

## HOW TO CONTROL THE BROILER PATHOGENIC INTESTINAL FLORA UNDER NORMAL OR HEAT STRESS CONDITIONS

### 1 - Medical plant - Probiotics - Sand as a litter

By

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**Abstract:** *An experiment was performed to reduce the intestinal pathogenic bacteria populations of broiler chicks under normal or heat stress conditions by using medical herbs (neem leaves), probiotic (biogen) or sand as a litter. A total of 240, unsexed one week old Hubbard chicks, were assigned into four equal groups, 60 chicks in each with two replicate in floor pens: 3 of 4 groups were fed an experimental diet and used the wheat straw as a litter, thus, inoculation of 2g biogen (bacteria concentration as probiotic) / kg of feed, 200 mg neem leaves powder (medical plant) / kg of feed or without inoculation (control), respectively. Chicks in the fourth group were fed control diet and used sand as a litter. At 35 days of age, each group was divided into two equal sub-groups, the first was kept under normal conditions (23 °C) while, the second sub-group was exposed to 38°C for 3 hrs daily for 6 days from 35 to 40 days of age with 70 % relative humidity.*

*Inclusion of biogen and neem leaves powder in broiler feed at either normal temperature (23°C) or high temperature (38°C) allowed the statistically significant ( $P<0.05$ ) improvement of the following parameters: body weight gain, feed consumption, feed conversion, mortality rate, carcass characteristics in terms of relative weight of dressing, giblets, and also lymphoid organs in terms of bursa and thymus relative weights. Blood total protein as well as albumin and globulin fraction, Tri-iodothyronine (T3), hemoglobin and hematocrit were increased ( $P<0.05$ ). Conversely, plasma cholesterol and total lipids values were ( $P<0.05$ ) reduced. Besides, creatinine, AST and ALT enzymes were not affected. Moreover, the total erythrocytic, leukocytic and leukocytic differential counts except heterophil cells were ( $P<0.05$ ) increased. However, using the sand as a litter in broiler pens resulted insignificant improvement in the previous parameters, except the mortality rate was ( $P<0.05$ ) improved with either normal or high temperature conditions. Furthermore, there were significant ( $P<0.05$ )*

*decreases total count of some intestinal (ilium and caecum) or faeces pathogenic bacteria (total viable count, E.coli, Salmonella, staphylococci and Coccidia ovum) with all experimental groups including the sand as a litter treatment. On the other hand, there were ( $P < 0.05$ ) decreases in body weight gain, feed consumption, (T3), plasma total proteins and increase in mortality rate of chicks subjected to heat stress, by the way, experimental treatments reduced the deleterious effects of heat stress. Probiotics or neem leaves powder was efficient as antibacterial and immunostimulant activities in controlling the intestinal pathogenic bacteria, consequently, improving broiler performance, physiological and bacteriological status. Therefore, It could be advisable to give more attention for importance of inclusion bacteria concentration (probiotics) and medical plant (neem leaves) on broiler diets or using the sand as a litter in broiler house in either normal or stressed environmental condition.*

## INTRODUCTION

In general, the literature showed that environmental stressors have been associated with not only decreasing productive performance of animal but also with impede disease resistance which emboldens the pathogenic avian E. coli and coccidiosis. Colibacillosis and coccidiosis are responsible for huge economic losses that may threaten poultry industry in many parts of the world (**Gross, 1991**).

The use of live microorganism probiotics (biogen) as a substitute for antibiotics in poultry production as growth promoter or to control the pathogenic bacteria has become an area of great interest. These microorganisms may inhibit the growth of either pathogenic organisms or salmonella and E. coli (**Oyarzabal and Conner, 1995**) and improve nutrient availability and absorption (**Sellars, 1991**). Furthermore, such useful bacteria may produce lactic acid which alter the pH of chicken gut making it improper media for harmful bacteria such as salmonella and pathogenic species of E. coli (**Leesson and Major, 1990**). Live microorganisms as probiotics improve immunity, live weight gain and the rates of feed conversion and mortality of broiler (**Jin et al, 2000; Zulkifli et al., 2000 and huang et al., 2004**).

Neem (*Azadirachia indica*) dry leaves powder as medical herbs could be beneficial in immunosuppressant diseases of poultry. Neem leaves powder has immunostimulant effect that activates the cell mediated immune response and therefore, creates an enhanced response to any future challenges occurred by disease organisms. So, the feeding neem leaves to immunosuppressed birds increase their humoral and cell mediate immune responses (Sadekar et

al., 1998). Neem leaves contain a vast array of hemically diverse and iologically active ingredients (Devakumar and Suktt, 1993). Low dose of neem leaves powder have an inhibitory action on wide spectrum of microorganisms Talwar et al., 1997) and immuomodulator actions that induce cellular immune reaction (Devakumar and Suktt, 1993). Also, Craig (1999) stated that several herbs can help providing some protection against bacteria and stimulate the immune system.

Nowadays, types of litter have been considerable attention as managerial practices. Expenditure of wheat straw, rarity of wood shaving and expansion of poultry industry preach or invite the producer to search for alternative bedding material. Sand is that one of these alternatives, it's very cheap, plentiful, economy, suitable and most of gulf countries used it as bedding for their farms. As stated by **Bilgili et al. (1999)** significant improvement of body weight and litter microbiological quality were found by using sand as litter. Also, **El-Sagheer et al. (2004)** reported that sand as litter for poultry farms can help poultry producers to reduce infection, pollution, improve production performance and lower costs in chickens. The inclusion of sand with straw may be a useful practical benefit for managing air quality in broiler housing, as it appears to have produced a litter that releases less ammonia to atmosphere than straw alone. This may be associated with an improved water holding capacity (**Al-Homidan and Robertson, 2007**). The present study, a trial to control the intestinal microbial populations of broiler chicks under normal or heat stress conditions by either feeding biogen preparation as probiotic, neem leaves powder as medical herbs or using the sand as a litter for broiler house, consequently improve the productive performance of broiler.

## MATERIALS AND METHODS

The present study was carried out at EL-Gimmizah Animal Production Research Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Gharbiyah Governorate, Egypt, during winter season months, December and January.

**Birds and Housing:** A total of 240 one day-old Hubbard chicks were bought from a local hatchery. Chicks were transferred to the experimental site and reared together on a wheat straw covered floor with suitable area under the same feeding, drinking, and brooding conditions. The experimental diet was used starting from the beginning of the second week of age, and so all birds were divided into 4 equal weight groups of 60 birds each to be treated as a treatment group, each group was divided into 2 equal weight replicates with 30 birds each. Treatment 1: Control group

(experimental diet and wheat straw as a litter), Treatment 2: Experimental diet contains 200 mg neem leaves powder/kg feed and wheat straw as a litter. Treatment 3: Experimental diet contains 2g biogen /kg feed and wheat straw as a litter, Treatment 4: Experimental birds were reared on a sand covered floor as a litter with suitable area under feeding the experimental diet, drinking and the same conditions of experiment. Neem leaves powder were obtained from neem trees (*Azadirachia indica*) bought from a local herbal store (grocery). Biogen (bacteria concentration as probiotic) is a preparation consisting of *Bacillus subtilis* ( $6 \times 10^7$  cells/g) + *Lactobacillus casei* ( $8 \times 10^7$  cells/g). Birds were managed, treated and vaccinated as any commercial broiler flock. Feed and water were provided *ad libitum* under light cycle 23L: 1D throughout the experimental period. At 35 days of age, each group was divided into two equal sub-groups of fifteen birds each. First: remained on the same normal conditions (23°C), whereas, the second was exposed to 38°C for 3 hrs daily for 6 days from 35 to 40 days of age with 70% relative humidity.

**Experimental diet:** Two types of diets were used. The starter was fed for the first 3 weeks (2-4 weeks) followed by the finisher for the rest of the experiment which lasted for 42 days (Table 1). The experimental diets were planned to meet the nutrient requirements of the chicks according to the strain catalog recommendations.

**Performance variables:** During the experimental period (7-42 days) the individual body weight and feed intake of each replicate was recorded at weekly basis. However, mortality was daily recorded throughout the experimental period. Average weight gain, average feed intake and average feed conversion ratio were calculated.

**Samples:** At the termination of heat stress period (40 days of age), five birds from each treatment were randomly chosen and slaughtered. Two blood samples was collected from slaughtered birds, first one were collected in heparinized tubes and centrifuged at 3000 rpm for 20 minutes. Plasma produced was frozen at -20C till the time of chemical analysis. Commercial Kits were used to determine the concentration of Tri-iodothyronine ( $T_3$ ) (ng/dl), total protein (g/dl), albumin (g/dl), alanine transaminase (ALT) (U/L), aspartate transaminase (AST) (U/L), total cholesterol (mg/dl) and total lipids (g/dl) according to the manufacture recommendations of commercial kits. While, the second blood sample was used for detection of the total red blood cells (RBC's) count/mm<sup>3</sup> blood, total white blood cells (WBC's) count/mm<sup>3</sup> blood and their differentiation. Also, Hematocrit (Ht) value and hemoglobin (Hb) concentrate were determined.

**Bacteriology study:** At the time of slaughter test, 5 samples of ileum and caecum contents were collected and examined to define and count the pathogenic bacteria for each treatment. Fecal matter samples were collected in sterile polyethylene bags. All samples were delivered directly to the laboratory for bacteria count and define using the procedure of A.O.A.C. (1990).

**Statistical analysis:** Data were subjected to one-way analysis of variance using SAS (1998). Differences among means were detected by using Duncan's multiple range test (Duncan, 1955). The percentage values were transferred to percentage angle using arcsine equation before subjected to statistical analysis, and then actual means are presented. The following model was used:  $Y_{ij} = G + T_i + e_{ij}$ . Where,  $Y_{ij}$  = observation for each dependent variable;  $G$  = General mean;  $T_i$  = Treatment effects ( $i = 1, 2, \dots$  and 8);  $e_{ij}$  = Random error.

## RESULTS AND DISCUSSION

### Body weight gain and mortality rate:

The addition of neem leaves powder or biogen to the broiler diets significantly ( $P < 0.05$ ) increased weight gain by 9.23 and 13.27% at normal temperature (23°C) or by 9.96 and 14.41% at high temperature (38°C), respectively. Weight gain was significantly ( $P < 0.05$ ) highest for biogen at both conditions. However, weight gain was increased numerically with using sand as a litter either at normal or high temperature. Concerning Mortality rate, significant ( $P < 0.05$ ) improvements were detected not only due to both supplementation but also due to both types of litter at both conditions. Present results show that, the deleterious effect of high temperature on performance parameters was significant ( $P < 0.05$ ). The parameters were compared with counterpart control one (Table 2).

The addition of neem leaves was effective in controlling intestinal bacteria as antibacterial by reducing *E. coli* in different internal organ according to **Garg et al., (1994)**, **Talwar et al., (1997)**, **Sadekar et al., (1998)** and **Das et al., (1999)**, subsequently decreased substantial damage to the mucosal epithelium, bleeding, morbidity, loss of weight gain, emaciation and susceptibility to disease agents (**Conway and Mckenzie 1991**), enhancement effect to the humoral and cell mediated immune response (**Devakumar and Suktt, 1993**), which leading to increase body weight gain and decrease mortality rate as the authors believed.

About the effect of biogen, **Panda *et al*, (2000)**, **Jin *et al*, (2000)**, **Zulkifli *et al*, (2000)** and **huang *et al*, 2004)** in this concept. All of them found that broiler performance was improved when probiotics were used to test their efficiency on growth and performance of broiler chicks. This improvement may be attributed to the mode of actions of these bacteria, which stimulate appetite (**Nahashon *et al*, 1994**), produce digestive enzymes (**Lee and Lee, 1990**), improve intestinal microbial balance (**Fuller, 1989**), inhibit the growth of either pathogenic organisms (**Herrick, 1972**), or salmonella and *E. coli* (**Oyarzabal and Conner, 1995**), improve nutrient availability and absorption (**Sellars, 1991**), produce specific antibacterial compounds such as hydrogen peroxide (**Collins and Aramaki, 1980**) and compete with other microbes for adhesive sites (**Dunham *et al*, 1993**). Furthermore, such microorganisms may produce lactic acid which alters the pH of chicken gut making it improper media for harmful bacteria such as salmonella and pathogenic species of *E. coli* (**Leesson and Major, 1990**).

Concerning results of sand as a litter, **Anisuzzaman and Chowdhury (1996)** who used sawdust, paddy straw, sand and rice husk as litter in broiler house and reported that no significant differences were observed in body weight gains. Similar effect was observed by **Al-Homidan and Robertson (2007)**, who used the chopped straw alone or chopped straw and sand as litter.

#### **Feed Consumption and conversion:**

There were significant differences ( $P < 0.05$ ) in feed intake (g/chick) and feed conversion (g feed/g gain) among the chicks fed on control diet and those fed on diet supplemented with neem or biogen. Where, amount of feed intake increased by 3.51 and 5.32% at normal temperature (23°C) or by 2.65 and 7.97% at high temperature (38°C), respectively. Improvement of feed conversion were from 2.28 in control group to 2.16 and 2.12 at normal temperature (23°C) or from 2.21 to 2.09 and 2.08 at high temperature (38°C) in neem or biogen groups, respectively. However, feed intake and feed conversion did not differ significantly by using sand as a litter as compared to wheat straw (Table 2).

The improvement of nutrients digestibility by supplementing chicks diets with medical plants or probiotic could attributed to different stimulators such as change enteric flora and reduction of *E. coli* population, lowering intestinal pH, synthesis of catabolic enzymes of favorable microorganism that help in releasing cell compound including amino acids, sugar, and fatty acids into the intestinal environment and involving active bacteria with the digestive processes and nutrient absorption in intestinal

tract (**Wenk, 2002**). Also, medical plant extracts increased the number of lactic acid bacteria in intestinal gut (**Tekeli et al., 2006**) and decreased the total microbial number of caecum (**El-Deep et al., 2006**).

The effect of biogen may be due to the effect of such probiotics which lead to improve absorption of nutrients and depressed harmful bacteria that causes growth depression. In this connection, **Panda et al, (2000)**, **Jin et al, (2000)**, **Zulkifli et al., (2000)** and **huang et al., (2004)**. In general, the enhanced feed conversion due to the inclusion of probiotics and neem leaves to broiler diets may be attributed to causing lethal or sub lethal damage to pathogens, resulting in a reduction of bacterial toxins; reducing bacterial utilization of essential nutrients; allowing increased synthesis of vitamins and growth factors; improving the absorption of nutrients by reducing the thickness of intestinal epithelium; reducing intestinal mucosa epithelial cell turnover and reducing intestinal motility. All these effects lead to more utilization of nutrients. This explanation is in line with the findings of **Zulkifli et al. (2000)** and **Abd El- Gawad et al., (2004)**.

Results of sand as a litter were confirmed with **Anisuzzaman and Chowdhury (1996)** who used sawdust, paddy straw, sand and rice husk as litter in broiler house and **Al-Homidan and Robertson (2007)** when used the chopped straw alone or chopped straw and sand as litter. All of them reported that feed intake and feed conversion ratios were similar at 28 and 42 days with all type of litters.

#### **Carcass traits:**

Significant ( $P < 0.05$ ) increase in percentages of carcass, giblets, bursa and thymus relative to pre-slaughter weight of birds fed diets supplemented with neem leaves or biogen at normal temperature ( $23^{\circ}\text{C}$ ) or high temperature ( $23^{\circ}\text{C}$ ) at 6 weeks of age compared with other birds fed control diet (Table 2). Also, this was associated with increasing dressing percentages at both conditions. In general, increasing the relative weights of bursa and thymus (lymphoid organs) due to dietary supplementation of neem and biogen may reflect higher immunity of birds in these groups. **Kalavathy et al (2003)** and **Abd-El Gawad et al. (2004)** are in the same concept. However, birds reared on sand as a litter showed similar carcass traits to those in wheat straw control litter. In this connection, **Anisuzzaman and Chowdhury (1996)** and (**Al-Homidan and Robertson 2007**) showed the same Trend. The present information of body weight gain and feed consumption and conversion may explain and confirm the carcass traits results.

### **Blood biochemicals:**

Adding the biogen or neem leaves to broiler diets increased ( $P < 0.05$ ) concentration of plasma  $T_3$ , total protein as well as albumin and globulin fractions comparing to untreated control groups under either normal or heat stress conditions. It is of interest to note that ratio of A/G increased ( $P < 0.05$ ) at normal conditions as a result of the changes in globulin with the addition of biogen or neem leaves (Table 3). From the previous increases in blood parameters, it could be indicate that an enhancement of immunity might be expected corresponding to adding biogen or neem leaves due to improving feed consumption, absorption and utilization of nutrients. Plasma of chick fed diets supplemented with probiotics (**Zulkifli et al. 2000**) or neem (**Garg et al. 1994**) contained more globulin which are associated with the production of antibodies. Therefore, the increase in globulins in blood could be an indication of presence of immunoproteins, wherefore, high immune response.

Oral inoculation of germ-free animals with *L. acidophilus* bacteria (**Pollmann et al. 1980**) or yeast culture (**Abd El-Azeem, 2002**) led to elevated ( $P < 0.05$ ) levels of total serum protein as well as albumin and globulin and hemoglobin concentrate, while the packed cell volume did not differ significantly from that in the control group. Come to the same result **Abdul-Rahman et al. (1994)** with broiler chicks and **Abd El-Azeem et al. (2001)** with Japanese quail.

Plasma cholesterol and total lipids decreased ( $P < 0.05$ ) for groups fed biogen or neem leaves as compared with control groups either at normal or heat stress conditions (Tables 3). The decrease in cholesterol and total lipids in plasma may reflect the rate of their absorption through the intestinal gut with feeding probiotics. These findings may agree with the results of **Tortuero et al., (1975)** who reported that, these bacteria may assimilate or degrade the cholesterol to bile acids followed by deconjugation to prevent resynthesis. Also, **Li et al., (1995)** observed a significant decrease in plasma cholesterol level of hypercholesterolemia rabbits given live bacteria (*Eubacterium coprostanolignes*) and presume that this type of bacteria convert feed cholesterol to coprostanol, which is absorbed poorly by gastrointestinal tract. However, some lactobacilli have a direct effect on cholesterol levels by assimilation and removal from the growth medium (**Fuller, 1989**).

Adding biogen or neem leaves to broiler diets did not alter AST, ALT enzymes and creatinine comparing to untreated control groups under either normal or high temperature conditions (Table 3). The similitude of

AST and ALT enzyme and creatinine concentration in supplemented or unsupplemented groups are exhibit healthy, non-pathological and non-toxic effect of biogen or neem leaves on liver or kidney functions. Similarly, **Abd El-Azeem (2002)** concluded that broiler chicks fed yeast culture recorded insignificant GOT, GPT enzyme activity and creatinine levels.

Dietary neem leaves provided protection against the inflammation in the liver and kidney cells caused by infection (**Klasing, 1991**). Therefore, the present results showed slightness changes in AST, ALT or creatinine levels among treated and untreated groups under either normal or heat stress conditions.

In accordance with the present results of sand group, there were no significant differences in blood biochemicals between types of litter under either normal or heat stress conditions as observed by **Bilgili et al., (1999)** and **El-Sagheer et al., (2004)**.

It is worthy noting that increasing blood constituents in heat stressed groups compared to unstressed groups may attributed to the alteration of the blood volume as a result to evaporation from respiratory system during panting process.

#### **Blood hematological picture:**

Table (4) showed significant ( $P < 0.05$ ) increase in counts of erythrocytes (RBC's), leukocytic (WBC's), leukocytic differentiation (Lymphocytes, Eosinophils and Basophils), hemoglobin concentrate and hematocrit values, while heterophil count decreased ( $P < 0.05$ ) due to feeding dietary biogen or neem leaves at normal temperature (23°C) or high temperature (38°C) compared to the control diet. However, monocyte was completely absent due to feeding dietary biogen or neem leaves at normal temperature (23°C) and return to the appearance due to stress of high temperature condition (38°C). In general, no significant differences were detected in count of erythrocytes (RBC's) and leukocytes or their differentiation between types of litter under either normal or heat stress conditions. It is well known that the alteration in leukocytic (WBC's) count may be attributed to the irritation of the bone marrow by the infection by-products and toxins. This infection did not occur in this study as the authors believed. However, the stress caused by infection or environmental condition increased the heterophil cells and decreased the lymphocytes (**Miake et al., 1985**)

These results indicated that biogen have an enhancement effect to the humoral and cell mediated immune response which agreed with that

reported by **Pollmann et al., (1980)** and **Miake et al., (1985)**. Come to similar results, **Zulkifli et al., (2000)** and **huang et al., (2004)** they indicated that an enhancement of immunity might be expected corresponding to adding probiotic.

Concerning neem leaves effects, **Garg et al., (1994)** reported that adding neem leaves have an enhanced the increase in Leukocytic (WBC's) and lymphocytes counts of blood. **In this respect, Sadekar et al., (1998)** reported that neem leaves powder has immunostimulant effect that activates the cell mediated immune response. So, neem leaves could be beneficial in immuomodulator actions that induce cellular immune reaction (**Devakumar and Suktt, 1993**). Also, Neem produced an increase in count of red blood cells, and so, there was an increase in hemoglobin and iron concentration (**Garg et al., 1994**).

#### **6- Bacteria Enumeration:**

Results presented in Table (5) indicated that experimental treatments caused severe suppression pathogenic intestinal bacteria counts. Where, there were significantly ( $P < 0.01$ ) reduction in counts of total viable bacteria, *E. coli*, salmonella, staphylococci and *Coccidia ovum* in ileum, caecum or fecal matter comparing to untreated control group. For example, *E. coli* counts in the ileum at normal temperature ( $23^{\circ}\text{C}$ ) reduced from ( $6.31 \times 10^6$ ) in control group to  $5.87 \times 10^6$  in sand treatment by about 6.97%, also, to  $3.73 \times 10^6$  in neem group by about 40.88 % and to  $4.51 \times 10^6$  in biogen group by about 28.53 %. Also, the mean colony forming unit in the ileum at normal temperature ( $23^{\circ}\text{C}$ ) reduced 15.53%, 55.27% and 32.76% in sand, neem and biogen groups respectively, compared to untreated control group. Also, the same trend was observed in all cases or conditions of experiment. Moreover, salmonella and *Coccidia ovum* were completely disappeared in the ileum, Caecum and faeces at either normal ( $23^{\circ}\text{C}$ ) or high temperature ( $38^{\circ}\text{C}$ ) conditions.

Concerning results of sand as a litter, **Bilgili et al., (1999)** found that significant improvement of litter microbiological quality were found by using sand as litter. Moreover, **El-Sagheer et al., (2004)** reported that sand as litter reduced infection and pollution in poultry farms. These beneficial effects might be more profound if birds were under stressful environmental conditions.

The present results of biogen agrees with that found by **Line et al. (1998)** who observed that frequency of *Salmonella* colonization was significantly reduced due to probiotic bacteria treatment. Also, **Oyarzabal**

**and Conner (1995)** reported that lactobacillus was able to inhibit the growth of some pathogenic bacteria like *E. coli* and salmonella. The antagonistic activity of lactic acid bacteria towards pathogens can be attributed to the production of bactericidal substances like bacteriocins, organic acids and hydrogen peroxide as reported by many workers for example **Joerger and Klaenhammer (1986)**. Moreover, **Fuller, (1989)** reported that probiotics bacteria produces antimicrobial compound in the gut. The metabolic by-products of probiotics bacteria (acetic and lactic acids) inhibit the growth of much kind of bacteria including pathogenic gram negative organism (**Mulder, 1991**). The addition of probiotics product decreased the *E. coli* count as found by **Watkins, et al., (1982); Watkins and Miller (1983)** and **Chateau et al., (1996)**. This type of bacteria produces lactic acid which alters the pH of chicken gut making it improper media for harmful bacteria such as salmonella and pathogenic species of *E. coli*. (**Leesson and Major, 1990**). Probiotics decreased proliferation of pathogenic bacteria (**Miles, 1993**). **Jin et al. (1997)** concluded that probiotics enable the host animal to return to normal through increasing normal gut flora on the expense of pathogenic organisms. Furthermore, **Huang et al., (2004)** reported the beneficial effect of probiotics since their microbial constituents produce natural lactic acid that helps in maintaining an optimum low pH which inhibits growth of undesirable bacteria leading to optimum enzyme activity. Authors concluded that the antibacterial action produced by probiotics was probably due to a combination of factors which include organic acids (acetic and lactic acids), hydrogen peroxide and bacteriocin.

The above mentioned results revealed that the addition of neem leaves powder in broiler diet was effective in decreasing *E. coli* counts in broiler chicks. In this concept, **Talwar et al., (1997)** reported an inhibitory action of neem leaves powder and seeds extract on a wide spectrum of microorganisms including urinary and gastrointestinal tract *E. coli*. The results also agreed with those of **Das et al., (1999)** who reported that the antibacterial effect of neem leaves powder against *E. coli* infection in fishes. Low dose of neem leaves powder have an immuomodulator actions that induce cellular immune reaction (**Devakumar and Suktt, 1993**). Also, **Sadekar et al., (1998)** reported that neem dry leaves powder as medical herbs could be beneficial in immunosuppressant diseases of poultry. Neem leaves contain a vast array of chemically diverse and biologically active ingredients (**Devakumar and Suktt 1993**). In supporting this finding, **Cowan (1999)** reported that plant is rich in a wide variety of secondary metabolites which was found to have antimicrobial properties. **Craig (1999)** stated that several herbs can help providing some protection against bacteria

and stimulate the immune system. In this concept, **El-Deep et al. (2006)** and **Tekeli et al., (2006)** reported that medical plant extracts decreased the total microbial number of intestinal gut.

#### **Economic efficiency:**

The net revenue or the economic efficiency of experimental treatments either during Normal (23°C) or High (38°C) temperature increased than those in control groups. The economic efficiency for chicks fed diets with medical herbs (neem leaves) or probiotic (biogen) recorded the highest values, it increased by 20.04 and 26.13 % at Normal (23°C) or 5.55 and 3.74 % at High (38°C) temperature respectively compared to those fed un-supplemented control diet. Come to similar results **Zulkifli et al., (2000)** and **huang et al., (2004)**.

Finally, addition of medical herbs (neem leaves), probiotic (biogen) in broiler diet or using sand as a litter in broiler house were efficient in controlling pathogenic bacteria in chickens intestinal especially *E. coli*, salmonella, staphylococci and *Coccidia* as antibacterial, antiparasitic or immunostimulant activities, consequently improving broiler performance under normal or heat stress condition. They could be beneficial in controlling immunosuppressed environmental conditions and reducing infection and pollution in poultry farms.

**Table 1:** Composition and calculated analysis of the experimental diets fed to experimental birds.

<b>Ingredients</b>	<b>Starter % (1 to 4 wks)</b>	<b>Finisher % (5 to 6 wks)</b>
Yellow corn	50.30	63.25
Soybean meal 44 %	41.00	29.50
Vegetable oil	04.70	03.75
Lime stone	1.20	01.20
Di-calcium phosphate	2.00	01.50
Salt (NaCl)	0.30	00.30
Vit. & Min. Mixture *	0.30	00.30
DL-Methionine 99%	0.20	00.20
<b>Total</b>	<b>100.00</b>	<b>100.00</b>
<b>Calculated analysis</b>		
Metabolizable energy (Kcal / Kg )	3000.27	3098.08
Crude protein %	22.03	18.00
Crude fiber %	4.15	3.61
Crude fat %	7.23	6.60
Calcium %	1.05	0.90
Available phosphorus %	0.52	0.41
Lysine %	1.33	1.02
Methionine %	0.56	0.51
Met + cystine %	0.92	0.81

## Pathogenic, Intestinal Flora, Heat Stress.

\* Supplied per Kg of diet: Vit. A, 10 000 IU; Vit. D<sub>3</sub>, 2 000 IU; Vit. E, 10 mg; Vit. K<sub>3</sub>, 1 mg; Vit. B<sub>1</sub>, 1mg; Vit. B<sub>2</sub>, 5 mg; Vit. B<sub>6</sub>, 1.5 mg; Vit. B<sub>12</sub>, 10 mcg; Niacin, 30mg; Pantothenic acid, 10mg; Folic acid, 1mg; Biotin, 50mcg; Choline, 260mg; Copper, 4 mg; Iron, 30mg; Manganese, 60mg; Zinc, 50mg; Iodine, 1.3mg; Selenium, 0.1mg; Cobalt, 0.1mg;

**Table (2):** Growth performance and Carcass traits of broiler chicks at 42 days of age as affected by experimental treatments.

Items	Normal temperature (23°C )				High temperature (38°C )			
	Control	Sand	Neem	Probiotics	Control	Sand	Neem	Probiotics
Wight gain (g)	1548.3 d± 39.5	1563.1d± 31.1	1691.2 b± 28.7	1753.7 a ±36.2	1469.6 e± 37.7	1485.7 e± 33.8	1616.0 c± 32.5	1681.5 b± 27.8
Mortality rate (%)35 – 42 day of age	1/27 3.57	0/2800	0/2900	0/2900	5/2718.52	2/287.14	1/293.44	1/293.44
Feed consumption (g)	3530.2 c± 33.3	3536.1c± 28.4	3654.1 b± 32.1	3718.0 a± 41.2	3245.5 e± 28.3	3253.8 e± 30.8	3328.4 d± 35.1	3501.0 c± 32.6
Feed conversion rate	2.28 a± 0.04	2.26 a± 0.05	2.16 c± 0.03	2.12 d ± 0.02	2.21 b± 0.05	2.19 b± 0.03	2.09 e± 0.04	2.08 e± 0.03
<b>Carcass traits</b>								
Pre-slaughter weight (g)	1555.3	1604.6	1697.4	1789.8	1463.6	1534.5	1619.2	1711.8
Carcass (g)	1057.3	1093.4	1186.5	1260.5	981.0	1034.3	1119.7	1196.2
Carcass%	67.98 c± 4.08	68.14 c± 3.13	69.90 a± 4.25	70.43 a± 3.25	67.02 d± 3.25	67.4 d± 3.15	69.15 b± 4.05	69.88 a± 4.12
Giblets%	5.04 c± 0.16	5.08 c± 0.11	5.25 a± 0.08	5.3 a± 0.13	4.72 e± 0.08	4.90 d± 0.15	5.15 b± 0.11	5.16 b± 0.17
Dressing%	73.02 c± 2 .87	73.22 c± 2.16	75.15 a±1.91	75.73 a± 2.05	71.74 d± 3.07	72.3 d± 2.81	74.30 b± 2.07	75.05 a± 2.20
<b>Lymphoid organs</b>								
Bursa %	0.07 c±0.01	0.06 c±0.00	0.12 b±0.00	0.13 b±0.00	0.09 c±0.01	0.07 c±0.00	0.12 b±0.00	0.16 a±0.00
Thymus %	0.26 e±0.02	0.24 e±0.00	0.41 c±0.05	0.45 b±0.07	0.29 d±0.04	0.30 d±0.00	0.49 a±0.05	0.48 a±0.07

Means on the same row differently superscripted are significantly different (P<0.05).

**Table (3):** Some blood biochemical of broiler chicks as affected by experimental treatments at 40 days of age.

Items	Normal temperature (23°C )				High temperature (38°C )			
	Control	Sand	Neem	Propiotics	Control	Sand	Neem	Propiotics
T <sub>3</sub> (ng/dl)	241.2 <sup>b</sup> ±11.41	249.10 <sup>b</sup> ± 11.2	263.7 <sup>a</sup> ± 10.10	269.09 <sup>a</sup> ± 12.2	188.90 <sup>c</sup> ± 10.1	191.45 <sup>cd</sup> ± 13.2	197.22 <sup>cd</sup> ± 11.9	202.12 <sup>c</sup> ± 17.1
Total protein (ng/dl)	4.36 <sup>d</sup> ± 0.10	4.38 <sup>d</sup> ± 0.08	4.82 <sup>b</sup> ± 0.10	4.86 <sup>b</sup> ± 0.06	4.56 <sup>c</sup> ± 0.12	4.54 <sup>c</sup> ± 0.12	5.08 <sup>a</sup> ± 0.08	5.18 <sup>a</sup> ± 0.15
Albumin (g/dl)	2.49 <sup>d</sup> ± 0.02	2.49 <sup>d</sup> ± 0.02	2.83 <sup>b</sup> ± 0.02	2.86 <sup>b</sup> ± 0.03	2.55 <sup>c</sup> ± 0.03	2.59 <sup>c</sup> ±0.03	2.84 <sup>b</sup> ± 0.02	2.90 <sup>a</sup> ± 0.03
Globulin (g/dl)	1.87 <sup>d</sup> ± 0.03	1.89 <sup>d</sup> ± 0.03	1.99 <sup>c</sup> ± 0.03	2.00 <sup>bc</sup> ± 0.03	2.01 <sup>bc</sup> ± 0.03	2.05 <sup>b</sup> ± 0.03	2.24 <sup>a</sup> ± 0.03	2.28 <sup>a</sup> ± 0.03
A/G ratio	1.33 <sup>b</sup> ± 0.02	1.32 <sup>b</sup> ± 0.02	1.42 <sup>a</sup> ± 0.02	1.43 <sup>a</sup> ± 0.02	1.27 <sup>c</sup> ± 0.02	1.26 <sup>c</sup> ± 0.03	1.27 <sup>c</sup> ± 0.02	1.27 <sup>c</sup> ± 0.03
AST (U/L)	22.24 <sup>a</sup> ±2.42	21.95 <sup>a</sup> ±1.54	21.78 <sup>a</sup> ±1.31	23.53 <sup>a</sup> ±1.07	22.73 <sup>a</sup> ±1.55	21.95 <sup>a</sup> ±0.85	21.95 <sup>a</sup> ±1.54	21.78 <sup>a</sup> ±0.81
ALT (U/L)	43.34 <sup>a</sup> ±3.02	42.86 <sup>a</sup> ±4.51	43.18 <sup>a</sup> ±4.11	43.83 <sup>a</sup> ±4.18	44.20 <sup>a</sup> ±3.63	44.16 <sup>a</sup> ±4.20	43.18 <sup>a</sup> ±4.31	43.83 <sup>a</sup> ±4.07
Creatinine (mg/dl)	0.79 <sup>a</sup> ± 0.02	0.78 <sup>a</sup> ± 0.02	0.79 <sup>a</sup> ± 0.02	0.78 <sup>a</sup> ± 0.02	0.79 <sup>a</sup> ± 0.02	0.79 <sup>a</sup> ± 0.02	0.787 <sup>a</sup> ± 0.02	0.787 <sup>a</sup> ± 0.02
Total lipids (mg/dl)	376.51 <sup>b</sup> ± 6.80	371.35 <sup>b</sup> ± 5.86	314.80 <sup>e</sup> ± 6.16	292.63 <sup>f</sup> ± 5.26	386.16 <sup>a</sup> ± 6.15	389.82 <sup>a</sup> ±4.48	341.64 <sup>c</sup> ±6.08	333.64 <sup>d</sup> ± 4.86
Cholestrol (mg/dl)	174.82 <sup>a</sup> ± 3.35	175.14 <sup>a</sup> ± 3.39	154.96 <sup>b</sup> ± 3.04	158.26 <sup>b</sup> ± 2.11	178.45 <sup>a</sup> ± 2.97	178.95 <sup>a</sup> ± 3.16	160.53 <sup>b</sup> ± 2.62	161.48 <sup>b</sup> ± 4.10

Means on the same row differently superscripted are significantly different (P<0.05).

**Table (4):** Blood hematological picture as affected by experimental treatments at 40 days of age.

Items	Normal temperature (23°C )				High temperature (38°C )			
	Control	Sand	Neem	Proiotics	Control	Sand	Neem	Proiotics
Erythrocytes (x10 <sup>6</sup> / μl)	2.88 <sup>d</sup> ±0.04	2.90 <sup>d</sup> ±0.03	3.2 <sup>b</sup> ±0.01	3.4 <sup>a</sup> ±0.01	3.01 <sup>c</sup> ±0.03	3.09 <sup>c</sup> ±0.03	3.06 <sup>c</sup> ±0.01	3.2 <sup>b</sup> ±0.01
Leukocytes (x10 <sup>3</sup> / μl)	11.7 <sup>e</sup> ±0.06	11.8 <sup>e</sup> ±0.06	12.3 <sup>c</sup> ±0.03	12.5 <sup>b</sup> ±0.05	12.1 <sup>d</sup> ±0.04	12.08 <sup>d</sup> ±0.01	13.2 <sup>a</sup> ±0.03	13.3 <sup>a</sup> ±0.05
Heterophil %	30.1 <sup>d</sup> ±0.23	30.1 <sup>d</sup> ±0.23	23.0 <sup>f</sup> ±0.07	26.0 <sup>e</sup> ±0.03	34.9 <sup>a</sup> ±0.03	34.3 <sup>a</sup> ±0.01	33.0 <sup>b</sup> ±0.07	32.0 <sup>c</sup> ±0.03
Lymphocytes %	54.3 <sup>c</sup> ±0.46	54.8 <sup>c</sup> ±0.46	59.0 <sup>b</sup> ±0.09	57.0 <sup>a</sup> ±0.15	42.2 <sup>e</sup> ±0.07	42.2 <sup>e</sup> ±0.03	46.0 <sup>d</sup> ±0.09	45.5 <sup>d</sup> ±0.15
Eosinophil %	4.2 <sup>c</sup> ±0.11	4.0 <sup>c</sup> ±0.11	5.0 <sup>a</sup> ±0.01	5.0 <sup>a</sup> ±0.01	3.4 <sup>d</sup> ±0.64	3.5 <sup>d</sup> ±0.05	4.0 <sup>c</sup> ±0.01	4.5 <sup>b</sup> ±0.01
Basophil %	10.3 <sup>c</sup> ±0.06	10.0 <sup>c</sup> ±0.06	13.0 <sup>a</sup> ±0.08	12.0 <sup>b</sup> ±0.01	8.00 <sup>e</sup> ±0.04	8.3 <sup>e</sup> ±0.08	9.0 <sup>d</sup> ±0.08	10.0 <sup>c</sup> ±0.01
Monocyte %	1.01 ±0.0	1.01 ±0.0	0.0 ±0.0	0.0 ±0.0	11.5 ±0.08	11.7 ±0.06	8.0 ±0.0	8.0 ±0.0
Hemoglobin (g/dl)	12.10 <sup>d</sup> ±0.81	12.24 <sup>d</sup> ±0.22	13.01 <sup>b</sup> ±0.24	13.16 <sup>b</sup> ±0.17	12.61 <sup>c</sup> ±0.31	12.75 <sup>c</sup> ±0.31	13.34 <sup>a</sup> ±0.54	13.46 <sup>a</sup> ±0.13
Hematocrit (%)	31.13 <sup>d</sup> ±0.13	31.21 <sup>d</sup> ±0.29	32.94 <sup>b</sup> ±0.20	33.24 <sup>b</sup> ±0.19	31.71 <sup>c</sup> ±0.10	31.95 <sup>c</sup> ±0.79	33.64 <sup>a</sup> ±0.25	33.64 <sup>a</sup> ±0.29

Means on the same row differently superscripted are significantly different (P<0.05).

**Table (5):** Counts of some intestine pathogenic bacteria (CFU /g fluid) of broiler chicks as affected by experimental treatments at 40 days of age.

Items	Normal temperature (23°C )				High temperature (38°C )			
	Control	Sand	Neem	Probiotics	Control	Sand	Neem	Probiotics
<b>Ileum</b>								
Aerobic plate count (x10 <sup>6</sup> /g)	7.02±0.6 <sup>c</sup>	5.93±0.4 <sup>d</sup>	3.14±0.3 <sup>g</sup>	4.72±0.3 <sup>e</sup>	89.2±0.7 <sup>a</sup>	76.4±0.6 <sup>b</sup>	4.39±0.2 <sup>f</sup>	6.02±0.4 <sup>d</sup>
E. coli (x10 <sup>6</sup> /g)	6.31±0.4 <sup>c</sup>	5.87±0.2 <sup>d</sup>	3.73±0.2 <sup>g</sup>	4.51±0.4 <sup>f</sup>	8.65±0.6 <sup>a</sup>	7.33±0.4 <sup>b</sup>	4.70±0.2 <sup>e</sup>	5.92±0.3 <sup>d</sup>
Salmonella (x10 <sup>3</sup> /g)	15 ±0.2	12±0.2	0.00	0.00	23±0.4	21±0.3	0.00	0.00
Staphylococci (x10 <sup>4</sup> /g)	36 ±0.2 <sup>b</sup>	34 ±0.3 <sup>c</sup>	30 ±0.3 <sup>e</sup>	32 ±0.2 <sup>d</sup>	39 ±0.3 <sup>a</sup>	36 ±0.3 <sup>b</sup>	30 ±0.2 <sup>e</sup>	32 ±0.2 <sup>d</sup>
Coccidia (x10 <sup>4</sup> /g)	4 ±0.3	1 ±0.1	0.00	0.00	16 ±0.6	9 ±0.4	0.00	0.00
<b>Caecum</b>								
Aerobic plate count (x10 <sup>7</sup> /g)	7.22±0.4 <sup>c</sup>	5.31±0.3 <sup>e</sup>	2.65±0.2 <sup>g</sup>	4.20±0.3 <sup>f</sup>	87.5±0.9 <sup>a</sup>	71.9±1.1 <sup>b</sup>	3.95±0.4 <sup>f</sup>	5.84±0.4 <sup>d</sup>
E. coli (x10 <sup>6</sup> /g)	5.12±0.6 <sup>c</sup>	4.71±0.6 <sup>d</sup>	3.42±0.4 <sup>g</sup>	3.25 ±0.4 <sup>h</sup>	7.52±0.6 <sup>a</sup>	6.19±0.3 <sup>b</sup>	4.30±0.2 <sup>e</sup>	4.10±0.2 <sup>f</sup>
Salmonella (x10 <sup>3</sup> /g)	14 ±0.3	12 ±0.1	0.00	0.00	17 ±0.2	15±0.2	0.00	0.00
Staphylococci (x10 <sup>4</sup> /g)	35±0.03 <sup>c</sup>	34 ±0.3 <sup>d</sup>	31±0.2 <sup>g</sup>	32 ±0.2 <sup>f</sup>	39 ±0.3 <sup>a</sup>	36±0.0 <sup>b</sup>	31±0.2 <sup>g</sup>	33±0.2 <sup>e</sup>
Coccidia (x10 <sup>4</sup> /g)	13 ±0.06	9 ±0.01	0.00	0.00	21 ±0.1	15 ±0.03	0.00	0.00
<b>fecal matter</b>								
Aerobic plate count (x10 <sup>7</sup> /g)	8.06±0.6 <sup>c</sup>	6.24±0.3 <sup>d</sup>	3.89±0.2 <sup>f</sup>	4.14±0.2 <sup>f</sup>	91.5±1.4 <sup>a</sup>	75.6±1.3 <sup>b</sup>	4.13±0.1 <sup>f</sup>	5.54±0.2 <sup>e</sup>
E. coli (x10 <sup>6</sup> /g)	6.43±0.4 <sup>c</sup>	5.75±0.4 <sup>d</sup>	3.56±0.3 <sup>g</sup>	4.28±0.4 <sup>f</sup>	8.33±0.6 <sup>a</sup>	6.90±0.6 <sup>b</sup>	4.96±0.3 <sup>e</sup>	5.88±0.3 <sup>d</sup>
Salmonella (x10 <sup>3</sup> /g)	14 ±0.1	12 ±0.1	0.00	0.00	16±0.1	14±0.1	0.00	0.00
Staphylococci (x10 <sup>4</sup> /g)	41.1 ±0.2 <sup>c</sup>	40.4 ±0.2 <sup>d</sup>	36.1±0.2 <sup>h</sup>	38.2±0.2 <sup>f</sup>	47.0±0.2 <sup>a</sup>	44.0 ±0.2 <sup>b</sup>	37.0±0.2 <sup>g</sup>	39.5±0.2 <sup>e</sup>
Coccidia (x10 <sup>4</sup> /g)	18±0.02	11±0.02	0.00	0.00	23±0.02	19±0.02	0.00	0.00

Each value is an average of 5 observations.

**Table (6):** Economical efficiency of of broiler chicks at 42 days of age as affected by experimental treatments.

Treatments		Normal temperature (23°C )				High temperature (38°C )			
		Control	Sand	Neem	Propiotics	Control	Sand	Neem	Propiotics
Feed	Total intake (Kg/chick)	3.53	3.536	3.654	3.718	3.245	3.253	3.328	3.501
	Price / kg (L.E)	2.03	2.03	2.10	2.10	2.03	2.03	2.10	2.10
	Cost (L.E)	7.17	7.17	7.67	7.79	6.58	6.60	6.97	7.35
Meat	Wight gain	1.548	1.563	1.691	1.753	1.469	1.485	1.616	1.681
	Price / kg (L.E)	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
	Total Revenue (L.E)	17.71	17.94	19.44	20.13	16.91	17.02	18.52	19.32
Net Revenue (L.E)		10.54	10.77	11.77	12.34	10.33	10.42	11.55	11.97
Economic efficiency		147.00	150.21	176.46	185.41	156.99	157.88	165.71	162.86
Relative Economic efficiency (%)		100	102.18	120.04	126.13	100	100.57	105.55	103.74

Net revenue = Price of Wight gain / chick - feed cost

Economic efficiency = net revenue / feed cost x 100

Relative economic efficiency (%) assuming the Control treatments = 100%

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### الملخص العربي

كيفية التحكم في الكائنات الحية الدقيقة المرضية في أمعاء بداري إنتاج اللحم تحت الظروف العادية أو الإجهاد الحراري

#### 1- النباتات الطبية - مركز البكتري الحيوية - الرمال كفرشة

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أجريت هذه الدراسة لمعرفة تأثير بعض المركبات (البوجين (مركز البكتري الحيوية) - مسحوق أوراق النيم - الرمال كفرشة) التي تعمل على تقليل أو التحكم في كمية أو عدد البكتيريا المعوية المسببة للأمراض المعوية التي تسبب خسائر إقتصادية كبيرة في حالة تعرض الطيور لظروف بيئية مجهدّة أو ضاغطة وبالتالي تحسين بعض الصفات الإنتاجية والفسبولوجية لكناكيت اللحم أثناء التربية العادية وكذلك أثناء الإجهاد الحراري (38°م). تم استخدام 240 ككتوت هبرد (هجين تجاري لإنتاج اللحم) وزعت عشوائيا إلى أربع مجموعات متساوية بكل منها 60 ككتوت (2 مكرر) وتم تربيتهم تحت ظروف متماثلة. المعاملة الأولى تم تغذيتها علي علققة المقارنة مع فرشة من تبن القمح بعمق 2.5 سم. المعاملة الثانية تم تغذيتها علي علققة المقارنة مع إضافة مسحوق أوراق النيم (بمعدل 200 جم / كجم عليقه) مع فرشة من تبن القمح بعمق 2.5 سم. و المعاملة الثالثة تم تغذيتها علي علققة المقارنة مع إضافة البوجين (مركز بكتريا  $Lactobacillus\ casei$  ( $8 \times 10^7$  cells/g) +  $Bacillus\ subtilis$  ( $6 \times 10^7$  cells/g) بمعدل 2 جم / كجم عليقه مع فرشة من تبن القمح بعمق 2.5 سم. المعاملة الرابعة تم تغذيتها علي علققة المقارنة مع فرشة من الرمال بعمق 2.5 سم. وعند عمر 35 يوم تم تقسيم كل معاملة إلى مجموعتين متساويتين كل منها 30 ككتوت. الأولى تم تربيتها تربية عادي (24°م) حتى نهاية التجربة والثانية تم تعريضها لمدة 6 أيام للإجهاد الحراري (38°م) لمدة 3 ساعات / اليوم من عمر 35 حتى 40 يوم. ودلت النتائج على أن:-

هناك استجابة معنوية ( $P < 0.05$ ) للإضافات الميكروبية الحيوية المستخدمة أو مسحوق أوراق النيم إلي علائق كناكيت إنتاج اللحم تحت ظروف التربية العادية أو التعرض للإجهاد الحراري على وزن الحسم الم كتسب والعلف المأكول مع الكفاءة التحويلية ومعدل النفوق. وكذلك استجابة معنوية ( $P < 0.05$ ) على الوزن النسبي لكل من الذبيحة والأجزاء المأكولة وكذلك الغدد اللمفاوية (غدة البرسا وغدة التيموسية).

1. أدت الإضافات العلفية إلي زيادة معنوي ( $P < 0.05$ ) للبروتين الكلي وبالمثل مستوى الألبومين والجلوبولين وتركيز الهيموجلوبين والهيماتوكريت وكذلك مستوى هرمون

- تراي أيودوثيرونين Triiodothyronine ( $T_3$ ) في بلازما الدم. كما أدت إلي انخفاض معنوي في كل من مستوى الكولسترول والدهون الكلية في بلازما الدم. بينما لم يتأثر معنوياً كل من تركيز الكرياتينين وإنزيم AST and ALT في بلازما الدم سواء في الظروف العادية أو ظروف الإجهاد الحراري.
٢. أدت الإضافات العلفية إلي زيادة معنوية ( $P<0.05$ ) في زيادة كل من خلايا الدم الحمراء erythrocytic (RBC's) وخلايا الدم البيضاء Leukocytic (WBC's) وأنواعها Lymphocytes, Eosinophil and Basophil, بينما لم يتأثر معنوياً كل من خلايا من نوع heterophil and Monocyte وكذلك الوزن النسبي لكل من غدة البرسما والثيموسية في الظروف العادية أو ظروف الإجهاد الحراري.
٣. استخدام الرمال كفرشة في عنابر كتاكتيت إنتاج اللحم لم يؤثر معنوية علي أي مقياس من المقاييس الأداء الإنتاجي والفسولوجي السابقة ما عدا معدل النفوق كان معنوياً بمستوي ( $P<0.05$ ).
٤. أدت إضافة كلا من البكتيريا الحوية ومسحوق أوراق النيم إلي العلائق أو باستخدام الرمال كفرشة في عنابر كتاكتيت إنتاج اللحم إلي انخفاض معنوي ( $P<0.05$ ) في العدد الكلي للبكتيريا المرضية و E. Coli و staphylococci في الزرق أو في الإمعاء (والصائمي والمستقيم) و إختفاء كل من ال Salmonella وطفيل الكوكسيديا Coccidia تماما في الزرق أو في الإمعاء (والصائمي والمستقيم) تحت ظروف التربية العادية أو التعرض للإجهاد الحراري.
٥. التعرض للإجهاد الحراري أدى إلي زيادة معنوية ( $P<0.05$ ) لمعدل النفوق، بينما انخفض معنوياً ( $P<0.05$ ) كل من وزن الجسم المكتسب والعلف المأكول ووزن الذبيحة. كما أدت إضافات العلفية المستخدمة الي تقليل أو تحسين الأثار السيئة لأرتفاع درجة الحرارة
- وأظهرت النتائج أنه ينصح باستخدام الإضافات الحوية الميكروبية أو مسحوق أوراق النيم في عليقة كتاكتيت إنتاج اللحم أو باستخدام الرمال كفرشة في عنابرها لتقليل أو التحكم في كمية أو عدد البكتيريا المعوية التي تسبب الأمراض المعوية لتجنب خسائر إقتصادية قد تكون كبيرة وكذلك لتحسين معدل الزيادة في وزن الجسم ومعدل التحويل الغذائي والصفات الفسيولوجية وخفض معدل النفوق في الأجواء الحارة وشبه الحارة أو تحت الظروف البيئية المجهد