في بعض قياسات الدم والكيمياء الحيوية لمصل الدم في الابقار المصابه بالقراد وتقيم كفاءه مضادات الحشرات المختلفه في السيطره علي المشكله وتم اجراء البحث علي عدد 40 بقره مستورده قسمت لمجموعتين الاولى مجموعه طابطه (10 ابقار) والثانية مجموعه مصابه (30 بقره) 10 انجس و 10 سيمنتال و 10 هوليشتين .اخذت عينات دم من الابقار المصابه لعمل مساحات دمويه لفحصها تحت الميكروسكوب لمعرفه طفيل الدم المسبب للاصابه . كما تم اخذ عيناتين دم من كل حيوان في المجموعتين . واحده لتقيم صوره الدم والاخري لتقيم بعض عناصر البيوكيمائيه لسيرم الدم . اوضحت نتائج صوره الدم في الابقار المصابه انخفاض معنوى ملحوظ في عدد كرات الدم الحمراء ونسبه الهيموجلوبين والهيماتوكريت في الابقار المصابه مما يدل علي اصابتها بالانيميا . بينما اوضحت نتائج بعض العناصر البيوكيمائيه لسيرم الدم زياده معنويه ملحوظه للبروتين الكلي ، البليروبين الكلي و مستوى انزيم الالكلين فوسفاتيز في الابقار المصابه . كما اوضحت محاولات العلاج بمضادات الحشرات المختلفه وعلي حسب نتائج الصوره الدمويه والبيوكيمائيه واعدد القراد في الحيوانات المصابه بعد العلاج ان استخدام ماده الدلتاميثرين 5%مع مخلوط النباتات الطبيه لها نتائج فعاله في مكافحه القراد واعاده الحيوانات المصابه الي حاله مقاربه لحالتها الطبيعيه من حيث الصوره الدمويه والبيوكيمائيه.