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Test the Activity of Supplementation Clove (*Eugenia caryophyllus*) Powder, Oil and Aqueous Extract to Diet and Drinking Water on Performance of Broiler Chickens Exposed to Heat Stress

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Abstract: The aim of this study was to investigate the effect of supplementing powder, oil and aqueous extract of clove to diet and drinking water on some productive and physiological parameters of broiler exposed to cyclic temperature 28-35-28°C. One hundred and sixty one day old unsexed Ross broiler chicken were used, reared on litter to 3 week, birds fed a starter diet contain 22.7% crude protein and 2935.7 Kcal ME/Kg diet and from 4-8 weeks in batteries, birds fed a finisher diet contain 20.2% crude protein and 3034.8 Kcal ME/Kg diet, management and health instruction for rearing Rose broiler was offered. Five treatments (four replicate each treatment) were carried out. Treatment T0 without supplementing clove to diet and drinking water, treatments T1, T2 supplementing 0.8, 0.4% of clove powder to diet respectively, treatment T3 supplementing 0.8% of clove oil to diet, treatment T4 supplementing 0.4% of clove aqueous extract to drinking water, this supplementation of clove to diet and drinking water was given to broiler daily for 9 hours from 900-1800 hours which the highest environmental temperature from 1200-1800 hours during experiment period 4-8 weeks of age and the relative humidity was 45-50%. The results revealed that there were a significant ($p < 0.01$) decrease in feed consumption in all treatments compared with T0 also there was an improvement in feed efficiency ratio in T1, T2 compared with other treatments at 5 week of age, meanwhile at 7 week of age feed consumption increase significantly in T2, T3, T4 compared with T0, T1 while feed consumption ratio improved significantly in T0, T1 compared with T2, T4, no significant effect on live body weight, weight gain, growth rate at 5, 7 weeks of age. At 5 week of age the pattern of feed consumption revealed a significant decrease in T1 compared with T2 at 1200 hours, also T1 reduced significantly compared with T3, T4 at 1500 hours while T2 reduced compared with other treatments at 1800 hours however in 7 weeks of age there was a reduction in T4 compared with T0, T2 at 1500 hours. At 7 week of age the pattern of water consumption reduced significantly in T1, T2 compared with other treatments at 1200 hours and T4 reduced compared with other treatments. Body temperature at 5 week of age increased in all treatments compared with T0 at 1800 hour while at 7 week of age T2, T3, T4 reduced compared with T0 at 900 hour and T3 reduced compared with T4 at 1200 hour and also T0, T3, T4 reduced compared with T1. From this study we can concluded that there was a little improvement in clove supplementation to diet and drinking water of broiler exposed to heat stress.

Key words: Heat stress, broiler, clove, clove oil, aqueous extract

INTRODUCTION

The summer in Iraq lasted for more than six months and this high environmental temperature constitute a large and complex problem for poultry producer. Heat stress causing deterioration of productivity and physiological traits (Sahin *et al.*, 2005; Ahmed *et al.*, 2008). Many methods were used to reduce the harm effects of heat stress such as mineral, glucose, vitamin C supplementation to drinking water or diet (Ibrahim *et al.*, 2002; Ibrahim and Shukri, 2002; Ibrahim and Al-Hammami, 2004) also fasting, dewinging, acclimation (Al-Hassani and Ibrahim, 1992; Al-Hassani and Ibrahim, 1994; Ibrahim and Al-Hassani, 1997), Medicines supplementation is another methods (like morphine, pethidine, heroin, aspirin, paracetamol) (Al-Qarawi,

2002) but medicines have adverse effects on consumer health as a result of accumulation or deposition in the body of birds and thus their transition to the consumer, we interested to find alternative materials safe and cheap and taking into account the availability in the market. For this reason recently we use herbal sources as a tool to reduce heat effect on poultry such as, black seed, oats, date pit, red pepper, rice bran, chamomile (Ibrahim and Al. kafagy, 2007; Butrus, 2007). Clove, considered as a spices and appetizer (Lawless, 1995; Barbara, 2003) and contains 10% volatile oils which most of it eugenol, a substance that have an anesthetic effects (Prashar *et al.*, 2006) also contain vitamins B, C (Merrill and Perry, 2009). Vitamin C involve in stress hormones synthesis thus has a major role in reducing

body temperature by enhancing heat dissipation through blood vessels that surrounding the body to maintain a relatively constant temperature (Pardue, 1983; Cheng, 1990); also clove contains phenols compounds that are anti-bacterial agents (Atherden, 1969; Dorman and Dean, 2000) there was not any previous attempts to use in mitigating the phenomenon of heat stress in poultry. Most research and studies conducted on the clove and clove oil was in the laboratory animals but in poultry rear research conducted within normal circumstances and for this came this experiment to study the effect of adding different forms of clove (powder, oil and aqueous extract) in concentrations (0.4, 0.8%) of the powder and the concentration (0.8%) of oil to the diet and the concentration (0.4%) of the aqueous extract to drinking water and are added during the period of heat stress for 9 hours a period of 3 hours before a summit of high temperature and thus the goal of this experiment is to reduce the impact of heat stress experienced by birds.

MATERIALS AND METHODS

This study was conducted in the field of poultry in the Department of Animal Resources, Faculty of Agriculture University of Baghdad, the target of this study was to test the effectiveness of Clove (*Eugenia caryophyllus*) powder and oil addition to the diet and the aqueous extract to drinking water of broiler chicken exposed to heat stress.

One day old 160 unsexed chick type Rose raised on the floor from one day old up to 3 weeks and from 4-8 weeks old raised in five batteries, of four tiers each (77x81 cm dimensions of each tire) in environmentally controlled room, broiler allocated to five treatments, four replicate (8 birds each replicate) each treatment. Birds Fed starter diet contain 22.7% crude protein and 2935.7 kcal ME/kg diet and finisher diet contain 20.2% crude protein and 3034.8 kcal ME/kg diet and used all the administrative procedures and health procedures in the education of broiler.

Five treatments were used T0 treatment of the control without any addition to the diet or drinking water, treatments T1, T2 has been added clove powder to the diet by 0.8 and 0.4%, respectively and treatment T3 add clove oil by 0.8% to the diet and treatment T4 added aqueous extract of clove flower 0.4% to drinking water and these additions to the diet, drinking water, lasted from 4-8 weeks of age and offer to the birds for 9 hours at 900-1800, where the birds exposed to cyclic temperature 28-35-28°C and the highest temperatures from 1200-1800 and at relative humidity 45-50% in the room. Clove and clove oil purchased from local market and identified by herbal center in the College of Agriculture University of Baghdad, clove flower ground in electric grinder, part of clove powder mixed with diet as required and other part used for doing the aqueous extract according the method described by Harborn,

(1973), 200 gram of clove powder mixed with 1 liter of water and leave it over night (24) hours after that we filtered by gauze and the participate heated at (40-50)°C for 15-20 minute and then let it be cool and then filtered another time and then this extract used by adding to drinking water in 0.4% level, this extract prepared at required amount daily and put in a dark bottle in refrigerator.

Body weight, weight gain, feed consumption, feed conversion ratio, growth rate were measured at 5, 7 weeks of age.

The pattern of feed and water consumption were measured in one day at middle of each of (5, 7) weeks of age for four periods (900, 1200, 1500, 1800) hours. body temperature was measured from (3 birds) at random from each replicate of the treatments in one day at middle of each of (5, 7) weeks and for four periods (900, 1200, 1500, 1800) hours, using a digital thermometer sensitive to the level of one decimal and by inserted the probe of digital thermometer in to cloaca space (5 cm) place until the stability of reading and recording temperature.

All data were statistically analyzed by analysis of variance using a completely randomized design and Duncan's multiple range test were used to determine significant difference between treatment means (Duncan, 1955).

RESULTS AND DISCUSSION

Table 1 and 2 show the impact of supplementation various level of powder and oil to broiler diet and the aqueous extract to drinking water of clove flower on productive traits (body weight, weight gain, feed intake, feed conversion ratio and the growth rate) for broiler at (5, 7) weeks of the age.

At 5 week of age body weight and weight gain revealed increase (not significant) in all treatments compared with T0 while feed consumption decrease significantly in all treatments compared with T0 meanwhile there was an improvement in T1, T2 in feed conversion ratio compared with other treatments.

At 7 week of age feed consumption increase significantly in T2, T3, T4 compared with T0, T1 while feed consumption ratio improved significantly in T0, T1 compared with T2, T4, no significant effect on live body weight, weight gain, growth rate at 5, 7 weeks of age.

Figure 1 and 2 revealed the impact of supplementation various level of powder and oil to broiler feed and the aqueous extract to drinking water of clove flower on feed consumption pattern in broiler at (5, 7) weeks of age at four periods (900, 1200, 1500, 1800) hours, at 5 week of age At 5 week of age the pattern of feed consumption revealed a significant decrease in T1 compared with T2 at 1200 hour, also T1 reduced significantly compared with T3, T4 at 1500 hours while T2 reduced compared

Table 1: Effect of clove powder and oil supplementation to diet and clove aqueous extract to drinking water on body weight, body weight gain, feed consumption, feed conversion ratio, growth rate of broiler chickens exposed to heat stress¹ at 5 week of age

Treatment ²	Body weight (gm/bird) (5) weeks	Weight gain (gm)	Feed consumption	Feed conversion ratio	Growth rate
T0	^a 1243.75±18.93	212.50±28.14	^a 567.85±4.68	^a 2.71±0.43	18.70±1.64
T1	1283.55±21.51	253.54±26.64	^d 470.48±4.49	^b 1.85±0.69	21.918±1.76
T2	1295.94±33.84	267.50±32.63	^c 483.36±3.07	^b 1.80±0.74	23.0±1.80
T3	1281.88±25.45	224.37±29.19	^{cd} 476.06±3.41	^a 2.12±0.65	19.182±1.49
T4	1324.38±31.45	266.56±37.63	^b 558.35±2.84	^a 2.09±0.68	22.45±1.58
Significant	N.S	N.S	**	*	N.S

Different letters within a column indicate a significant differences between the means at the level of probability ($p < 0.01$).

¹Cyclic temperature (28-35-28 °C).

²Treatments T0 = control without adding to the diet and drinking water.

T1 = add (0.8%) of the clove flower powder to the diet.

T2 = add (0.4%) of the clove flower powder to the diet.

T3 = add (0.8%) of clove oil flower to diet.

T4 = add (0.4%) of clove flower aqueous extract to drinking water.

³The mean ± standard error.

Table 2: Effect of clove powder and oil supplementation to diet and clove aqueous extract to drinking water on body weight, body weight gain, feed consumption, feed conversion ratio, growth rate of broiler chickens exposed to heat stress¹ at 7 week of age

Treatment ²	Body weight (gm/bird) (7) weeks	Feed consumption	Feed conversion ratio	Weight gain (gm)	Growth rate
T0	^a 2117.19±55.62	403.12±59.16	^c 637.22±2.35	^b 1.58±0.18	21.04±1.48
T1	2156.13±64.64	380.64±57.41	^c 632.50±3.02	^b 1.66±0.75	19.39±1.37
T2	2084.69±56.05	329.06±51.88	^a 787.08±4.01	^a 2.39±0.61	17.13±1.54
T3	2108.13±47.05	379.06±53.52	^b 733.34±6.08	^{ab} 1.93±0.80	19.75±1.62
T4	2163.13±51.88	285.93±64.54	^a 804.07±13.52	^a 2.81±0.71	14.15±1.27
Significant	N.S	N.S	**	*	N.S

Different letters within a column indicate a significant differences between the means and at the level of probability ($p < 0.01$).

¹Cyclic temperature (28-35-28 °C).

²Treatments T0 = control without adding to the diet and drinking water.

T1 = add (0.8%) of the clove flower powder to the diet.

T2 = add (0.4%) of the clove flower powder to the diet.

T3 = add (0.8%) of clove oil flower to diet.

T4 = add (0.4%) of clove flower aqueous extract to drinking water.

³The mean ± standard error.

with other treatments at 1800 hours however in 7 week of age there was a reduction in T4 compared with T0, T2 at 1500 hour.

Figure 3 and 4 revealed the impact of supplementation various level of powder and oil to broiler feed and the aqueous extract to drinking water of clove flower on water consumption pattern in broiler at (5, 7) weeks of age at four periods (900, 1200, 1500, 1800) hours At 7 week of age the pattern of water consumption reduced significantly in T1, T2 compared with other treatments at 1200 hour and T4 reduced compared with other treatments.

Figure 5 and 6 revealed the impact of supplementation various level of powder and oil to broiler feed, and the aqueous extract to drinking water of clove flower on body temperature in broiler at (5,7) weeks of age at four periods (900,1200,1500,1800) hours, at 5 week of age body temperature increased in all treatments compared with T0 at 1800 hour while at 7 week of age T2, T3, T4 reduced compared with T0 at 900 hour and T3 reduced compared with T4 at 1200 hour and also T0, T3, T4 reduced compared with T1.

In another data belong to the same author (Salman, 2010) we get a little benefit from clove supplementation to diet and drinking water in productive characters and this may be due to that the clove contains mineral salts and vitamins, including vitamin (C) (Merrill, Perry, 2009) where vitamin (C) plays a central role in the ability of birds to resist stressful factors as this vitamin be included in the manufacture of stress hormones (Central epinephrine and nor epinephrine and corticosterone) (Fenster, 1989), Also the reduction in body temperature (Salman, 2010) may be due to that vitamin (C) plays a fundamental role in reducing body temperature (Pardue, 1983) through the waste heat from the blood vessels peripheral to maintain a relatively constant temperature (Cheng *et al.*, 1990) Heat stress causes the accumulation of free radicals which cause gradual crash and imperceptible in the cells and tissues of the body and lead to a deterioration of productive and then the health of birds (Jaeschke, 1995). Clove has a powerful anti-oxidants, which due to the presence of phenolic compounds such as (Terpenoids) (in eugenol), which have powerful anti-oxidation, as this material

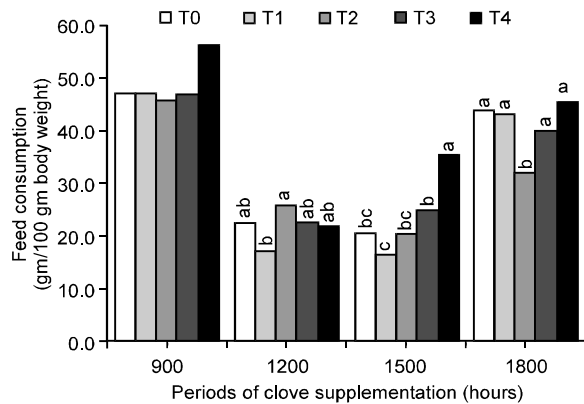


Fig. 1: Effect of clove powder and oil supplementation to diet and clove aqueous extract to drinking water on feed consumption pattern of broiler chickens exposed to heat stress¹ at 5 week of age. Different letters within a period indicate a significant differences between the means at the level of probability ($p < 0.01$).

¹Cyclic temperature (28-35-28°C).

²Treatments:

T0= control without adding to the diet and drinking water.
 T1 = add (0.8%) of the clove flower powder to the diet.
 T2 = add (0.4%) of the clove flower powder to the diet.
 T3 = add (0.8%) of clove oil flower to diet.
 T4 = add (0.4%) of clove flower aqueous extract to drinking water.

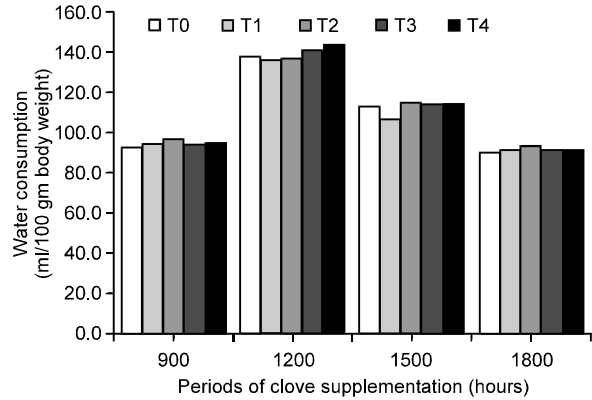


Fig. 3: Effect of clove powder and oil supplementation to diet and clove aqueous extract to drinking water on water consumption pattern of broiler chickens exposed to heat stress¹ at 5 week of age. Different letters within a period indicate a significant differences between the means at the level of probability ($p < 0.01$).

¹Cyclic temperature (28-35-28°C).

²Treatments:

T0 = control without adding to the diet and drinking water.
 T1 = add (0.8%) of the clove flower powder to the diet.
 T2 = add (0.4%) of the clove flower powder to the diet.
 T3 = add (0.8%) of clove oil flower to diet.
 T4 = add (0.4%) of clove flower aqueous extract to drinking water.

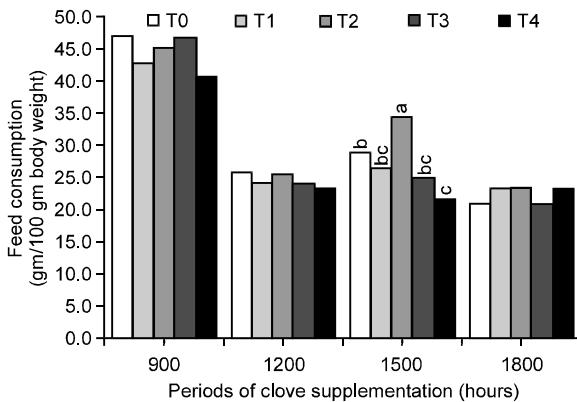


Fig. 2: Effect of clove powder and oil supplementation to diet and clove aqueous extract to drinking water on feed consumption pattern of broiler chickens exposed to heat stress¹ at 7 week of age. Different letters within a period indicate a significant differences between the means at the level of probability ($p < 0.01$).

¹Cyclic temperature (28-35-28°C).

Treatments:

T0= control without adding to the diet and drinking water.
 T1 = add (0.8%) of the clove flower powder to the diet.
 T2 = add (0.4%) of the clove flower powder to the diet.
 T3 = add (0.8%) of clove oil flower to diet.
 T4 = add (0.4%) of clove flower aqueous extract to drinking water.

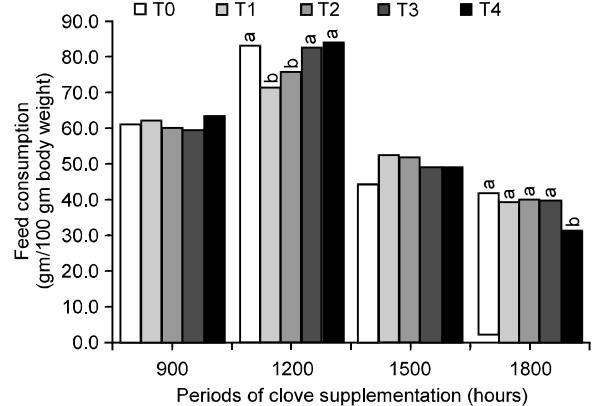


Fig. 4: Effect of clove powder and oil supplementation to diet and clove aqueous extract to drinking water on water consumption pattern of broiler chickens exposed to heat stress¹ at 7 week of age. Different letters within a period indicate a significant differences between the means at the level of probability ($p < 0.01$).

¹Cyclic temperature (28-35-28°C).

²Treatments

T0= control without adding to the diet and drinking water.
 T1 = add (0.8%) of the clove flower powder to the diet.
 T2 = add (0.4%) of the clove flower powder to the diet.
 T3 = add (0.8%) of clove oil flower to diet.
 T4 = add (0.4%) of clove flower aqueous extract to drinking water.

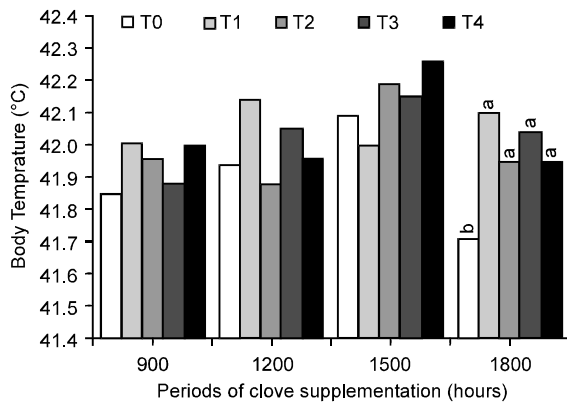


Fig. 5: Effect of clove powder and oil supplementation to diet and clove aqueous extract to drinking water on body temperature of broiler chickens exposed to heat stress¹ at 5 week of age. Different letters within a period indicate a significant differences between the means at the level of probability ($p < 0.01$).

¹Cyclic temperature (28-35-28°C).

²Treatments T0 = control without adding to the diet and drinking water.

T1 = add (0.8%) of the clove flower powder to the diet.

T2 = add (0.4%) of the clove flower powder to the diet.

T3 = add (0.8%) of clove oil flower to diet.

T4 = add (0.4%) of clove flower aqueous extract to drinking water.

equivalent to free radicals and prevent the spread of the oxidation process (Kamel, 2000). Improvement in feed consumption and feed efficiency ratio in our experiment and in (Salman, 2010) may be with agreement with the work done by Moleyar and Narasimham (1992) found the synergistic effect of the addition (Eugenol and Cinnamaldehyde) as this mixture caused the inhibition of four types of bacteria in a period of more than (30 days) and thus clove may have a direct impact on the elimination of harmful bacteria in the canal tract. Also heat stress has a direct negative effect on the process of absorption in the digestive tract through its impact on the length of the villi and shortening the villi in the duodenum, and ileum and lead to reduce the number of Goblet Cell per unit length of the villi ileum and so will be less process absorption (Sandikci *et al.*, 2004), also eugenol in the clove may have a calming and analgesic effect to birds that may impact positively on the length of villi and Goblet Cell number and thus will increase the absorption of food and water. Also they found that eugenol slows down nerve conduction of the neuron for fish (Cray fish) and makes it less exciting and also inhibits the effectiveness of the nerves within the teeth in cats and thus, the eugenol reduces pain through its impact on the inhibition of sodium and calcium voltage gate channel (Hai *et al.*, 2008) and thus inhibition of pain which may affect the animal during the

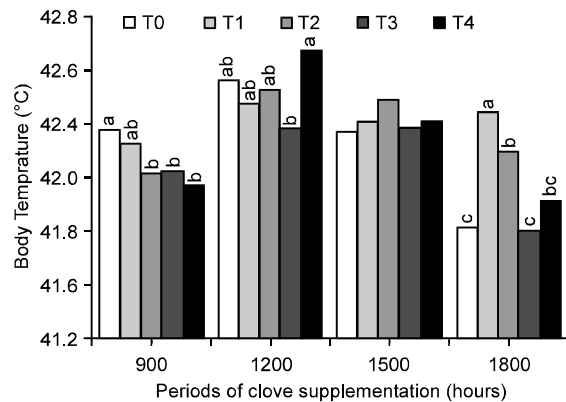


Fig. 6: Effect of clove powder and oil supplementation to diet and clove aqueous extract to drinking water on body temperature of broiler chickens exposed to heat stress¹ at 7 week of age. Different letters within a period indicate a significant differences between the means at the level of probability ($p < 0.01$).

¹Cyclic temperature (28-35-28°C).

²Treatments:

T0= control without adding to the diet and drinking water.

T1 = add (0.8%) of the clove flower powder to the diet.

T2 = add (0.4%) of the clove flower powder to the diet.

T3 = add (0.8%) of clove oil flower to diet.

T4 = add (0.4%) of clove flower aqueous extract to drinking water.

heat stress. Sarmisha, Sukta (2005) noted that the aqueous extract of clove have an impact on inflammation and reduced the injury, tumor, cancer in mice, Research indicated that the clove is working to reduce the temperature of the body through the inhibition of formation prostaglandin which working to raise the temperature of the body (Feng and Lipton, 1987). All these above reason made clove a good tool for reducing heat stress in broiler and we see some improvement in physiological characters seen published by (Salman, 2010).

Conclusion: We can concluded from this experiment that a little improvement gained from adding clove to diet and drinking water and need a future investigations to have a clear result.

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