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# PRODUCTIVE, PHYSIOLOGICAL, IMMUNOLOGICAL AND ECONOMICAL EFFECTS OF SUPPLEMENTING NATURAL FEED ADDITIVES TO BROILER DIETS

By

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**Abstract:** *Ross commercial broilers (n: 280) were utilized to evaluate effects of supplementing diets with Rosemary (R), Marjoram (M) or Sweet Basil (SB) as natural feed additives at 0.5 or 1.0 g./ kg diet. Chicks were divided into 7 groups with 4 replicates of 10 each. Results could be summarized as follow:*

*1. Proximate analysis showed SB superiority in protein, moistur and ash contents of 14.00, 9.89 and 30.44%, respectively. While, R had higher fiber (16.51%), ether exract (4.92%), nitrogen free extract (59.28%), and ME (3103.56 kcal/ kg), respectively. Weight gains increased (15.17%) with higher M followed by corresponding SB (12.40%).*

*2. Overall, feeding broilers higher R reduced (**P** $\leq$ 0.05) feed consumed (3451.50 g./ bird/ period) than other treatments, better feed conversion ratio (1.58 g feed / g gain) was noted due to feeding higher M for the whole experiment, while the control had worst values 1.89 (g feed / g gain).*

*3. Higher M or SB levels during growing and finisher periods resulted in better protein efficiency ratio and performance index values. However, the opposite was seen with energy utilization values which were better as broilers fed the control diet.*

*4. Higher carcass weights were noted for birds fed on the higher R level. feeding the control diet resulted in higher gizzared (2.43%), and lymphoid organs, while lower M had heavier thymus. Feeding SB levels increased red blood cell (**RBC**) counts to 4.24 and 4.36, respectively. Lymphocytes were increased due to SB (1 g./ kg) as compared to the control. Feeding SB (0.5 g./ kg) increasd glucose (**P** $\leq$ 0.05).*

*5. Better economic efficiency was recorded with feeding the higher M level (124.38%) as compared to all other dietay treatments and the control.*

*In conclusion, using R, M or SB levels (0.5 or 1.0 g./ kg diet) in broiler diets would improve productivety and immunelogical performance and carcass characteristics as well. Dietary M supplementation of (1 g./ kg) might be acceptable for achieving optimum broilers performance and revenue cost ratio.*

## INTRODUCTION

Currently, consumers around the world are increasingly more conscious of the nutritional value and safety of their food and its ingredients. In poultry nutrition, it is a soild fact that feeding cost is considered the most expensive item in the whole production process. Therefore, attempts are usually made to reduce feed cost without adversely affecting performance or product safety. Feed additive are classified into two categories: $1^{st}$, those essential for the biological function of birds as in vitamins and trace elements, wherase the $2^{nd}$ category includes additives not essential for biological function, but have demonstrated a positive effect on bird's as in growth promoters, absorption enhancers, anti-microbial agents and metabolic modifiers (Gill, 1999; Dickens *et al.*, 2001; Abaza, 2001; Al-Harthi, 2002; Hassan *et al.*, 2004 and Hassan *et al.*, 2007). As a result, supplementing broiler diets with some feed additives may be considered as an alternative to improve growth and feed conversion efficiency.

With many countries currently banding usage of synthetic drugs including antibiotics used as growth promoters due to their negative side effects on both poultry and human (Heitzman, 1986; Khachatourians, 1998, Wary and Davies, 2000), many attempts have been made to use natural feed additives such as herbs and edible plants which have some properties as growth enhancers to replace synthetic drugs. Therefore, renewed interests of using alternative feed additives have been arising due to recent consumer scares over animal production practices, particularly using those additives from plant origin which are natural and safe to consumers. Generally, it is worth to note that medicinal plants not only serve as a medical purpose but also contain aromatic substances and essential oils which are widely used in feed industries.

One possible mechanism of how medicinal plants work is by improving broilers growth and feed utilization through the improvement of nutrients digestibility. This is thrugh facilitating absorption of calorigenic nutrients across the gut wall by increasing its absorption capacity Nelson *et al.*, (1963). Reports by (Abaza 2001, Al-Harthi 2002 and El-Husseiny *et al.*, 2002) showed an improvement in nutrients digestibility of broiler diets using medicinal plants mixture. Among these medical plants, Rosemary, Marjoram and Sweet Basil, those have been used to combat a variety of ailments, and are popular herbs widely used as culinary spices. The approved modern therapeutic applications of these plants leaves are supported based on their long history of use in well established systems of traditional medicine, in *vivo* and *in vitro* pharmacological studies in poultry and also phyto-chemical investigations.

Rosemary (***R***; *Rosmarinus Officinalis*) is a bushy evergreen shrub with thick aromatic leaves (Leung, 1980), contains phenolic acid; phenolic diterpenoid bitter substances; triterpenoid acids; flavonoids; 1.2 to 2.5% volalile oil and tannins (Leung and Foster 1996 and Newall, 1996). Sweet Basil (***SB***; *Ocimum Basillicum*) has the following compounds of: basil oil, linalool and methylchaviol that varies considerably in the amount. Also, differences in the K/ Ca ratio can change the quantity of major constituents in the essential oil (Van Duong, 1993 and Takano 1993). Marjoram (**M**; *Origonum Marjorana*) is a very popular and a common medicinal plant that has an antioxidant activity. It contains about 0.5 to 3% oil. Marjoram oil chemical composition includes borneol, terpinene, pinene, sabinene and terpineol (Hermann, 1973). Triantaphyhou *et al.*, (2001) studied the essential oils and extracts of aromatic herbs obtained by organic solvents for their antioxidant activity in lipid substances. Authors reported that sweet M have a remarkable capacity in retarding lipid oxidation.

The main purpose of this study was carried out to evaluate the effect of different dietary levels of R, M or SB on broilers performance. In addition, study productive, physiological, immunological performance of broiler chicks as well as carcass characteristics and economic efficiency as affected by the tested feed additives.

## MATERIALS AND METHODS

### Experiment Management:

One day-old Ross commercial broiler chicks (n: 280) were utilized in this experiment. Chicks were randomly divided into seven groups of 40 chicks with four replicates of 10 birds each. Chicks were kept in caged wire floor batteries in a controlled environmental house. Experimental diets and water were offered *ad-libitum* over the experimental period.

### Experimental Diets:

Experimental diets were formulated to meet all nutrients requirement for broiler as recommended by NRC (1994). Chicks were fed basal diet 23% and 3065, 22.4% and 3160 and 20.5% CP and 3200 kcal/kg during the starter, grower and finisher periods, respectively. Dietary treatments included two dietary levels of M, R or SB (0.5 or 1.0 g./ kg diet). Each feed additive was incorporated into the basal diet for each period resulting in a total of seven dietary treatments as follow: **1)** Control diet, **2)**, Basal diet plus R (0.5 g./ kg diet), **3)** Basal diet plus R (1g./ kg diet), **4)** Basal diet plus M (0.5g./ kg diet), **5)** Basal diet plus M (1g./ kg diet), **6)** Basal diet plus SB (0.5g./ kg diet), and **7)** Basal diet plus SB (1g./ kg diet).

Composition and calculated chemical analysis of all tested experimental diets are presented in (Table 1). Tested feed additives M, R and SB leaves were purchased from a local commercial market, and each additive chemical analysis is presented in (Table 2). Furthermore, metabolizable energy (ME) value was also calculated according to Carpenter and Clegg (1956).

**Performance criteria:**

Live body weights and gains (g.) of chicks were recorded at three intervals 14, 28 and 42 days of age and over all (1-42) days of age, while daily feed consumption (g.) and feed coversion ratio (g.feed/ g. gain) were recorded and calculated every two weeks.

**Protein efficiency ratio and efficiency of energy utilization:**

Protein efficiency ratio (**PER**) and energy utilization (**EEU**) values were calculated during each studied growth periods according to equations of Persia *et al.*, (2003) and Ali, (1999) as follow: *PER* = (g. weight gain) / (crude protein consumed), and

*EEU* = (ME consumed kcal / g. body weight gain).

**Performance index (PI):**

was calculated during studied growth periods according to the equation of North (1981) and Ali, (1999) as follow:

*PI* = (live body weight (kg) / feed conversion ratio) x 100

**Slaughter and Blood traits:**

At the end of the experiment (42 days of age), 4 birds/ treatment were randomly chosen, fasted for about10 hours, weighed and slaughtered. After removal of edible, non-edible and lymphoid organs carcass was weighed, then relative organ weights were calculated on live body weight basis.

Individual blood samples were taken from the same slaughtered birds from each treatment at 42 days of age. Blood samples were collected into dry clean tubes containing heparin drops to determine hematological parameters including, red (**RBC's**), and white (**WBC's**) blood cells as described by Hawkey and Dennett (1989), hemoglobin (**Hb**) concentration as described by Tietz (1982), packed cell volume (**PCV**) and thrombocyte / 1000 RBC's according to Winderobe (1967). Another centrifuge tubes with no heparin were used to collect blood and centrifuged for 15 minutes (4000 rpm). Serum samples were stored in deep freezer at approximately -20° C for further chemical analysis.

Serum total protein and albumin were determined according to Doumas, (1971); Witt and Trendelenburg (1982). Globulin concentration was calculated as the difference between total protein and albumin, and then the ratio of albumin/ globulin was also calculated. Assay of serum Glutamic Oxaloacetic transaminase (**GOT**) and Glutamic Pyruvic Transaminase (**GPT**) activity were conducted according to procedures of Reitman and Frankel (1957). Total cholesterol was determined according to (Watson, 1960). Also, creatinine was determined according to Jaffe method (Kaneko, 1980). Plasma triglyceride was determined according to the method of Fossati (1983). Finally, plasma glucose was determined according to the procedure of Coles, (1986).

**Immune response evaluation:**

Humeral immune response was evaluated by measuring antibody against Newcastle Disease Virus (**NDV**) vaccine using Enzyme- Linked Immunosorbent Assay (**ELISA**) and Haemagglutination Inhibition (**HI**) according to King and Seal (1998), (Anan, 1971), and Snyder and Marquardt (1989), respectively.

**Economic efficiency:**

For economic efficiency (**EE**) determination meat production management factors in all treatments were considered constants, and the amount of feed consumption and weight gains per treatment were calculated. Prices of experimental diets and feed additives (R, M or SB) were calculated according to the price of local market at the time of the experiment. Economical efficiency = (the revenue / price of feed intake) x 100

**Statistical analysis:**

Data from all response variables were subjected to one way analysis of variance applying SAS program (SAS, 2001) using general liner model GLM. Significant difference among treatment means were separated using Duncan's multiple range procedure (Duncan, 1955) at 1 and 5% probability.

# RESULTS

**Chemical compositions of rosemary, marjoram and sweet basil:**

Chemical constituents of tested feed additives may vary according to processing of these plants, climatic conditions under which the seeds were grown and the kind of soil. The proximate analysis of R, M and SB powders are presented in Table (2). It is clear that SB has a better composition of crude protein (14.00%), crude fiber (7.34%) and ash (30.44%) than those of other studied feed additives of R and M, while, R contained the lowest percent of protein (4.0%) and ash (6.15%), respectively. On the other hand, R powder had the highest calculated metabolizable energy (3103.56 kcal/ kg) according to equation of Carpenter and Clegg (1956). Higher energy level of R could be due to higher ether extract level (4.92%) as compared to M (2.21%) and SB (0.58%), respectively.

**Effect of feeding different natural feed additives on broiler performance:**

It is worthy to note that all chicks during studied growth periods had 100% viability for all experimental groups fed diets supplemented with studied feed additives (R, M or SB), therefore, data of mortality were not presented. Feeding broiler diets supplemented with natural feed additives (R, M or SB) on body weights and gains during growth periods (14, 28 and 42 days of age) are presented in (Table 3). A significant increase in body weights ($P \leq 0.05$) was noted by feeding diets supplemented with R, M or SB at the upper level (1 g./kg; 1182.58, 1197.42 and 1204.08 g), respectively than those fed the same feed additives at the lower level of 0.5g/kg and the control. Broilers at 42 days of age fed diets supplemented with M at 1 g. /kg had significantly heavier body weights ($P \leq 0.05$; 2325.83 g.) when compared to all other dietary treatments and the control of 5.23, 2.42 and 14.88%, respectively.

In regard to weight gains shown in (Table 3), similar trend was recorded as the previously obtained with body weights. It is evident that supplemental R, M or SB to broiler basal diets resulted in a positive effect when compared with that of the un-supplemented diet. During the grower period feeding dietary treatments at higher levels 1g/kg resulted in a significant increase in weight gain ($P \leq 0.05$) over that of the control group. However, the enhancement in body weight gain owed to M supplementation was the best 875.50 g as compared with those of the other treatments R or SB, respectively. During the finisher period, feeding M at 1 g. / kg continued to have superior weight gains followed by SB at the lower level

1128.42 and 1101.00 g., respectively. Overall, body weight gains (1-42 d) showed a similar pattern as in earlier periods as broiler chicks fed experimental diets supplemented with M and SB at 1g./ kg significantly gained more weight ($P \leq 0.05$) as compared to those of the control (2285.83 and 2230.83 *vs.* 1984.67g.) and all other treatment groups as well.

Feed consumption data for all experimental periods and overall are presented in (Table 3). Generally, it is clear that inclusion rate for any of tested additives resulted in a decrease ($P \leq 0.05$) of feed consumed during all growth periods among dietary treatments as compared to the control diet, except for higher SB level which was statistically similar to the control diet (14-28 and 1-42 days), respectively. During grower (14-28) period, the highest amount of feed consumption was recorded for chicks of the control group followed by SB at 1 g./ kg diet of 1348.17 and 1288.92 g., respectively, while broilers fed R at the upper level consumed the lowest amount of feed. Overall, the control group consumed significantly more feed ($P \leq 0.01$) of 3755.08 g followed by SB (1g/kg; 3711.08 g.). While, broilers fed diets with either R, or M at 0.5 g./ kg consumed the lowest amounts as compared with that of the control.

Feed conversion ratio data are presented in (Table 3). Through grower period (14 to 28 d), feeding broierls dietary treatment of SB at the lower level resulted in better feed conversion raio (1.40 g feed/g gain; $P \leq 0.05$) when compared to the other dietary treatments, and the control group, which had the worest feed conversion value of 1.88 g feed/g gain. Results of the finisher period (28 to 42 d) showed similar results for the control group being significantly impaired in feed conversion ratio value of (2.01 g feed / g gain), while broilers fed diets with M at either levels (0.5 or 1g/ kg) had better feed conversion ratio of 1.77 and 1.74, respectively followed by Rosemary at level 0.5 g./ kg of 1.83 g feed / g gain. Overall there was a similar trend to that of the finisher period as of supplementing M at both levels resulted in significantly ($P \leq 0.05$) better feed conversion values and the worest value was obtained due to feeding the control group 1.89 g feed / g gain.

**Protein efficiency ratio, efficiency of energy utilization and Performance index:**

The effect of feeding dietary inclusion levels of studied natural feed additives of R, M or SB throughout the entire experimental growth period and the overall trial are summarized in (Table 4). During the 1$^{st}$ growing period (0-14 d), feeding broiler chicks either dietary levels of R 0.5 g./ kg or SB 1 g./ kg in experimental diets significantly increased PER ($P \leq 0.05$) values of 3.56 and 3.49, respectively as compared to all other dietary treatments of R and M (1 g./ kg), and the control group. Feeding broilers grower diets, PER highest value was recorded with feeding 1 g./ kg of R of 3.42, while the lowest value of 2.40 corresponded with feeding chicks the control diet. Feeding 1 g./ kg of M during the 3rd growth period (28-42 d) resulted in significantly ($P \leq 0.05$) higher PER values of 2.80 and was non significantly different when comaperd to feeding the lower M dietary level (0.5 g./ kg) of 2.76. Overall, feeding R (0.5 g./ kg), M (0.5 or 1 g./ kg), or SB (0.5 g./ kg) had significnalty better ($P \leq 0.05$) PER values when compared to the control group and those of R (0.5 g./ kg) and SB (1 g./ kg), respectively.

Overall, feeding broilers diets supplemented with higher dietary M level resulted in significantly ($P \leq 0.05$) the lowest EEU value (5.00) as compared to the control group (6.00), this finding positively corresponds with with the highest BWG of 2285.83 g/ bird/ period for the higher M level and the lowest BWG of 1984.67 g/ bird/ period for the control group, respectively. During all experimental periods and overall in comparison to all other dietary treatments the EEU corresponding values ranged from 4.68 to 6.44 confirming that the control diet fed group had significantly higher EEU values ($P \leq 0.05$), which corresponds with the lowest BWG. Performance index values showed that starting the 14th day of age feeding broilers diets supplemented with M (1 g./ kg) sustained significantly higher PI values ($P \leq 0.05$) till the end of the experiment (42 d). It is worthy to note that the control group recorded the lowest PI value during all experimental periods. Among all tested dietary levels of studied feed additives, upper level of M had the best values of PER and PI when compared to those of the lower levels, while the opposite was true with feeding the control group in regard to EEU values.

**Carcass and Organs Relative Weights:**

Data of carcass traits of the broiler chicks at 42 days of age relative to live weight of broiler are summarized in (Table 5). Dietary supplementation of R, M or SB did not significantly affect liver, heart and abdominal fat percent compared to the control group, respectively. Regarding live body weight or dressing, they were significantly increased ($P \leq 0.01$) by R dietary levels at the higher level (1g./ kg diet) as compared to those of the control by about 3.99 and 5.43%, respectively. Followed by increase in live body weight by incorporating SB at (1g./ kg diet) by 3.20% over that of the control. Feeding broilers diets of the control or 0.5 g./ kg of R or SB resulted in higher gizzard percent of 2.43, 2.15 and 2.29%, respectively. Furthermore, dietary supplementation of the upper R level resulted in a significantly ($P \leq 0.05$) higher percent of spleen and bursa as compared to the control (0.16 and 0.20% *vs.* 0.13 and 0.14%), respectively. In contrast, gizzard relative weights were reduced ($P \leq 0.05$) as broilers were fed on higher dietary R level as compared to the control group (2.04 *vs.* 2.43%; respectively). Moreover, thymus highest value was obtained from feeding the lower M of 0.60% as compared to the control of 0.26%.

**Hematological Characteristics and White Blood Cells Diferntiation:**

Hematological traits data for broilers at 42 days of age fed basal diets supplemented with R, M or SB dietary levels are summarized in (Table 6). Addition of any of these three natural feed additives to broilers diets did not significantly affect Hb, PVC or thrombocytes values as they were all significantly similar to those of the control group. Hemoglobin average values obtained herein ranged between 9.83 for the control to 12.33% for those received the higher level of SB. Similar finding was observed with the upper levels of M and SB of 30.75 and 31.0% for PCV as compared to that of the control of 29.67%, respectively. Also, thrombocyte scores were similarly affected by dietary feed additives as averaged between 15.o for broilers fed diets of R and SB (0.5 & 1 g./ kg) to 34 the highest for chicks received the control diet. Feeding either SB dietary levels significantly increased ($P \leq 0.01$) RBC count to 4.24 and 4.36, respectively, however, broilers fed the control diet recorded the lowest RBC count of all treatment groups of 3.37. These results are consistent with Elnagar, *et al.*, (2003) who reported an increase in RBC count for birds fed diets with garlic extract as compared to the control.

White blood cell differentiation results are presented in (Table 7). No significant effect of feeding different dietary levels of R, M or SB was obtained on total WBC, Heterophil, monocytes or eosnophil counts as compared to the control group. However, lymphocytes were significantly increased ($P \leq 0.05$) due to feeding dietary SB (1 g./ kg) when compared to the control diet or either two dietary levels of R and M. Furthermore, feeding broilers 1 g./ kg diet M increased ($P \leq 0.05$) Heterophil/ lymphocyte ratio (1.88) as compared to the lowest ratio (0.66) reported for the lower dietary M, followed by the control group (0.88), respectively.

**Blood Biochemical Parameters:**

Serum biochemical parameters could be used as indicators of the nutritional and physiological status of experimental broiler chicks, data are presented in (Table 8). It is obvious that dietary R, M or SB did not significantly affect cholesterol, triglycerides, GOT, GPT, creatinine and total protein, respectively. Although serum glucose levels were in the normal range, Feeding diets supplemented with SB (0.5 g./ kg) or the control had a significant tendency ($P \leq 0.05$) to increase serum concentration of glucose (214.75 and 214.10 mg/ dl), respectively as compared to the lowest glucose 178.23 mg/ dl as a result of feeding upper dietary SB (1 g./ kg). Albumin and A/G ratio were also increased ($P \leq 0.05$) by feeding broiler the control diet as compared to all other dietary treatments. Dietary treatments reduction effect on albumin was significantly low with M lower level of 1.67 g/ dl, and both levels of M or lower SB level for A/G ratio. On the other hand, blood globulin (g/ dl) values followed a different manner with feeding different levels of studied feed additives. In that, supplementing either M (1g/kg) or SB (0.5 g/kg) caused a significant increase in globulin ($P \leq 0.01$) when compared to that of the control of 1.06, 0.93 *vs.* 0.45 g/dl, respectively.

**Immune response:**

Broiler immune system status was measured by ELLSA and HI as a response to feeding different levels of either the three natural feed additives is illustrated in (Table 9). It is obviously that feeding experimental diets inclusive either R, M or SB improved the immune status as reflected by ELISA titer compared with that of the control, expect that of R at level 1g./ kg diet which was statistically equal to that of the control. The highest values were obtained with group fed diet supplemented with M (0.5g/kg) of 2.31 followed by R at 0.5g/kg diet of 1.90. While, the lowest value 0.27 was recorded with treatment of the upper level of R. Similar result was recorded with method of HI titer comparing with their respective the control group. In that, supplemental the high level of R to experimental diets gave the highest value of 3.0 in this respect followed by the other studied treatments.

**Economical efficiency**

Economical evaluation of feeding different experimental diets through the period of 42 days of age as affected by dietary R, M or SB levels are presented in Table (10). It is obviously that feeding dietary treatments decreased production costs as compared to that of the control. It is worthy to note that supplementing low levels of R, M or SB to basal diets resulted to reduction in feed cost as compared to corresponding upper levels. Average EE values of different treatments were between 1.99 being the best for broilers fed M at (1g./ kg) to the worst value 1.60 for chicks fed the control diet. Across all dietary feed additives, upper levels had better values in this respect than those lower ones, except that of the SB treatment.

Relatively, averages of improvement due to feeding studied natural feed additives ranged between 15.00 and 24.38% for broilers fed SB and M at (1g./ kg), respectively. These improvements could be attributed to the better findings previously obtained either in growth performance or feed utilization of broilers as. These results agree with finding of Abdel El-Latif *et al.*, (2002), Abdo, Zeinab *et al.*, (2003) and Hassan *et al.*, (2004) who reported that the inclusion levels of herbal feed additives in diets recorded the least cost/kg gain and the highest percent of economic efficiency compared with that un-supplemented diet.

## DISCUSSION

Positive effects of supplementing R, M or SB on broilers performance may be due to the fact that these plants may contain natural substances that could promote health and alleviate illness consequently improving general performance. These plant origin additives maintain the gut environment and play as a key part of reducing disease challenge in poultry production. Correct fermentation to liberate energy and vitamins from undigested fiber forms an extremely important part of the poultry nutrition. Herbs were used generously to flavor food providing a variety of active photochemical that promote health and protect against chronic disease (Eisenberg *et al.*, 1993, Craig, 1999). Along the same line, of medicinal plants components mechanism may include improving the physical conditions of gut ecosystem and enhancing function of immune system of chickens (Guo, 2003). Furthermore, the increase in broilers weight gains is suggested to be a result of existance of some extracts such as phenolic acids, which are also among M components, which act as antimicrobial and cause sterilization of the gastrointestinal tract, so as a result improved feed utilization and result in increasing weight gains (Yoshino *et al*, 1996).

All reported performance data are in agreement with many published research papers (King, 1976, Cowan, 1999, Craig, 1999, Ismail, *et al.*, 2001, Trianaphyhou *et al.*, 2001, Abdo Zeinab *et al.*, 2003, Soilman at al., 2003). The majority of previously published papers have stressed on the positive impact and the importance of medicinal plants on improving the performance parameters such as body weights, weight gains, feed consumption and feed conversion ratio as well as PER, EEU and PI of broiler chickens as a result of incorporating these natural feed additives in poultry "broiler" feed rations. Abdo Zeinab *et al.*, (2003) reported that feeding dietary M at 1.5 or 3% enhanced the appetite of broiler chickens at the first three weeks of age and overall. Moreover, feed intake values were also significantly increased by 12.1 and 14.3% as compared to the control. However, the same author reported that during the last three weeks of age, chicks received the control diet consumed more feed in comparison to all other dietary treatments. This was not the case found herin our experiment. However, we found a similar trend to that reported by Abdo Zeinab *et al.*, (2003) in the overall data of feed consumption which we had a significantly higher values for the control group as compared to all other dietary treatments. On the other hand, Soliman *et al.*, (2003) reported that broiler chickens fed on M significantly consumed more feed ($P \leq 0.01$) in comparison to those fed the control group, yeast, Zinc Bacitracin or yeast + Zinc Bacitracin, respectively. In the same report, feeding broiler chickens natural herb (Marjoram) did not have any significant influence on body weights, weight gains or feed conversion ratio, respectively.

Performance parameters reported here in our trial reveal that most of natural feed additives used, especially M and SB at the upper level (1 g./ kg diet) have positively improved body weights, weight gains, feed consumption and feed conversion ratio. This may be due to the ability/ role of these natural feed additives to enhance appetite, and consequently increasing feed consumption and improving body weight and weight gains as a result. The positive effect of these feed additives, M for example, is due to the fact that it contains a wide variety of secondary metabolites, such as, trepenoids, which have been found to have antimicrobial properties (Cowan, 1999), and antioxidant activity (Trianaphyhou *et al.*, 2001), which in turn improves the lower gut health, bacterial population, improves nutrients absorption, utilization and eventually improves bird's health and increases body weight and weight gain.

Marjoram has been reported to have antioxidant activity due to bound forms of phenolic components such as hydroxycinnamic acids and flavonoids (Trianaphyhou *et al.*, 2001). In support to these findings, Yoshino *et al.*, (1996) reported an improvement in the performance, especially feed utilization which meight be increased due to the biological function of green tea flower containing diets that have some extracts such as phenolic acids, catechins and β-carotene which acts anti-microbial and caused sterilization of gastrointestinal tract. In this respect, broilers when fed green tea as a natural feed additives, body weights, weight gains, feed consumption and feed conversion ratio were all significantly improved when compared to the control (Abdel-Azeem *et al.*, 2005) due to the excestance of flavonoids as one os the green tea components and represent 26 to 30% (Line *et al.*, 1998). Flavonoids, as a one component of M, may influence the intestinal micro flora resulting in better nutrient utilization and absorption. Another positive influence of flavonoids is improving the feed conversion ratio (Varilek *et al*, 2001) which is attributed to flavonoids acting as antimicrobial, anti fungal and antiflammatory agent. These characteristics of flavonoids would reduce mold growth and can completely inhibit the formation of aflatoxins, which would lead to higher efficiency of nutrients utilization in the feed.

Looking at terpenoides and flavonoids as joint components which are available in R, M and many other natural medicinal plants "herbs" including Thyme, it was also reported by Abdel-Malak (1995) that supplementing diet with thyme had a significant improvement in body weights and weight gains. Similar results were documented by Ghazalah and Ibrahim (1996) with ducks; Ibrahim *et al.*, (1998) and Abdel El-Latif *et al.*, (2002) with broiler chickens. Incorporating different levels of thyme into broiler diets has been reported to significantly improve feed conversion ratio (Abdel-Malak *et al.*, 1995). Similar results were also reported by Ghazalah and Ibrahim (1996) with ducks and Abdel El-Latif *et al.*, (2002) with Japanese quail. Also, Tollba and Hassan (2003) found that chicks feeding diet supplemented with 1% ground of dried thyme improved feed conversion during periods 35, 42 and 49 days of age compared with those received the un-supplemented diet. All of these reports emphesis the biological importance of herbal additives in broiler's diet to reduce mold growth and accordingly led to a higher utilization efficiency of nutrient in feed (Farag *et al.*, 1986 and Osman Mona, 2002). Also, results of El-Gendi *et al.*, (2000) indicated that feeding chicks on diet contained 0.5kg/ ton of Bio-tonic as a feed additive improved the performance index value.

Carcass results could explain the role of the active components in natural feed additives used in the study. The highest carcass weight percent was found in group of the upper level of R followed by SB, this increase was due to heavier live body weights as compared to the control. Lymphoid organs such as spleen and bursa relative weight of upper level of R and that of thymus with the lower M level were significantly heavier than those of control, respectively. Like the most medical herbs such as black seed or garlic supplementation, this improvement meight be related to the biological function of these additives which enhance the immune response (Mahfouz and El-Dakhakhny, 1960 and El-Ghamry, 2004). So, these organs play a considerable role in birds' immunity (Jones and Bark, 1979). This is in agreement with our results in regard to the positive influence of higher R, SB and lower M levels on organs relative weights.

Abdo Zeinab *et al.*, (2003) reported that only heart, bursa and thymus values were affected significantly by feeding diets containing M at 1.5 or 3% when compared to the control group. In the same report, both bursa and thymus percentages increased due to M addition of 1.5% or the combination with Red pepper. Results of Abdel-Azeem *et al.*, (2005) showed an increase in lymphoid organs as a result of supplementing broiler diets with bacitraci, yeast + bacitracin or M with no effect on the rest of carcass traits by these dietary treatments. Only gizzard parent was decreased as a result of feeding all studied dietary treatments, which correlate with our findings. Although, gizzard percentage of the live body weight was decreased as broilers were fed dietary treatments as compared to the control group, significant reduction was recorded with the upper level of R and SB or M. This may be due to function of K/ Ca ratio which can change the quantity of the major constituents in the essential oil of SB (Van Duong, 1993; Takano, 1993) this would affect gizzard movement and capacity and as a result play a role in gizzard weight.

The increase in RBC and WBC counts may be attributed to the direct effect on the haemopoietic tissue (Khodary *et al.*, 1996) or to the production of specific or non-specific antibodies against different antigens (El-Feki, 1987). Furthermore, findings of WBC may be attributed to enhancement of cellular functions due to implementing these studied feed additives in broiler diets with almost no available literatures to explain the effect of R, M and SB on WBC's differentiation. Reported biochemical results displayed no adverse effects on blood components as a result of adding different natural feed additives. The reduction of total blood cholesterol may be due to active substrate of R, M and SB supplementation. Like most of natural feed additives such as powdered green tea flower inhibits lipid metabolism by interfering with micelles solubilization of cholesterol in digestive tract which in turns decreased cholesterol absorption and increased the excretion of fecal bile acid cholesterol (Yang and Koo, 2000). Also, green tea like most of natural feed additives reduced pancreatic lipase activity and gastric lipase which resulted in a drastic decrease in gastric lipase that causes inhibition of digestive lipids and so likely to reduce fat digestion (Deng *et al.*, 1998). Furthermore, feed additives used did not have any deleterious impacts on kidney (as measured by creatinine levels), or liver functions (as measured by GOT and GPT levels). The similitude of enzyme activity and creatinine concentration exhibit healthy, non-pathological and non-toxic effect of R, M and SB addition on liver and kidney. Similar results were obtained by Abdel-Malak *et al.*, (1995) with biotonic as herbal feed additive.

Serum glucose reduction due to SB treatment might be related to an increase in insulin response during feeding the upper level, probably because the transport of blood glucose to the peripheral tissues was enhanced. On the other hand, increasing serum globulin may be due to the active components of the studied feed additives known as polyphones that may increase globulin level in the blood. It is well known that globulin is formed by lymphatic tissues including spleen as above mention in (Table 7) which had the highest relative weight for treatment of either levels of R or M (0.5 g./ kg). So, it is interesting to note that supplementing broilers diets with different levels of natural feed additives had positively improved their immunity status as reflected by globulin increasing levels, especially when compared to the corssponding of the control diet. Also, albumen as a one of the important proteins that keeps the osmotic pressure stable in the blood has acted adversely. As only broilers fed inclusion level (0.5 g./ kg) of R or SB were significantly lower in blood albumen content as compared to all other dietary treatments. Both albumen and globulin results reflect the ability of broiler chicks to store reserve proteins even after their bodies have reached maximum capacity of depositing tissues. These results are also supported by the significant increase in body weights and weight gains as a result of feeding these natural feed additives. In addition, the decrease in A/ G ratio indicates an increase in globulin production by the liver which reflects a good hepatic function of these birds and correlates very well with high immunity status of these birds (Grimimger, 1986). Our results are in agreement with those reported earlier by (Stroev, 1989, Azouz 2001, Hasegawa, 2003, Abdo Zeinab *et al.*, 2003, Abdel-Azeem *et la.*, 2005). However, these results are in contrast with those reported by (El-Sherbiny *et al.*, 1990, Abdel-Azeem, 2001, Soilman, 2003) of which, feeding broiler chickens different feed additives did not significantly affect blood constituents. Finally, these results could explain the role of many active components in natural feed additives used herein the study.

The improvement of antibody level against Newcastle disease virus (NDV) could be attributed due to higher mineral contents of M, thus affecting oxygen transportation which is needed for eventually increasing hemoglobin synthesis in the blood (Jones and Bark, 1979). Also, Craig (1999) discovered that several herbs including M and SB, can stimulate some protection against cancer, and simulate the response of immune system. Ismail *et al.*, (2001) reported that there were significant reductions in the population of Yarrowia lipolytica, which is one of the predominant yeasts in raw poultry, occurred when the yeast was inoculated into 100% Marjoram decoctions. Along the same line, Guo, (2003) suggested that the mechanism of medicinal plants components may include improving the physical conditions of gut ecosystem and enhancing function of immune system of chicks.

**Table (1):** Composition of experimental diets

| Ingredients, % | Starter | Grower | Finisher |
|---|---|---|---|
| Yellow Corn | 54.00 | 54.44 | 58.77 |
| Soybean meal | 31.50 | 30.00 | 26.91 |
| Gluten meal | 7.50 | 7.50 | 6.44 |
| Veg. Oil | 2.84 | 4.14 | 4.27 |
| Di.Ca.Ph. | 1.95 | 1.859 | 1.68 |
| Limestone | 0.87 | 0.782 | 0.80 |
| Salt (NaCl) | 0.30 | 0.30 | 0.30 |
| Premix* | 0.40 | 0.40 | 0.40 |
| Choline Chloride | 0.075 | 0.075 | 0.075 |
| L-Lysine | 0.378 | 0.347 | 0.240 |
| DL-Methionine | 0.19 | 0.17 | 0.11 |
| Total | 100.00 | 100.00 | 100.00 |
| Calculated analysis, % | | | |
| CP | 23.06 | 22.38 | 20.54 |
| Phosphorus | 0.50 | 0.48 | 0.44 |
| Lysine | 1.36 | 1.13 | 1.13 |
| Methionine | 0.53 | 0.52 | 0.48 |
| Ca | 0.96 | 0.90 | 0.85 |
| ME (Kcal/Kg) | 3065 | 3160 | 3200 |

*Supplied per 3 Kg: vit. A: 12 000 000 IU; vit. D3: 2 200 000 IU; vit. E: 10 000 mg; vit. K3: 2 000 mg; vit. B1: 1 000 mg;
vit. B2: 5 000 mg; vit. B6: 1 500 mg; vit. B12: 10 mg; Niacin: 30 000 mg; Folic acid: 1 000 mg; Pantothenic acid: 1 000 mg;
Biotin: 50 mg; Choline chloride: 500mg; Copper: 4 000 mg; Iron: 30 000 mg; Manganese: 60 000 mg; Zinc: 50 000 mg;
Iodine: 1 000 mg; Selenium: 100 mg; Cobalt: 100mg.

**Table (2):** Chemical Compaosition of studied feed Additives

| Items, % | Rosemary | Marjoram | Sweat Basil |
|---|---|---|---|
| Protein | 4.00 | 11.30 | 14.00 |
| Fiber | 16.51 | 13.37 | 7.34 |
| Ether Extract | 4.92 | 2.21 | 0.58 |
| Moisture | 9.14 | 8.84 | 9.89 |
| Ash | 6.15 | 14.13 | 30.44 |
| Nitrogen free Extract | 59.28 | 50.15 | 37.75 |
| Metabolizable energy (Kcal/kg)* | 3103.56 | 2767.63 | 2212.54 |

*Calculated according to Carpenter, K. J. and Clegg (1956).

**Table (3):** Effect of feeding dietary levels of natural feed additives on production performance of broilers

| Dietary Treatments | Body weight (g) | | | Body weight gain (g/ bird/ period) | | | Feed Consumption (g/ bird/ period) | | | Feed Conversion Ratio (g feed/ g gain) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 14 day | 28 day | 42 day | 14 –28d | 28 – 42 d | 1 - 42 d | 14 –28d | 28 – 42 d | 1 - 42 d | 14 –28d | 28 – 42 d | 1 - 42 d |
| Control | 315.92$^{d}$ ± 1.17 | 1036.83$^{d}$ ± 9.46 | 2024.58$^{e}$ ± 5.14 | 720.92$^{d}$ ± 9.70 | 987.58$^{e}$ ± 8.38 | 1984.67$^{c}$ ± 5.12 | 1348.17$^{a}$ ± 15.13 | 1985.42$^{b}$ ± 16.27 | 3755.08$^{a}$ ± 21.69 | 1.88$^{a}$ ± 0.04 | 2.01$^{a}$ ± 0.02 | 1.89$^{a}$ ± 0.01 |
| Rosemary | | | | | | | | | | | | |
| 0.5 g/kg | 317.17$^{d}$ ± 2.75 | 1063.58$^{c}$ ± 7.59 | 2116.00$^{d}$ ± 17.23 | 746.42$^{d}$ ± 9.64 | 1052.42$^{cd}$ ± 19.66 | 2078.25$^{d}$ ± 17.29 | 1199.25$^{c}$ ± 34.22 | 1915.33$^{c}$ ± 13.73 | 3454.33$^{c}$ ± 49.64 | 1.50$^{b}$ ± 0.04 | 1.83$^{bcd}$ ± 0.04 | 1.62$^{bc}$ ± 0.03 |
| 1.0 g/kg | 331.08$^{b}$ ± 3.68 | 1182.58$^{a}$ ± 13.49 | 2210.17$^{c}$ ± 20.36 | 851.50$^{ab}$ ± 14.93 | 1027.58$^{cd}$ ± 23.08 | 2170.17$^{c}$ ± 20.36 | 1115.42$^{d}$ ± 27.12 | 1952.92$^{b}$ ± 5.31 | 3451.50$^{c}$ ± 31.18 | 1.41$^{b}$ ± 0.05 | 1.91$^{b}$ ± 0.05 | 1.63$^{bc}$ ± 0.03 |
| Marjoram | | | | | | | | | | | | |
| 0.5 g/kg | 316.17$^{d}$ ± 1.04 | 1145.25$^{b}$ ± 3.77 | 2217.92$^{c}$ ± 6.46 | 829.08$^{bc}$ ± 4.55 | 1072.67$^{bc}$ ± 3.74 | 2177.92$^{c}$ ± 6.46 | 1246.75$^{bc}$ ± 19.18 | 1894.25$^{c}$ ± 2.86 | 3497.75$^{c}$ ± 26.74 | 1.51$^{b}$ ± 0.02 | 1.77$^{cd}$ ± 0.01 | 1.60$^{c}$ ± 0.01 |
| 1.0 g/kg | 321.92$^{cd}$ ± 2.57 | 1197.42$^{a}$ ± 8.93 | 2325.83$^{a}$ ± 13.72 | 875.50$^{a}$ ± 7.85 | 1128.42$^{a}$ ± 12.52 | 2285.83$^{a}$ ± 13.72 | 1264.67$^{bc}$ ± 11.04 | 1962.67$^{b}$ ± 4.83 | 3603.50$^{b}$ ± 17.09 | 1.44$^{b}$ ± 0.02 | 1.74$^{d}$ ± 0.02 | 1.58$^{c}$ ± 0.01 |
| Sweet Basil | | | | | | | | | | | | |
| 0.5 g/kg | 326.50$^{bc}$ ± 2.04 | 1137.08$^{b}$ ± 6.59 | 2238.08$^{bc}$ ± 11.68 | 810.58$^{c}$ ± 7.26 | 1101.00$^{ab}$ ± 14.66 | 2198.08$^{bc}$ ± 11.68 | 1132.58$^{d}$ ± 32.14 | 2021.83$^{a}$ ± 18.71 | 3530.67$^{bc}$ ± 42.55 | 1.40$^{b}$ ± 0.04 | 1.84$^{bc}$ ± 0.03 | 1.61$^{c}$ ± 0.02 |
| 1.0 g/kg | 345.58$^{a}$ ± 1.76 | 1204.08$^{a}$ ± 6.76 | 2270.83$^{b}$ ± 9.45 | 858.50$^{a}$ ± 7.76 | 1070.58$^{bcd}$ ± 10.81 | 2230.83$^{b}$ ± 9.45 | 1288.92$^{ab}$ ± 12.07 | 2042.50$^{a}$ ± 15.84 | 3711.08$^{a}$ ± 23.71 | 1.50$^{b}$ ± 0.02 | 1.91$^{b}$ ± 0.02 | 1.68$^{b}$ ± 0.02 |

$^{a,b,c}$ = Means on the same row have the same letter are not significantly different ($P \le 0.05$).

**Table (4):** Effect of feeding dietary levels of natural feed additives on protein efficiency ratio, efficiency of energy utilization and performance index of broilers

| Dietary Treatments | Protein Efficiency Ratio | | | | Energy Utilization | | | | Performance Index | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1-14d | 14-28d | 28-42 d | 1-42d | 1-14d | 14-28d | 28-42 d | 1-42d | 1-14d | 14-28d | 28-42 d | 1-42d |
| Control | 2.84 $^{d}$ ± 0.01 | 2.40 $^{e}$ ± 0.05 | 2.42 $^{d}$ ± 0.02 | 2.46 $^{c}$ ± 0.02 | 4.68 $^{a}$ ± 0.02 | 5.93 $^{a}$ ± 0.13 | 6.44 $^{a}$ ± 0.07 | 6.00 $^{a}$ ± 0.04 | 20.66 $^{d}$ ± 0.12 | 55.71 $^{d}$ ± 1.74 | 101.05 $^{d}$ ± 1.05 | 107.24 $^{d}$ ± 0.97 |
| **Rosemary** | | | | | | | | | | | | |
| 0.5 g/kg | 3.56 $^{a}$ ± 0.07 | 2.81 $^{d}$ ± 0.1 | 2.68 $^{bc}$ ± 0.05 | 2.81 $^{b}$ ± 0.05 | 3.75 $^{c}$ ± 0.08 | 5.09 $^{b}$ ± 0.18 | 5.85 $^{bcd}$ ± 0.12 | 5.28 $^{b}$ ± 0.09 | 26.03 $^{b}$ ± 0.58 | 71.68 $^{c}$ ± 2.32 | 116.54 $^{c}$ ± 3.17 | 130.84 $^{c}$ ± 2.87 |
| 1.0 g/kg | 3.30 $^{c}$ ± 0.06 | 3.42 $^{a}$ ± 0.07 | 2.56 $^{c}$ ± 0.06 | 2.94 $^{a}$ ± 0.04 | 4.04 $^{b}$ ± 0.07 | 4.14 $^{e}$ ± 0.08 | 6.12 $^{b}$ ± 0.15 | 5.05 $^{c}$ ± 0.07 | 25.23 $^{bc}$ ± 0.65 | 84.94 $^{a}$ ± 3.42 | 116.55 $^{c}$ ± 3.61 | 136.06 $^{bc}$ ± 3.21 |
| **Marjoram** | | | | | | | | | | | | |
| 0.5 g/kg | 3.38 $^{abc}$ ± 0.09 | 2.98 $^{cd}$ ± 0.04 | 2.76 $^{ab}$ ± 0.01 | 2.90 $^{a}$ ± 0.02 | 3.96 $^{bc}$ ± 0.11 | 4.75 $^{c}$ ± 0.07 | 5.65 $^{cd}$ ± 0.02 | 5.09 $^{c}$ ± 0.04 | 24.67 $^{bc}$ ± 0.69 | 76.28 $^{bc}$ ± 1.14 | 125.64 $^{b}$ ± 0.81 | 138.50 $^{b}$ ± 0.60 |
| 1.0 g/kg | 3,25 $^{c}$ ± 0.04 | 3.10 $^{bc}$ ± 0.04 | 2.80 $^{a}$ ± 0.03 | 2.96 $^{a}$ ± 0.02 | 4.09 $^{b}$ ± 0.06 | 4.57 $^{cd}$ ± 0.06 | 5.57 $^{d}$ ± 0.06 | 5.00 $^{c}$ ± 0.04 | 24.18 $^{c}$ ±· 0.45 | 83.62 $^{a}$ ± 1.60 | 133.80 $^{a}$ ± 2.15 | 147.69 $^{a}$ ± 1.98 |
| **Sweet Basil** | | | | | | | | | | | | |
| 0.5 g/kg | 3.32 $^{bc}$ ± 0.08 | 3.22 $^{b}$ ± 0.09 | 2.66 $^{bc}$ ± 0.05 | 2.91 $^{a}$ ± 0.03 | 4.03 $^{b}$ ± 0.09 | 4.42 $^{de}$ ± 0.12 | 5.89 $^{bc}$ ± 0.10 | 5.10 $^{c}$ ± 0.06 | 25.00 $^{bc}$ ± 0.69 | 82.00 $^{ab}$ ± 2.35 | 122.16 $^{bc}$ ± 2.70 | 139.53 $^{b}$ ± 1.92 |
| 1.0 g/kg | 3.49 $^{ab}$ ± 0.04 | 2.98 $^{cd}$ ± 0.03 | 2.55 $^{c}$ ± 0.03 | 2.81 $^{b}$ ± 0.02 | 3.81 $^{c}$ ± 0.04 | 4.75 $^{c}$ ± 0.06 | 6.11 $^{b}$ ± 0.08 | 5.28 $^{b}$ ± 0.04 | 27.84 $^{a}$ ± 0.37 | 80.29 $^{ab}$ ± 1.23 | 119.17 $^{bc}$ ± 2.01 | 135.67 $^{bc}$ ± 1.89 |

a,b,c = Means on the same row have the same letter are not significantly different ($P \leq 0.05$).

**Table (5):** Effect of feeding dietary levels of natural feed additives on carcass characteristics of broilers

| Dietary Treatments | LBW[1] (g) | Carcass characteristics, (%) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Carcass | Gizzard | Liver | Heart | Spleen | Abdominal fat | Thymus | Bursa |
| **Control** | $2153.00^{c} \pm 22.72$ | $68.14^{b} \pm 1.83$ | $2.43^{a} \pm 0.17$ | $2.78 \pm 0.04$ | $0.52 \pm 0.03$ | $0.13^{ab} \pm 0.01$ | $1.50 \pm 0.22$ | $0.26^{b} \pm 0.01$ | $0.14^{b} \pm 0.01$ |
| **Rosemary** | | | | | | | | | |
| **0.5 g/kg** | $2162.25^{bc} \pm 16.54$ | $70.85^{ab} \pm 0.53$ | $2.15^{ab} \pm 0.08$ | $2.93 \pm 0.07$ | $0.52 \pm 0.02$ | $0.15^{ab} \pm 0.02$ | $1.50 \pm 0.13$ | $0.35^{ab} \pm 0.01$ | $0.15^{b} \pm 0.01$ |
| **1.0 g/kg** | $2239.00^{a} \pm 3.65$ | $71.84^{a} \pm 0.38$ | $2.04^{b} \pm 0.07$ | $2.83 \pm 0.16$ | $0.55 \pm 0.05$ | $0.16^{a} \pm 0.02$ | $1.60 \pm 0.14$ | $0.32^{ab} \pm 0.01$ | $0.20^{a} \pm 0.01$ |
| **Marjoram** | | | | | | | | | |
| **0.5 g/kg** | $2164.75^{bc} \pm 15.23$ | $70.81^{ab} \pm 0.63$ | $2.02^{b} \pm 0.11$ | $2.87 \pm 0.09$ | $0.57 \pm 0.02$ | $0.15^{ab} \pm 0.02$ | $1.44 \pm 0.25$ | $0.60^{a} \pm 0.26$ | $0.14^{b} \pm 0.01$ |
| **1.0 g/kg** | $2218.25^{abc} \pm 19.07$ | $70.87^{ab} \pm 0.15$ | $1.99^{b} \pm 0.12$ | $2.84 \pm 0.07$ | $0.51 \pm 0.04$ | $0.13^{ab} \pm 0.03$ | $1.93 \pm 0.23$ | $0.33^{ab} \pm 0.01$ | $0.16^{ab} \pm 0.02$ |
| **Sweet Basil** | | | | | | | | | |
| **0.5 g/kg** | $2200.25^{abc} \pm 34.55$ | $70.99^{ab} \pm 0.84$ | $2.29^{ab} \pm 0.05$ | $2.88 \pm 0.04$ | $0.51 \pm 0.03$ | $0.12^{ab} \pm 0.02$ | $1.41 \pm 0.17$ | $0.35^{ab} \pm 0.01$ | $0.14^{b} \pm 0.01$ |
| **1.0 g/kg** | $2222.00^{ab} \pm 20.51$ | $71.05^{ab} \pm 0.81$ | $1.99^{b} \pm 0.17$ | $2.82 \pm 0.02$ | $0.48 \pm 0.03$ | $0.10^{b} \pm 0.01$ | $1.63 \pm 0.22$ | $0.32^{ab} \pm 0.03$ | $0.15^{b} \pm 0.01$ |

a, b, c = Means on the same row have the same letter are not significantly different ($P \leq 0.05$).

[1]**LBW**: Live body weights

**Table (6):** Effect of feeding dietary levels of natural feed additives on hematological parameters of broilers

| Dietary Treatments | Hematological Parameters | | | |
|---|---|---|---|---|
| | Hb, % | PCV, % | RBC's Count $10^6$/ul | Thrombocyte /$10^3$ RBCs |
| **Control** | 9.83 ± 0.45 | 29.67 ± 0.88 | $3.37^{b}$ ± 0.20 | 34.00 ± 11.02 |
| **Rosemary** | | | | |
| **0.5 g/kg** | 11.23 ± 1.39 | 29.50 ± 0.65 | $3.83^{ab}$ ± 0.19 | 15.00 ± 4.34 |
| **1.0 g/kg** | 10.10 ± 0.74 | 29.50 ± 0.29 | $3.80^{ab}$ ± 0.14 | 24.25 ± 9.20 |
| **Marjoram** | | | | |
| **0.5 g/kg** | 11.17 ± 0.23 | 29.00 ± 0.58 | $3.94^{ab}$ ± 0.13 | 30.00 ± 9.17 |
| **1.0 g/kg** | 9.95 ± 0.57 | 30.75 ± 1.03 | $3.96^{ab}$ ± 0.31 | 28.50 ± 4.03 |
| **Sweet Basil** | | | | |
| **0.5 g/kg** | 10.75± 0.74 | 29.25 ± 0.95 | $4.24^{a}$ ± 0.11 | 28.25 ± 8.49 |
| **1.0 g/kg** | 12.33 ± 0.81 | 31.00 ± 0.91 | $4.36^{a}$ ± 0.14 | 15.00 ± 1.73 |

a,b,c = Means on the same row have the same letter are not significantly different ($P \leq 0.05$).

**Table (7):** Effect of feeding dietary levels of natural feed additives on white blood cell differentiation parameters of broilers

| Dietary Treatments | White Blood Cell Differentiation | | | | | |
|---|---|---|---|---|---|---|
| | WBCs $10^3$/ul | Heterophil $10^3$/ul | Lymphocytes $10^3$/ul | Monocyte $10^3$/ul | Eosinophil $10^3$/ul | Heterophil / Lymphocytes |
| **Control** | 79.33 ± 8.41 | 31.90 ± 7.57 | $41.21^{bc}$ ± 8.77 | 3.73 ± 1.38 | 2.50 ± 1.32 | $0.88^{b}$ ± 0.28 |
| **Rosemary** | | | | | | |
| **0.5 g/kg** | 87.00 ± 2.61 | 42.05 ± 5.19 | $34.42^{bc}$ ± 7.05 | 7.13 ± 1.27 | 3.41 ± 1.45 | $1.41^{ab}$ ± 0.30 |
| **1.0 g/kg** | 83.75 ± 13.55 | 39.01 ± 8.41 | $36.93^{bc}$ ± 5.95 | 4.06 ± 1.48 | 3.76 ± 2.01 | $1.13^{ab}$ ± 0.28 |
| **Marjoram** | | | | | | |
| **0.5 g/kg** | 76.33 ± 6.94 | 28.44 ± 3.71 | $42.52^{bc}$ ± 1.42 | 3.59 ± 1.86 | 1.78 ± 0.30 | $0.66^{b}$ ± 0.07 |
| **1.0 g/kg** | 85.75 ± 12.73 | 48.98 ± 9.67 | $28.88^{c}$ ± 4.51 | 7.04 ± 1.89 | 0.86 ± 0.86 | $1.88^{a}$ ± 0.54 |
| **Sweet Basil** | | | | | | |
| **0.5 g/kg** | 99.25 ± 7.77 | 42.93 ± 3.08 | $49.51^{ab}$ ± 5.33 | 6.36 ± 1.42 | 0.45 ± 0.26 | $0.90^{b}$ ± 0.11 |
| **1.0 g/kg** | 105.25 ± 6.66 | 37.57 ± 2.23 | $61.27^{a}$ ± 3.74 | 3.79 ± 0.87 | 2.63 ± 0.33 | $0.62^{b}$ ± 0.02 |

a,b,c... = Means on the same row have the same letter are not significantly different ($P \leq 0.05$).

**Table (8):** Effect of dietary levels of natural feed additives on biochemical parameters of broilers

| Dietary Treatments | Blood Biochemical Parameters, (%) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cholesterol (mg/ dl) | Triglyceride (mg/ dl) | GPT (U/ L) | GOT (U/ L) | Glucose (mg/ dl) | Creatinine (mg/ dl) | T. protein[1] (g/ dl) | Albumin (g/ dl) | Globulin (g/ dl) | A/ G ratio[2] |
| **Control** | 123.18 ± 3.93 | 95.73 ± 7.99 | 138.00 ± 8.39 | 18.67 ± 2.85 | 214.10$^{a}$ ± 8.81 | 0.25 ± 0.05 | 2.47 ± 0.23 | 2.01$^{a}$ ± 0.10 | 0.45$^{c}$ ± 0.14 | 5.90$^{a}$ ± 1.69 |
| **Rosemary** | | | | | | | | | | |
| **0.5 g/kg** | 122.40 ± 1.13 | 85.80 ± 12.47 | 128.50 ± 3.50 | 21.00 ± 4.00 | 200.26$^{a}$ ± 2.95 | 0.30 ± 0.00 | 2.47 ± 0.21 | 1.91$^{ab}$ ± 0.05 | 0.59$^{bc}$ ± 0.15 | 3.51$^{ab}$ ± 0.66 |
| **1.0 g/kg** | 122.70 ± 2.73 | 86.10 ± 4.64 | 127.00 ± 6.39 | 19.75 ± 1.89 | 196.40$^{ab}$ ± 15.76 | 0.30 ± 0.00 | 2.45 ± 0.10 | 1.87$^{abc}$ ± 0.01 | 0.58$^{bc}$ ± 0.09 | 3.58$^{ab}$ ± 0.74 |
| **Marjoram** | | | | | | | | | | |
| **0.5 g/kg** | 123.90 ± 2.58 | 77.38 ± 2.80 | 143.67 ± 2.96 | 21.67 ± 2.19 | 206.90$^{a}$ ± 0.82 | 0.25 ± 0.05 | 2.36 ± 0.15 | 1.67$^{bc}$ ± 0.09 | 0.70$^{abc}$ ± 0.07 | 2.44$^{b}$ ± 0.19 |
| **1.0 g/kg** | 129.10 ± 8.21 | 95.32 ± 0.98 | 143.00 ± 9.64 | 19.00 ± 1.00 | 197.85$^{a}$ ± 539 | 0.23 ± 0.03 | 2.85 ± 0.20 | 1.80$^{abc}$ ± 0.08 | 1.06$^{a}$ ± 0.13 | . |
| **Sweet Basil** | | | | | | | | | | |
| **0.5 g/kg** | 119.23 ± 2.19 | 95.38 ± 5.96 | 150.25 ± 6.13 | 16.50 ± 0.29 | 214.75$^{a}$ ± 1.72 | 0.28 ± 0.03 | 2.56 ± 0.11 | 1.64$^{c}$ ± 0.05 | 0.93$^{ab}$ ± 0.11 | 1.85$^{b}$ ± 0.24 |
| **1.0 g/kg** | 122.24 ± 0.17 | 95.57 ± 1.12 | 154.00 ± 19.55 | 18.67 ± 1.45 | 178.23$^{b}$ ± 0.85 | 0.28 ± 0.03 | 2.56 ± 0.08 | 1.84$^{abc}$ ± 0.16 | 0.72$^{abc}$ ± 0.28 | 3.13$^{ab}$ ± 1.43 |

$^{a,b,c}$ = Means on the same row have the same letter are not significantly different ($P \leq 0.05$).

[1]**T. protein**: total protein  [2]**A/ G ratio:** albumen/ globulin ratio

**Table (9):** Effect of dietary levels of natural feed additives on immune system status of broilers

| Dietary Treatments | Immune System | |
|---|---|---|
| | ELIZA | NDV |
| **Control** | 0.29 [b] ± 0.16 | 2.75 ± 0.95 |
| **Rosemary** | | |
| **0.5 g/kg** | 1.90[a] ± 0.81 | 2.75 ± 0.75 |
| **1.0 g/kg** | 0.27 [b] ± 0.01 | 3.00 ± 1.08 |
| **Marjoram** | | |
| **0.5 g/kg** | 2.31 [a]± 1.2 | 2.50 ± 0.87 |
| **1.0 g/kg** | 0.83 [ab]± 0.35 | 2.75 ± 1.03 |
| **Sweet Basil** | | |
| **0.5 g/kg** | 0.56 [ab] ± 0.19 | 2.75 ± 0.25 |
| **1.0 g/kg** | 0.52 [ab] ± 0.21 | 2.75 ± 0.75 |

a,b,c = Means on the same row have the same letter are not significantly different ($P \le 0.05$).

**Table (10):** Effect of dietary levels of natural feed additives on economic efficiency

| Parameter | Dietary Treatments | | | | | | |
|---|---|---|---|---|---|---|---|
| | Control | Rosemary | | Marjoram | | Sweet Basil | |
| | | 0.5 g./ kg | 1g./ kg | 0.5 g./ kg | 1g./ kg | 0.5 g./ kg | 1 g./ kg |
| Feed cost, L.E | 8/82 | 8.19 | 8.22 | 8.25 | 8.54 | 8.33 | 8.79 |
| Selling revenue, L.E | 22.17 | 23.28 | 24.31 | 24.39 | 25.58 | 24.62 | 24.98 |
| Net revenue, L.E | 14.07 | 15.09 | 16.09 | 16.14 | 17.04 | 16.29 | 16.19 |
| Economic efficiency | 1.60 | 1.84 | 1.95 | 1.96 | 1.99 | 1.96 | 1.84 |
| Relative economic efficiency,% | 100.00 | 115.00 | 121.88 | 122.50 | 124.38 | 122.50 | 115.00 |

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# الملخص العربى

## التأثيرات الإنتاجية ، والفسيولوجية والمناعية والمردود الاقتصادي لإستخدام الإضافات الغذائية الطبيعية فى علف كتاكيت اللحم

**منى عثمان محمد طاهر، هيثم محمد ياقوت، هادى فتحى عباس مطاوع،**

**وليد فاروق عبد الفضيل عز العرب**

تم استخدام كتاكيت روس التجارية (عدد : ٢٨٠) لتقييم الآثار المترتبة على التغذية على كلا من البردقوش، الريحان أو حصالبان كإضافات غذائية طبيعية للأعلاف بمستوى ٠.٥ أو ١.٠ جم/ كجم علف. تم تقسيم الكتاكيت إلى ٧ مجموعات فى ٤ مكررات بكل منها ١٠كتاكيت فى تجربة نمو. ويمكن تلخيص النتائج المتحصل عليها على النحو التالي:

١. كشفت التحليلات الكيميائية لمساحيق الإضافات العلفية موضوع الدراسة تفوق حصالبان في البروتين ، الرطوبة والرماد ١٤.٠٠ ، ٩.٨٩ و ٣٠.٤٤ ٪ على التوالي. في حين ان البردقوش كان أعلى فى محتواه من الألياف (١٦.٥١ ٪) ، مستخلص الاثير (٤.٩٢%)، و المستخلص الخالى من النتروجين (٥٩.٢٨ ٪) ، و الطاقة الميتابوليزمية (٣١٠٣.٥٦ كيلو كالوري/ كجم)، على التوالي. أعلى زيادة الوزن (١٥.١٧ ٪) نتجت من التغذية على١ جم حصالبان تلاها البردقوش عند نفس مستوى الإضافة (١٢.٤٠ ٪).

٢. عموما فان تغذية كتاكيت اللحم على المستوى الأعلى من البردقوش ادى الى انخفاض حاد فى استهلاك العلف (٣٤٥١.٥٠ جم/ طائر/ فترة) مقارنة بالاضافات الأخرى، مع تحسن كفاءة تحويل العلف (١.٥٨ جم علف / جم وزن مكتسب) ، في حين أن عليقة الكنترول كانت أسوأ القيم (١.٨٩ جم علف / جم وزن مكتسب).

٣. التغذية على المستويات العالية من حصالبان او الريحان أدى الى تحسين كفاءة الإستفادة من البروتين وقيم مؤشر الأداء Performance Index . وعلى العكس من ذلك فإن القيم المتحصل عليها بالنسبة الطاقة كانت اقل خاصة عندما غذيت الكتاكيت على عليقة الكنترول.

٤. أعلى أوزان للذبيحة لوحظت عند تغذية الطيور على المستوى الأعلى من البردقوش، اما التغذية عل الكنترول تسببت في ارتفاع الوزن النسبي للقونصة (٢.٤٣ ٪). التغذية على مستويات حصالبان ادى الى زيادة عدد خلايا الدم الحمراء الى ٤.٢٤ و ٤.٣٦، على التوالي. كذلك زادت الخلايا اللمفاوية كنتيجة للتغذية على حصالبان (١ جم / كجم) مقارنة بالكنترول وازداد مستوى الجلوكوز عند التغذية على حصالبان (٠.٥ جم / كجم).

٥. تحسنت الكفاءة الاقتصادية مع التغذية على المستوى الأعلى من الريحان (١٢٤.٣٨٪) بالمقارنة مع كل الإضافات الأخرى وكنترول.

**في الختام ، فان باستخدام البردقوش، حصالبان او الريحان بمستويات (٠.٥ أو ١.٠ جم / كجم في العلف) في اعلاف كتاكيت اللحم ادى الى تحسين الأداء الإنتاجي وصفات المناعة وخصائص الذبيحة. فان استخدام البردقوش بمستوى (١ جم / كجم) قد يكون مقبولا لتحقيق الأداء الأمثل لكتاكيت اللحم انتاجيا و اقتصاديا.**