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COMPARATIVE STUDIES ON REPRODUCTIVE MALE RABBITS AS AFFECTED BY IVERMECTIN OR BOTH OF GARLIC AND CINNAMON OILS TREATMENTS

1. ACARICIDAL EFFICACY OF IVERMECTIN, GARLIC AND CINNAMON OILS AGAINST *Sarcoptes scabiei* IN SUFFERING INFESTED RABBITS.

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Thirty-six V-Line male rabbits of ten months age, average weight 3.5 kg were used. They were allocated randomly into six equal groups. First and second were served as a negative (NC) and positive (PC) control, third group was injected by double therapeutic dose (DTD) 1mg/kg body weight of ivermectin via subcutaneous injection, fourth group was treated with 5% garlic oil (GO), fifth group was treated with 5% cinnamon oil (CO), while, sixth group was treated with 5% garlic oil + 5% cinnamon oil mixture (MO). Groups were treated GO, CO and MO received daily topically treatment for 7 successive days. Groups PC and IV were treated with paraffin oil and (DTD) ivermectin.

Results showed that*: Total disulfide (e.g. disulfide, Dipropyldisulfide, Propenyl propyl disulfide, allyl methyl disulfide) and Trisulfides, Diallyl (e.g. Dipropyl trisulfide) found in garlic oil. Cinnamic acid, Cinnamaldehyede, cinnamat, Caryophyllene, Cinnamyl acetate, Phellanderene, Pinene, Eugenil, and α-Terpinol found in cinnamon oil.*

Garlic or cinnamon oils and their mixture (5%) were highly efficacious against S. scabiei var. cuniculi larvae as 100 % mortality was reached 24 hrs. with treatment. On the other hand, all mites treated with oils (5 %) and ivermectin double dosage (1%) died 72 hrs.

Garlic or cinnamon oils (5%) and their mixture had a good acaricidal effect on the Sarcoptic scabie is similarly to ivermectin (1%) in vitro. In vivo treatment of P. soroptes sp. infections with the essential oil components trans-cinnamic acid resulted in high mite mortality.

Rabbits treated with ivermectin injection (IV) or garlic and cinnamon oils topically showed a significant increase in live body weight and feed intake compared with infested and untreated rabbits (PC). While, rabbits treated with garlic and cinnamon improved in live body weight and feed intake compared with those of infested and treated with ivermectin (IV).

Key words: *In vitro & in vivo, Cinnamomum zeylanicum (cinnamon), Allium sativum (garlic) oils extract, Ivermectin against, Sarcoptes scabiei var. cuniculi.*

Scabies is one of the common animals and human skin diseases. This disease is caused by a mite known as common itch mite (*Sarcoptes scabiei L*.). Sarcoptic mange belongs to the family sarcoptidae and is a highly contagious and burrowing parasite causes that inhabits the epidermis of the skin and feed on lymph and sloughed epithelial cells (Walton and Currie, 2007). *S. scabiei L.* can be difficult to eliminate in rabbits compared to other domestic animals (Aiello *et al*., 1998) it is a widely spread and a highly contagious disease throughout the World (Burgess, 1994) and an important ectoparasite in rabbits because of the possibility of zoonotic infection (Harrenstien *et al.*, 1995) and considerable losses in weight, productivity, wool, and fiber quality (Aiello *et al*., 1998). *Sarcoptes scabiei* var. *cuniculi* causes mange infestation in rabbits, affecting their ears, nose, feet, and areas around the genitalia, resulting in hypertensive reaction, body weight loss, and death (Aiello *et al.,* 1998) and lack of timely therapeutic intervention leads to clinical signs of anorexia, weight loss, meningitis and even death in rabbits (Singh *et al.,* 2012). Nowadays, chemical agents such as ivermectin demonstrate satisfactory resourceful range clinical efficacy against such parasites (Wen *et al*., 2010).

Ivermectin is one of macrocyclic lactones macrolide antibiotics belonging to group known avermectins and it is produced by a fungus *Streptomyces avermitilis*. Ivermectin has high potency and broad spectrum of activity against many nematode and arthropod parasites infesting (Atakisi *et al.,* 2009) in rabbits and (Gonzalez *et al.,* 2012) in human. The mechanism of anti-parasitic action of ivermectin is reported to be due to its interaction with glutamate and gama-inobutyric acid (GABA)-gated chloride channels, which cause influx of chloride ions, so it causes paralysis of many types of parasites Sutherland and Campbell (1990). On the other hand, their overuse can cause a development of resistance in the target (Terada *et al.,* 2010). Such side effects of chemical acaricides have prompted a search for new alternatives (Khater, 2013). The pharmacological properties of botanical acaricides or its ingredients are attributed as an antiviral (Frolove and Mishenkova, 1970) antibacterial, antifungal (Yoshida *et al.,* 1998) anthelmintic (Pena *et al.,* 1988) and antiparasitic (Anthony *et al.,* 2005) activities. Therefore, there is increasing interest in developing botanical acaricide agents. Prior research has shown that essential oils from *Eugenia caryophyllata* and *Cinnamomum zeylanicumcontain* active ingredients against *P.cuniculi* (Fichi *et al*., 2007b). *Cinnamic acid* has active component efficacy against *P*. soroptes in sheep (Wall and Bates, 2011). Also, *Allium* species are a rich source of phytonutrients, useful for the treatment or prevention of a number of diseases, (Lawson, 1998). *Moreover,*

Alliums are the largest and most important representative genus of the *Alliaceae* family and comprise 450 species, besides the well-known garlic and onion. Garlic (*Allium sativum*) is the most important *Alliums* species consumed all over the World. Essential garlic oil contains at least 33 sulfur compounds such as *allicin, alliin, ajoene, dially disulfide, dithiin, S-allylcysteine, trisulfide, vinyldithiine, allylpropl*, and others (Block, 1985).

Therefore, the current study aimed to investigate the effect of garlic, cinnamon and their mixture oils on *Sarcoptic scabiei* (Skin Mange), biochemical alterations of liver and kidney function, oxidative status, hormonal profile and semen quality.

MATERIALS AND METHODS

Experimental animals:

Thirty-six V-Line male rabbits of ten months of age weighting averaged 3.5 kg were used for the present study. They were housed in clean separate wire-floored metal cages and maintained under standard laboratory conditions at an ambient temperature of 25±2°C with 55-64% relative humidity and (16 h light and 8 h dark). They were allowed free access to a standard pelleted diet (17% crude protein, 2.56% crude fat and 2500 Kcal/kg-ration digested energy and 12% crude fiber). Food and water were available *ad libitum.* Rabbits were kept under the same manegerial and environmental conditions, during the experimental period.

Experimental Design:

Thirty-six male V-line rabbits that were allocated according to their initial live body weight at ten months of age into six equal groups (6 rabbits in each) as follow:

Group 1: It was served as a negative control (non-infested and non-treated) (NC).

Group 2: It was served as positive control (infested and non-treated) (PC)

Group3: An infested rabbits were treated with ivermectin injection by double therapeutic dose (DTD) 1mg kg-1 of ivermectin via subcutaneous injection (Atakisi *et al.*, 2009) (IV).

Group 4: Infested rabbits were treated with 5% garlic oil (GO) in paraffin oil.

Group 5: Infested rabbits were treated with 5% cinnamon oil (CO) in paraffin oil.

Group 6: Infested rabbits were treated with garlic and cinnamon, oils, (5% garlic oil + cinnamon oil 5%) (MO) in paraffin oil.

Groups were treated GO, CO and MO received daily topically treatment embrocating by 2.5 ml of therapeutic oil for 7 successive days.

Groups PC and IV were treated with paraffin oil and double therapeutic dose ivermectin (DTD) by injection 1 mg kg-1 of ivermectin (by embrocation) as the untreated positive and control groups, respectively

Experimental groups on the infested areas in limbs and pinna of rabbits after cleaning with warm water and removal of scabs according to Fichi *et al.*, (2007a). Rabbits in all groups were followed up by skin scraping and examination under stereomicroscope till complete recovery.

Analysis of essential oils:

The essential oils used in this study were provided by the Medicinal and Aromatic Plants Division belonging to Research Institute, Agricultural Research Center in Egypt. The chemical analysis of essential oils was done with a GC - ULTRA gas chromatography according to Adams (2007).

Clinical and laboratory examination:

Samples were collected from rabbit's skin lesions in symptomatic rabbits. Skin scrapings were taken from both distal forelimbs, using blunt scalpel blade dipped in physiological solution. Samples were collected and included dermis, epidermis, scales and hair. (Suckow *et al*., 2002).

Each sample was dissolved in 5 ml of 10% solution of potassium hydroxide (KOH). The mixture was stirred, centrifuged and the supernatant discarded. From each sample, a few drops of solution were placed on a slid for examination using a light microscope under x 40magnification. Graded infestation according to Aiello *et al*., (1998) as Low (++), medium (+++) and high (++++) when 2-4, 5-7, 8-10, respectively.

Acaricidal effect of oils (in-vitro):

The essential oil of garlic, cinnamon and mixture was diluted from the concentration of 5% in paraffin oil and 3 ml of each solution were added to a clean Petri dishes (4 m diameter), Containing 40 motile stages (larvae, nymphs, adults) of *Sarcoptic scabiei* and incubated at 35°C for 30 min (Fichi *et al*., 2007b). Three replicate were made for each treatment. The mites were exposed to the oil and mixture for 72 hr and mites' mortality was recorded at 24, 42 and 72 hr. All the motionless mites were stimulated with a needle, lack of reactions and persistent immobility indicated their death (Perrucci *et al*., 2001). The mites mortality observed in these dishes was compared with that observed in plate treated with 3 ml of ivermectin 1% (treated control) and 3 ml of saline (untreated control plate) and treatment groups. The percentage clinical therapeutic efficacy of each treatment was calculated as follows (Tabassam *et al*., 2008): (No. mites before treatment – No. mites after treatment) /No. mites before treatment × 100.

Live body weight and feed intake:

Live body weight and feed intake were recorded at 0(10 months of age), 7, 14 and 30 days of experiment period.

Statistical analysis:

All data were subjected to analysis of variance according to the statistical analysis system described by SAS, (2002). The differences among groups means were tested by using Duncan's multiple rang test (Duncan, 1955).

RESULTS AND DISCUSSION

***Chemical composition of the essential oils*:**

Gas chromatography analysis of garlic and cinnamon oils is presented in Table (1) the important components were positively identified. The analysis showed that total disulfide (e.g. *disulfide, Dipropyldisulfide, Propenyl propyl disulfide, allyl methyl disulfide*) and *Trisulfides, Diallyl* (e.g. *Dipropyl trisulfide*) in garlic oil. A*llium* species are characterized by their rich content in sulfur compounds that are responsible for the organoleptic parameters (and contribute to the antioxidant and antimicrobial activities of these vegetables (Corzo-Martinez *et al*., 2007). Similar results in garlic obtained by Benkeblia and Lanzotti, (2007).

Concerning the cinnamon oils compounds which represent *Cinnamic acid, Cinnamaldehyede, cinnamat, Caryophyllene, Cinnamyl acetate, Phellanderene, Pinene, Eugenil, and α-Terpinol*. However, many paper report eugenol as the main component of the oil of the leaves and *cinnamaldehyde* for the oil from the C. zeylanicum (Samarasekera *et al.*, 2005 and Fichi *et al*., 2007a). Similar results obtained by Emtenan *et al.*, (2010) showed that analysis of cinnamon is content thirty compounds were positively identified and *cinnamaldehyed* (57.37%) was the main compound of the extracted oil. Bioactive monoterpenes, e.g. *eugenol and terpinol*, were successfully identified and the reason of the good acaricidal activity Fichi *et al*., (2007b).

Laboratory and clinical examination:

Garlic or cinnamon oils and their mixture (5%) were highly efficacious against *S. scabiei* var. *cuniculi larvae* as 100 % mortality was reached 24 h with treatment groups. On the other hand, all mites treated with oils (5 %) and ivermectin (IV) double dosage (1%) died 72 h after treated. The lethal percentages of oils (GO, CO, MO) were 12.5, 17.5 and 10%, respectively. After 48 h of treatment as shown in Table 2, these results attempt to investigate the effect of garlic and cinnamon oils showed

Table 1: Some important compounds of the essential oils of garlic and cinnamon.

Compounds	Essentials oil%	
	Garlic	Cinnamon
Diallyl disulfide	**37.90**	**-**
Dipropyl disulfide	**0.25**	**-**
Dipropyl trisulfide	**Tr**	
Allyl methyl disulfide	**-**	
Methyl propyl disulfide	**3.69**	**-**
Diallyl sulfide	**Tr**	**-**
Disulfides	**14.30**	**-**
Total trisulfides	**23.16**	**--**
Cinnamaldehyde	**57.4**	**-**
Cinnamic acid	**-**	**52.37**
Cinnamate.	**-**	**3.34**
Caryophyllene oxide	**-**	**0.67**
Cinnamyl acetate	**-**	**0.64**
Phellandrene	**-**	**3.43**
Pinene	**-**	**4.21**
Eugenol	**-**	**1.17**
A-terpineol	**-**	**0.65**

a good acaricidal effect respect to the untreated controls with 100% mortality resembled ivermectin (1%) on *Sarcoptic scabies in-vitro.*

The degree of infection of each rabbit was performed and recorded according to the scoring criteria shown in material and methods. The mean degree of infestation was similar in each group at the start of the experiment and no significant differences were detected (Table 3 and Figure 1). The clinical scores were recorded on the 14^{th} day of treatment

Table 2: Effect of ivermectin or garlic, cinnamon and their mixture oils on mortality percentage of *Sarcoptic scabieis* (Lsmean ± SE) (*in vitro*).

Groups therapeutic	No. of mites	After 24 hours		After 48 hours		After 72 hours	
		NDM	MR	NDM	MR	NDM	MR
Negative Control (NG)	-	-	-	-	-	-	-
Positive control (PC)	40	5.0± 0.31^{cA}	12.5	8± 0.49^{cA}	20.0	10.0± 0.61^{bA}	25.0
IV (1%)	40	38.0± 2.32^{aA}	95.0	40± 2.44^{aA}	100	00± 0.00^{cB}	100
GO	40	23.0± 1.40^{bB}	57.5	35± 2.13^{abA}	87.5	40± 2.41^{aA}	100
CO	40	22.0± 1.34^{bC}	55.0	33± 2.01^{aB}	82.5	40± 2.44^{aA}	100
MO	40	24.0± 1.46^{bB}	60.0	36± 2.20^{abA}	90.0	40± 2.56^{aA}	100

^{ABC} different small letters within a column denote significant differences between the different treatments groups (P≤0.05). ^{ABC} different capital letters in within a row denote significant differences between the different treatments hours (P≤0.05). Ivermectin 1% = IV, negative control NC, positive control (untreated group) = PC, Garlic oil = GO, Cinnamon oil = CO, Mixture oils (garlic and cinnamon oils) = MO, Average number of dead mites = NDM, Mortality rate (%) =MR (%).

then till the end of the experiment (on the 30th day of treatment) as in Table 3. All infested rabbits treated with garlic and cinnamon oils (groups GO, CO and MO) recovered and were completely cured by day 30. Interestingly, no mites or eggs were ever observed or recovered from these scabs after examination. On the 30th day of therapeutics, the index scores of rabbits infested with *Sarcoptic scabies* and treated with garlic, cinnamon and mixture oils topically individual or mixture were not significantly changed when compared with those infested and treated ivermectin at (P≤ 0.05).

In the present study, garlic, cinnamon oils (5%) and their mixture had a good acaricidal effect on the *Sarcoptic scabie is* similarly to ivermectin (1%) *in vitro* (Table 2). These findings are nearly similar to that recorded by Birrenkott *et al*. (2000) revealed that topical use of garlic reduces northern fowl mite infestation in laying hens. Fichi *et al*.(2007b) suggested

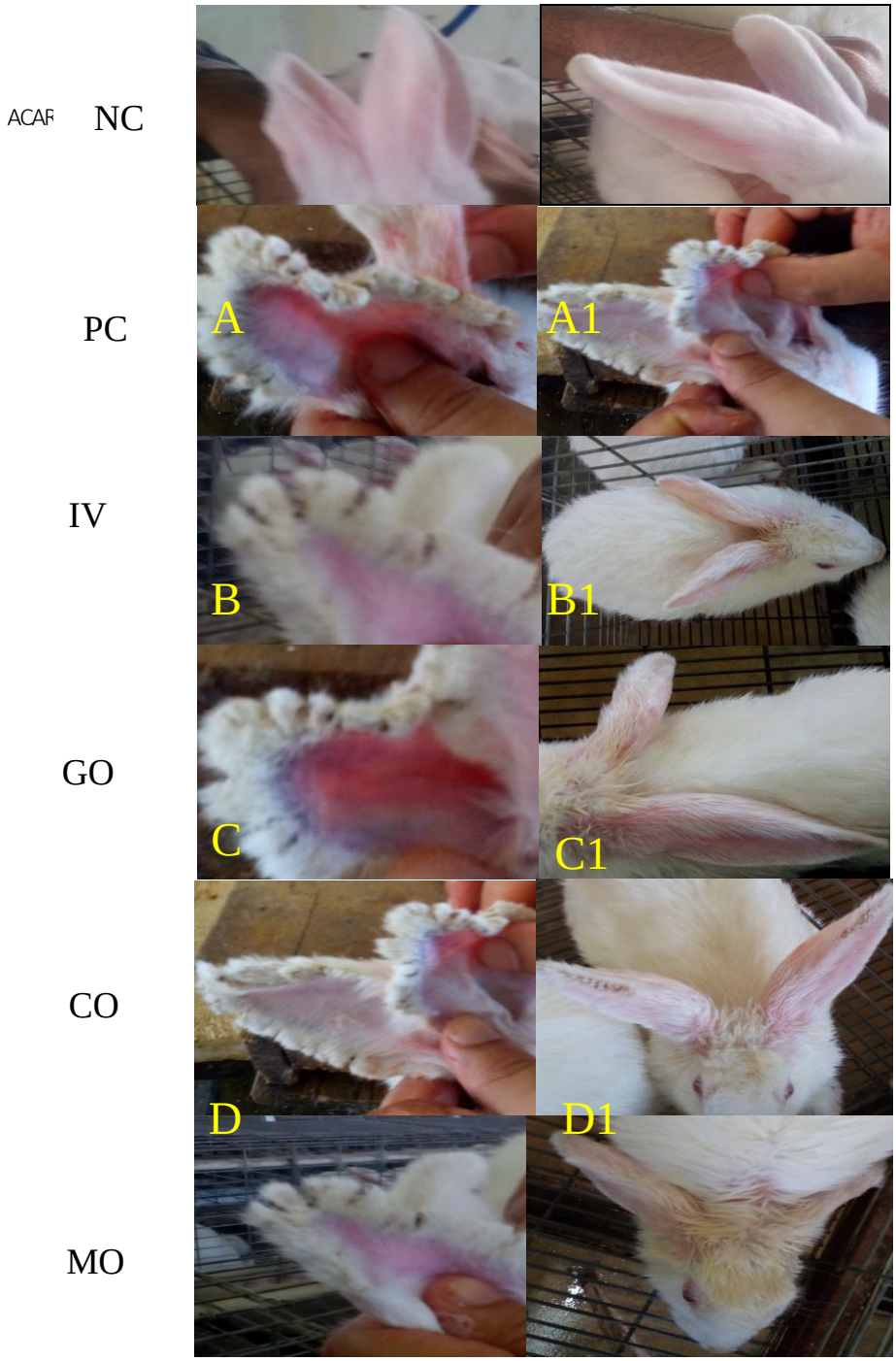
Table 3: Clinical score of infection and recovery degree for embody therapeutic of rabbits with ivermectin or garlic and cinnamon oils (Lsmean ± SE) (*in vivo*).

Days	Group1 (NC)	Group 2 (PC)	Group 3 (IV)	Group 4 (GO)	Group 5 (CO)	Group 6 (MO)
0	00.00 ±00^{aB}	3.25 ±0.18^{aA}	3.09 ±0.19^{aA}	3.19 ±0.18^{aA}	3.14 ±0.17^{aA}	3.32 ±0.19^{aA}
7	00.00 ±00^{aC}	3.10 ±0.19^{aA}	1.73 ±0.10^{bB}	1.92 ±0.12^{bB}	1.96 ±0.12^{bB}	1.92 ±0.12^{bB}
14	00.00 ±00^{aC}	3.22 ±0.20^{aA}	0.30 ±0.02^{cB}	0.52 ±0.03^{cB}	0.46 ±0.03^{cB}	0.40 ±0.02^{cB}
30	00.00 ±00^{aC}	3.17 ±0.19^{aA}	0.00 ±00^{cB}	0.15 ±0.01^{dB}	0.10 ±0.06^{dB}	0.12 ±0.01^{cB}

^{abc} different small letters within a row denote significant differences between the different treat groups (P≤ 0.05).

^{ABC} different capital letters in brackets within a column denote significant differences between the different treatment days (P≤0.05). Group NC = Negative control (non-infested and non-treated). Group PC =Positive control (infested and non-treated), with Paraffin oil, Group IV = therapeutic dose (DTD) 1 mg kg-1 of ivermectin, Group GO = Treated with garlic oil, Group CO = Treated with cinnamon oil, Group MO = Treated with mixture oils (garlic and cinnamon).

that the use of cinnamon oil against skin problems likes mange is visualized and also included many medicinal recipes are used for lice and other skin parasites. The *allicin* derivative products (*diallyl disulfide, diallyltrisulfide*) found in garlic essential oils have shown good antimicrobial (Kim *et al.*, 2004) and antioxidant activities (Amagase *et al*., 2001 and Banerjee *et al.,* 2003). Casella *et al*., (2012) showed that the garlic essential oil composition *diallyldisulfide and diallyltrisulfide* are the two major compounds. The current investigation, of the chemical composition of essential oil of cinnamon represented that the important component has antioxidant activity and may play a major role in therapeutic of *Sarcoptic scabiei*. Camkerten *et al*. (2009) showed that tight relationship between the *Sarcoptic scabiei* infestation and oxidant/antioxidant imbalance in dogs. This observation was harmony and agreement with this study whereas the oxidative status of the therapeutic animals is improved after recovery. Cinnamon oil consists of several compounds with known acaricidal or insecticidal activity. The neuro-insecticidial activity of eugenol was demonstrated on Periplaneta americana by Enan (2001). Previous study about the structure/activity relationship of some monoterpenes as acaricides against *P. cuniculi* (Perrucci *et al.,* 1995) showed a high *in vitro* activity of eugenol on this



Picture (1): Clinical observations of rabbits treated with ivermectin (IV), garlic oil (GO), cinnamon oil (CO) and their mixture (MO), respectively. A, B, C, D, E and F, show the signs of infection before treatment; A1, B1, C1, D1, E1 and F1 and show the signs of infection after treatment (30 days) for negative control (NC), positive control (PC), ivermectin (IV), garlic oil (GO), cinnamon oil (CO) and their mixture (MO), respectively.

mite species both by direct contact and by contact only with their vapor phase. In another study (Yang *et al*., 2005), cinnamyl acetate showed insecticidal activity against pediculus human us capitis, thus confirming previous reports on the insecticidal properties of cinnamyl acetate (Cheng *et al*., 2004).

In vivo treatment of *P. soroptes sp*. infestations with the essential oil components *trans-cinnamic* acid resulted in high mite mortality. Likewise, infected sheep treated with *trans-cinnamic* acid were completely cured of scab and reduction in mite abundance and scab size (Wall and Bates, 2011). Harmony with the present study, Anthony *et al.,* (2005) and Seddiek *et al.,* (2008) showed that garlic extract plant medicament using natural garlic extract was considered as an efficient and safe alternative therapy for treatment of rabbit's ear mange and garlic extract did not cause tissue residues. Thereby, it solves the problems resulted in pesticides including toxicity, tissue residues and drug resistance besides its public health concern. Also, Anthony *et al.,* (2005) demonstrated that direct acaricidal effect of *allicin* substance of garlic extract on parasite when treated with garlic extract topically. Yazwinski *et al.,* (2005) who found that the application of 10% garlic oil resulted in significant reduction of mite populations. Emtenan *et al.*, (2010) mentioned that the cinnamon essential oil good curative effect for the skin lesions in rabbits.

Fichi *et al*., (2007a&b) reported that whole essential oils of cinnamon shown to have high levels of acaricidal efficacy against *P.cuniculi* in rabbits at concentrations of 2.5%. Fichi *et al*., (2007b) reported that the component of essential oil of cinnamon is fare effect variable depending on locality variable, locality of growth and the organ used. Zampieron and Kamhi, (2000) documented that the essential oils are natural and volatile complex component characterized by strong odor and are formed by aromatic plants as secondary metabolites and their antiseptic, bacterial, veridical, fungicidal and acraricidal medicinal properties.

Live body weight and feed intake:

Mean live body weight and feed intake of infestation rabbits treated with ivermectin injection (IV) or garlic and cinnamon oils topically showed a significant ($P \leq 0.05$) increase compared with infested and untreated rabbits (PC). Infested rabbits treated with garlic and cinnamon significantly ($P \leq 0.05$) improved in live body weight and feed intake compared with those of infested and treated with ivermectin (IV), (Figures 1 & 2). Infested male buck rabbits showed loss body weight (Figure 1) with reduced feed intake (Figure 2), severe itching of the skin, dullness and did not show any sexual

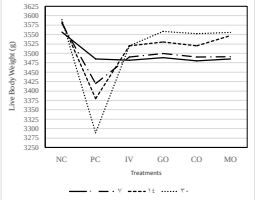


Figure 1. Effect of treating rabbits by ivermectin, garlic oil, cinnamon oil and its mixture on body weight.

behavior and finally die. While, uninfected group showed normal weight, feed intake and sexual behavior.

These findings are in agreement with Anthony *et al.*, (2005) who mentioned that the increase of body weight and feed intake may be attributed to the direct antiparasitic effect of allicin substance of the garlic on the mites besides its indirect effects as antibacterial, antifungal, and anthelmintic activities. Shin *et al.*, (1995) indicated that cinnamon bark has a wide range of activities such as stimulation of feed intake and endogenous secretions, and also has positive effects on blood metabolites. Also, insulin potentiating factor (IPF) which was isolated from cinnamon bark has lowered plasma glucose levels by increasing the activity of insulin in glucose metabolism (Anderson *et al.*, 2001). Marieb and Hoehn(2010) showed that increasing levels of cortisol in ivermectin therapeutic rabbits are a clear indication of the stress condition of those animals. Mitrou *et al.*, (2010) mentioned that the therapeutic by ivermectin that elevation indicate

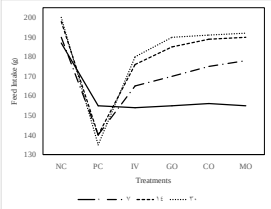


Figure 2. Effect of treating rabbits by ivermectin, garlic oil, cinnamon oil and their mixture on feed intake.

the happening of muscle injuries which might be induced by a significantly increased serum T_3 and T_4 which consequently accelerates the muscle protein degradations which accompanied by weight loss is the major clinical sign was observed due to the increased protein degradation by increased thyroid hormones.

Conclusively, the present data indicated that *Cinnamomum zeylanicum* and *Allium sativum* oils had in vitro and in vivo acaricidal efficiency similar to that of ivermectin and improved the therapeutic status of rabbits without inducing adverse effects on treated rabbits; consequently, oils uses could be suitable as a promising alternative acaricide for veterinary use.

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Zampieron, E. and E. Kamhi (2000). Cinnamon therapeutic uses. *Healthy and Natural Journal Dec*. **اين ارقام الصفحات**

دراسات مقارنة على الكفاءة التناسلية لذكور الأرانب المعاملة بالإيفرمكتين أو كل من زيت القرفه أو زيت الثوم.

أ- التأثير القاتل لكل من الإيفرمكتين وزيت كل من الثوم والقرفة على أكاروس جرب الجسم فى الأرانب المصابه.

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إستخدم فى هذة التجربة عدد ٣٦ ذكر أرنب عمر ١٠ شهور بمتوسط وزن ٣,٥ كيلو جرام وزن حى من خط الفى لاين، حيث تم توزيعهم عشوائيا إلى ٦ مجاميع تجريبية كالتالى:

المجموعه الأولى : كنترول (بدون معاملة).

المجموعه الثانية : كنترول موجب

المجموعة الثالثة : تم الحقن تحت الجلد بجرعة ١مجم/كجم وزن حى من عقار إيفرمكتين ١% بجرعتين بينهما ١٤ يوم.

المجموعة الرابعة: تم معاملة الأرانب موضعيا بزيت الثوم ٥% فى زيت برافين لمدة ٧ أيام متصله.

المجموعة الخامسة: تم معاملة الأرانب موضعيا بزيت القرفة ٥% فى زيت برافين لمدة ٧ أيام متصله.

المجموعة السادسة: تم معاملة الأرانب موضعيا بخليط من زيت الثوم ٥% + زيت القرفة ٥% فى زيت برافين لمدة ٧ أيام متصله.

وقد أوضحت النتائج مايلى:

- زيت الثوم يحتوى على العديد من المركبات الكبريتية الثنائية والثلاثية، كما يحتوى زيت القرفة على عدد من المركبات الفعالة مثل حامض السينامیك.
- وجد أن إستخدام زيت الثوم أو زيت القرفة كل بمفردة أو خليطهما بتركيز ٥% فى زيت برافين فى علاج جرب الأرانب أعطى تأثيرا شديدا على يرقات الجرب (معمليا) حيث تسبب فى قتلها بنسبة ١٠٠% خلال ٢٤ ساعة من المعاملة.
- كل طفيليات الجرب قتلت خلال ٧٢ ساعة من المعاملة بأى من زيت الثوم ٥%، أو زيت القرفة ٥% أو خليطهما أو الأيفرمكتين ١% (معمليا).
- زاد وزن الجسم وكمية الغذاء المأكول معنويا (مستوى ٥%) فى الأرانب المعاملة بكل من زيت الثوم أو زيت القرفة أو الإيفرمكتين مقارنة بمجموعة المقارنة الموجبة (PC).
- لوحظ تحسن كل من وزن الجسم وكمية الغذاء المأكول معنويا (مستوى ٥%) لمجاميع الأرانب المعاملة بزيت الثوم أو القرفة أو خليطهما مقارنة بالمجموعة المعاملة بالإيفرمكتين.
- لوحظ أن الأرانب المصابة بطفيل الجرب والغير معاملة (PC) تفقد وزنها بشكل متصاعد مع إنخفاض معدل تناول الغذاء مع فقد أى سلوك تناسلى حتى تنتهى إلى النفوق.

التوصية : من خلال هذه الدراسة وجد أن كل من زيت الثوم وزيت القرفة بتركيز ٥% له تأثير قاتل لأكاروس جرب الأرانب سواء معمليا أو على الحيوان نفسه مماثل لتأثير الحقن بالأيفرمكتين ١%، كما أدى إلى تحسن فى الحالة العلاجية للأرانب دون إحداث تأثيرات ضارة عليها مع تحسن وزن الجسم والغذاء المأكول.