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EFFECT OF MEDICINAL PLANTS AGAINST INTESTINAL COCCIDIOSIS AND CAPILLARIASIS INFECTING PIGEONS

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Abstract

This study evaluated the effect of garlic and black pepper against *Eimeria columbae* & *Capillaria obsignata* naturally infected 400 pigeons (*Columba livia*), fecal samples and crop swaps. Pigeons were divided into six groups of 10 pigeons each. G1: Control not treated. G2: Received 7garlic cloves (9.13gm/pigeon) orally as a single dose. G3: Received black pepper kernels (0.64gm/pigeon) orally as a single dose. G4: Received orally garlic cloves (9.13gm/pigeon) and 7 black pepper kernels (0.64gm/pigeon). G5: Received Meterindazole® 250mg/liter of drinking water for three days. G6: Received a combination of 1g Amprolium® & 2g Piperazine®/ liter drinking water for three days.

The results showed that *E. columbae* oocysts and *C. obsignata* eggs 2 & 5 days post-treatment significantly decreased ($P< 0.05$) compared to controls. Combined garlic and black pepper gave same effect as meterindazole and the other two. Stained crop smear did not show trichomoniasis.

Key words: Garlic, Black pepper, Pigeons, *Eimeria columbae, Capillaria obsignata*.

Introduction

Coccidiosis is one of the serious protozoan diseases of poultry caused by genus *Eimeria*, which usually inflict on the gastrointestinal tract leading to decrease feed intake, weight gain, feed efficiency, high mortality and decrease productivity of pigeon flock (Tanweer *et al,* 2014; Chand *et al,* 2016). Also, the gastrointestinal tract usually contained nematodes (Coppi *et al,* 2006), risk economic losses and welfare issues (Bould *et al,* 2009). Drugs resistance with side effects on animal products pave the way to alternative treatment strategies as medicinal herbs and plants (Kumar *et al,* 2010), in treating infectious and communicable diseases (WHO, 2014).

Garlic (*Allium sativum*) with alkaloids as allin, ajoene, allicin and diallylsulphide sallylcysteine (Adibmoradi *et al,* 2006) was one of the medicinal plants with inhibitory activity against parasites, bacteria, viruses and fungi, antihypertensive, anticancer, anti-atherosclerotic, immune-stimulant, hypoglycemic and cardio-protective as well as dental and oral diseases (Abouel-Nour *et al*, 2016; Alali *et al,* 2017, Hoglund *et al,* 2020). Also, garlic proved effective veterinary medicines (Viegi *et al,* 2003; Peachey *et al,* 2015). Black pepper (*Piper nigrum* L.) is historically one of the most important spices and herbal medicines, and is now cultivated worldwide (Dosoky *et al,* 2019). Also, metronidazole, amprolium and piperazine are known anti-parasitic chemical drugs (Tojo and Santamarina, 1998)

This study aimed to evaluate the effect of garlic & black pepper in treating pigeons natural infected coccidiosis and capillariasis as compared with Meterindazole®, Amprolium® and Piperazine®.

Material and methods

Pigeons: Four hundred adults (*C. livia*), native breed weighted (200-350gm) were obtained from the Poultry Farm, Faculty of Agriculture, Assiut University. They were housed in separate well-ventilated mesh floor cages (200x100x80cm), with temperature 25 to 35°C & relative humidity 60 to 70%.

Fresh fecal samples were collected in clean labeled plastic sacks, and microscopically examined for parasites by stained direct smear and floatation methods (Garcia, 2001), Also, 400 Giemsa stained crop smears were examined for *Trichomonas* (Begum *et al,*

2008). Diagnostic stages were measured by using an eyepiece micrometer.

Treatment: Sixty naturally infected pigeons were divided into six groups of 10 pigeons each. G1: control did not receive treatment. G2: treated with garlic cloves (9.13 gm/pigeon). G3: treated with black pepper kernels (0.64gm/pigeon), G4: treated with garlic cloves (9.13gm/pigeon) with black pepper kernels (0.64gm/pigeon), G5: treated with meterindazole 25mg/liter of drinking water for three days, and G6 treated with a combined of 1g amprolium & 2g piperazine/liter of drinking water for three days.

The garlic and black pepper were locally purchased, and the drugs were purchased as well Veterinary Pharmacy. All of garlic cloves and black pepper were oral administrating for one time as a single dose. Fecal samples were collected from pigeons in the second and five days post-treatment.

Statistical analysis: Data were analyzed by using SAS (2001) programing, version 8.2. Effect of treatments was evaluated by one-way ANOVA. Significant differences were tested by Duncan multiple range test (Steel and Torrie, 1980), significance was $P<0.05$. The following equation was used $Y_{ij} = \mu + T_i + E_{ij}$, Where, Y_{ij} = experimental results, μ = general mean, T_i = effect of treatment, where i = G1, G2, G3, G4, G5 & G6, & E_{ij} = terrors related to individual observation

Results

The fecal samples of 400 pigeons showed that parasites were 77.8%. *Eimeria columbae* was 33% and *Capillaria obsignata* 28% & mixed infection (16.75%). *E. columbae* oocyst measured 16.25-12.5x10-15µm with completed sporulation in 2 to 3days**.** *C. philippinensis* eggs ovoid, with a thick shell, two polar plugs, and a single cell. Pigeons were highly emaciated, dehydrated, anemic with dead feathers and brittle. Details were given in tables (1 & 2) and figures (1, 2, 3 & 4).

Table 1: Parasites in fecal samples of pigeon

Parasites	Infected	Positive %
Eimeria columbae	132	33%
Capillaria obsignata	112	28%
Mixed infection	67	16.75%
Total	311	77.8%

Table 2: **A**nti-parasitic effect of garlic cloves and black pepper kernels on *Eimeria columbae* and *Capillaria sp.*

Time PT/days	parasites	Treatment						P - Value
		G1	G2	G3	G4	G5	G6	
Two	*E. columbae*	46.7±2.39^{a}	24.20±1.32^{b}	25.90±0.97^{b}	15.30±1.24^{c}	17.70±0.80^{c}	5.10±0.50^{d}	0.0001
	C. obsignata	12.70±0.74^{a}	7.10±0.38^{b}	3.60±0.45^{c}	0.70±0.26^{d}	2.00±0.55^{d}	1.3±0.37^{d}	0.0001
Five	*E. columbae*	45.4±2.10^{a}	11.10±0.48^{b}	11.80±0.57^{b}	3.30±0.42^{c}	3.60±0.62^{c}	3.00±0.54^{c}	0.0001
	C. obsignata	12.10±0.62^{a}	2.90±0.55^{b}	1.10±0.40^{c}	0.70±0.21^{c}	0.90±0.28^{c}	0.70±0.21^{c}	0.0001

^{a,b,c,d} Values in same row with different superscripts differ significantly ($p<0.05$).

E. columbae oocysts or *C. obsignata* eggs significantly decreased ($P< 0.05$) on second day post treatment with oral combination of garlic cloves an black pepper kernels in G4 than oral administration 3 garlic cloves alone or black pepper kernels alone in G2 & G3, respectively. Combination garlic and black pepper gave equal result as meterindazole in drinking water (G5). Adding amprolium and piperazine to drinking water (G6) was more effective ($P< 0.05$) compared with other treatments. After 5 days post treatment with garlic, black pepper and three drugs, *E. columbae* oocysts and/or *C. obsignata* eggs decreased significantly ($P< 0.05$) compared to controls. Garlic and black pepper combined with medicinal drugs significantly ($P< 0.05$) cured infections as compared with G2 & G3.

Discussion

In the present study, the pigeons were infected with *E. columbae* oocysts and *C. obsignata.* This agreed with Parsani and Momin (2010) in India who reported that coccidiosis and capillariasis were common in pigeons, which might be due to high abundance and resistance to common sanitizers and environmental conditions (Soulsby, 1982). Besides, the contaminated premises or soil act as a source for transmitted parasites (Islam *et al,*

2009). The present signs and symptoms due to *C. obsignata* and *E. columbae*, agreed with Sood *et al.* (2018) who found that diseased pigeons showed emaciation, ruffled feathers and diarrhea fecal droppings.

In the present study, garlic and pepper given once orally to pigeons cured infection, particularly in five days post-treatment. Heckendorn (2005) found that tannin bind with to proteins on the nematode surface disturbing normal physiological functions as food absorption, mobility, or reproduction. Gaafar (2012) found that garlic successfully eradicated the *Cryptosporidium* oocysts from stool and intestinal sections of the infected immunocompetent mice received garlic two days before infection. Khan *et al.* (2012) reported that garlic increased the white blood cells, antibodies improving phagocytosis of *Eimeria* infective stages. Kim *et al.* (2013) reported that allicin stimulated immunity by increasing profiline antibody response in *E. acervulina* in chickens to kill oocysts. Ali *et al.* (2019) found that ginger and garlic in little amount diminished oocyst/gm feces in *Eimeria* treated birds as compared to positive control. As to pepper, Sudhakar *et al.* (2013) who found that piperine 10mg/ml gave significant anthelmintic activity. Also, Thiengsusuk *et al.* (2018) reported that piperine exposure gave marked change in *P. falciparum* clone within 48hrs.

Generally, garlic bulb phytochemical alkaloids contain terpenoids, flavonoids, steroid, phenol, tannin, anthraquinones, saponin, and cardiac glycosides (Bin *et al,* 2020). Piperine, an active pepper ingredient contains photochemistry as volatile oil, oleoresins, and alkaloids immuno-modulatory, antioxidant, anti-asthmatic, anti-amoebic, anti-carcinogenic, antiulcer and anti-inflammatory activities (Meghwal and Goswami, 2013). Strong activity of these alkaloids active body immune system, and strengthens defense mechanism (Masamha, 2010).

Conclusion

Oral administrated of garlic (9.13gm/bird) and black pepper kernels (0.64gm/pigeons) with or without metronidazole, amprolium and piperazine combination were effective for treating *Eimeria columbae* and *Capillaria obsignata* adult pigeons.

References

Abouel-Nour, MF, El-Shewehy, DMM, Hamada, SF, Morsy, TA, 2016: The efficacy of three medicinal plants; garlic, ginger and mirazid and a chemical drug metronidazole against *Cryptosporidium parvum*: ii- Histological changes. J. Egypt. Soc. Parasitol. 46, 1:185-200

Adibmoradi, M, Navidshad, B, Seifdavati, J, Royan, M, 2006: Effect of dietary garlic meal on histological structure of small intestine in broiler chickens. J. Poultry Sci. 43, 4:378-83

Alali, FQ, El-Elimat, T, Khalid, L, Hudaib, R, Al-Shehabi, TS, *et al,* 2017: Garlic for cardiovascular disease: Prevention or treatment. Curr. Pharm. Des. 23:1028-41.

Ali, M, Chand, N, Khan, RU, Naz, Sh, Gul, S, 2019: Anticoccidial effect of garlic (*Allium sativum*) and ginger (*Zingiber officinale*) against experimentally induced coccidiosis in broiler chickens. J. Appl. Anim. Res. 47, 1:79-84.

Begum, N, Mamun, MAA, Rahman, SA, Bari, ASM, 2008: Epidemiology and pathology of *Trichomonas gallinae* in the common pigeon (*Columba livia*). J. Banglad. Agril. Univ. 6, 2:301-6.

Bin, C, Al-Dhabi, NA, Esmail, GA, Arokiyaraj, S, Arasu, MV, 2020: Potential effect of *Allium sativum* bulb for the treatment of biofilm forming clinical pathogens recovered from periodontal and dental caries. Saudi J. Biol. Sci. 27, 6: 1428-34.

Bould, JG, Elsheikha, HM, Morsy, TA, 2009: Avian coccidiosis: the basic pathology to control. J. Egypt. Soc. Parasitol. 39, 1:85-98.

Butt, MS, Pasha, I, Sultan, MT, Randhawa, MA, Farhan Saeed, F, *et al,* 2013: Black pepper and health claims: A comprehensive treatise. Crit. Rev. Food Sci. Nutr. 53, 9:875-86.

Chand, KK, Lee, KM, Lavidis, NA, Rodriguez-Valle, M, Ijaz, H, *et al,* 2016: Tick holocyclotoxins trigger host paralysis by presynaptic inhibition. Sci. Rep. 6:29446**.**

Coppi, A, Cabinian, M, Mirelman, D, Sinnis, P, 2006: Antimalarial activity of allicin, a biologically active compound from garlic cloves. Antimicrob. Agents Chemother.50:1731-7.

Dosoky, NS, Satyal, P, Barata, LM, da Silva, JK, Setzer, WN, 2019: Volatiles of black pepper fruits (*Piper nigrum* L.). Molecules 24, 23:42

-44
Gaafar, MR. 2012: Efficacy of *Allium sativum* (garlic) against experimental cryptosporidiosis. Alex. J. Med. 48:59-66.
Gracia, LS, 2001: Diagnostic Medical Parasitology. ASM Press; Washington, DC.
Heckendorn, F, 2005: Kondensierte Tannine - Eine Möglichkeit zur Kontrolle von Magen-Darm-Würmern? Forum1/2, pp 11-13
Hoglund, KB, Barnett, BK, Watson, SA, Melgarejo, MB, Kang, Y, 2020: Activity of bioactive garlic compounds on the oral microbiome: a literature review. Gen. Dent. 68, 3:27-33
Islam, A, Trisha, AA, Das, M, Amin, MR, 2009: Retrospective study of some poultry diseases at Gaibandha district in Bangladesh. Banglad. J. Vet. Med. 7, 1:239-47.
Khan, RU, Naz, S, Nikousefat, Z, Tufarelli, V, Javdani, M, *et al,* 2012: Potential applications of ginger (*Zingiber officinale*) in poultry diet. World's Poultry Sci. J. 68:245-52.
Kim, DK, Lillehoj, HS, Lee, SH, Lillehoj, EP, Bravo, D, 2013: Improved resistance to *Eimeria acervulina* infection in chickens due to dietary supplementation with garlic metabolites. Br. J. Nutr. 109:76-88.
Kumar, A, Lakshman, BS, Jayaveera, K, Nandeesh, KN, Manoj, R, *et al,* 2010: Comparative in vitro anthelminthic activity of three plants from family Amaranthaceae. Arch. Biol. Sci. 62, 1:185-9.
Masamha, B, Gadzirayi, CT, Mukutirwa, I, 2010: Efficacy of *Allium sativum* (garlic) in controlling nematode parasites in sheep. Inter. J. Appl. Res. Vet. Med. 8, 3: 161-9.
Meghwal, M, Goswami, TK, 2013: *Piper nigrum* and piperine: an update. Phytother. Res. 27, 8:1121-30.
Parsani, HR, Momin, RR, 2010: Prevalence of Nematode infection of pigeons of Gujarat state, India. Zool. Print (web version). 25, 10:32-4.
Peachey, LE, Pinchbeck, GL, Matthews, JB, Burden, FA, Mulugeta, G, *et al,* 2015: An evidence based-approach to the evaluation of ethnoveterinary medicines against strongyle nematodes of equids. Vet. Parasitol. 210:40-52.
Sood, NK, Harkirat, S, Sukhmeet, K, Ashwani K, Raj Sukhbir S, 2018: A note on mixed coccidian and *Capillaria* infection in pigeons. J. Parasit. Dis. 42, 1:39-42.
Soulsby, EJL, 1982: Helminths, Arthopods and Protozoa of domesticated animals (7th Ed), ELBS and BailliereTindall, London.
Sudhakar, S, Basha, SC, Kumar, KS, Hajivalli, S, Singotam, M, *et al,* 2013: Anthelmintic activity of piperine from black pepper. J. Glob. Trend. Pharmac. Sci. 4, 1:1013-7.
Thiengsusuk, A, Muhamad, P, Chaijaronkul, W, Na-Bangchang, K, 2018: Antimalarial activity of piperine. J. Trop. Med. vol. 2018; https: //doi.org/10.1155/2018/9486905.
Tojo, JL, Santamarina, MT, 1998: Oral pharmacological treatments for parasitic diseases of rainbow trout *Oncorhynchus mykiss*. I: Hexamita salmonis. Dis. Aquat. Organ. 33, 1:51-6.
Viegi, L, Pieroni, A, Guarrera, PM, Vangelisti, R. 2003: A review of plants used in folk veterinary medicine in Italy as basis for a databank. J. Ethnopharmacol. 89:221-4.
WHO, 2014: Traditional Medicine Strategy. Geneva, at:who.int7 irislbitstream710665l92455 lll 9789241506090eng.pdf?ua=1.

Explanation of figures

Fig.1: Usporulated *Eimeria columbae* oocyst x100
Fig. 2: Sporulated *Eimeria columbae* oocyst x100
Fig.3: immature egg Capillaria sp. X40
Fig. 4: Parasitic diseased pigeon