Effect of Dietary levels of Spearmint (*Mentha spicata*)
On Broiler chicks Performance

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Requirement of Master of Science in Animal Production
(Tropical animal Production)

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Jan., 2011
 تعالى
قال:
صافٍ في فوقيهم
الطيِّر إلى يروى
لم أو يقبّن
ه مسكيٌّ
شيءٍ بكل
إنه الرحمن
الأعظم
الله صدق
الملكة سورة الآية 19

(19 يف 3)

(۳ نَعْمَانَةُ أُمُّ سَرِيع

يشهون مما طير وليل
والله واقعة سورة الآية 21

(21 يف 5)
DEDICATION

• To my father
• To my mother
• To my brothers and sisters
• To my great family
• To my friends and colleague

With endless thanks

Bushra
ACKNOWLEDGEMENTS

My thanks firstly and lastly to Allah for completion of this study. Word can never express my deepest appreciation and sincere gratitude to my supervisor Dr. El Samani Omer Amasaib for his valuable advice, scientific guidance and encouragement to complete this study. Thanks are extended to all members of the Department of, Animal Nutrition, Faculty of Animal Production, University of Khartoum. Moreover, I would like to express my great appreciation to my family members for their support during my study. My thanks also extended to staff members of Animal Production, friends, everyone who helps me during experimental period and colleagues.
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Effect of Dietary levels of Spearmint (*Mentha spicata*) on Broiler chicks Performance

Abstract

This study was conducted to reconfirm determine the effect of addition different levels of spearmint (*Mentha spicata*) on broiler chicks’ performance. One hundred and twenty eight day old unsexed (Cobb) broiler chicks were used in this experiment. Birds were distributed randomly into 16 pens (8/pen) as replicates, in complete randomized design. The experimental diets were formulated with four levels of spearmint (*Mentha spicata*) of 0, 1, 1.5 and 2%. Feed and water were provided ad-libitum. Feed intake, body weight gain and feed conversion ratio were weekly recorded. Mortality rate was recorded also throughout the experiment. At the end of the experimental period, four birds from each treatment were randomly selected, weighed and slaughtered for determination of carcass weight and dressing percentage. Average feed intakes obtained from the experiment were 2680.20, 2679.11, 2708.55 and 2692.57 for diets 0, 1%, 1.5% and 2%, respectively. However, the increased in body weight for the treatments were 1481.63, 1512.81, 1519.57 and 1519.63, 0, 1%, 1.5% and 2%, respectively. Feed conversion ratios for the four treatments were found to be 1.92, 1.94, 1.92 and 1.99 respectively. Dressing percentage were 73.12, 74.17, 73.08 and73.47 respectively.

The results indicated that the addition of different levels of spearmint were found to be not significant (P>0.05) effect on weight gain, feed conversion ratio and dressing percentage. Also
the data showed that the supplementation of different levels of spearmint to the diets of broiler improved feed intake and body weight gain.

It could be concluded that spearmint (*Mentha spicata*) can be used as natural flavoring agent in broiler chicks at 1.5% of spearmint as an optimum level in the diets.
لا يمكنني قراءة النص العربي في الصورة. من فضلك قم بإعادة إرسال الصورة إذا كنت بحاجة إلى مساعدة في شيء آخر.
INTRODUCTION

Feed additives plants, herbs and spices were used in poultry diets as feed additive non nutritive substance. In the presence of these substances the nourishing value of the ration are primarily included to improve the efficiency of the birds’ growth, prevent disease and improve feed utilization.

The intentional feed additives are added to feed to produce a desired effect such as maintain freshness, improve nutritional quality and improve the performance of agricultural livestock. Common feed additives used in poultry diets include antibiotic, enzyme, antioxidant, pellet-binder, antifungal, coloured pigment and recently plants, plant products as flavouring agent (Scott et al., 1982).

Moreover herb contains active substance that can improve digestion and metabolism (Sabra and Metha, 1990).

Specific effect of feed additive plants as flavouring on broiler chicks performance have not received much attention in the Sudan, so it’s needed more research.

Recently there is one study on the response of broiler chicks to spearmint supplementation as flavoring agent (Yaghoub, 2009). The author used different levels of spearmint in the basal diets 0.0, 0.5, 1 and 1.5% and broiler chicks (Hubered) were used. Therefore the present of this study is to confirm the effect of feeding different levels of dietary spearmint (Mentha spicata) on broiler chick’s performance using higher level of spearmint and different breed of birds.
CHAPTER ONE
LITERATURE REVIEW

2.1 Aromatic plants

Spearmint group (*Mentha spicata*) is considered as one of the most important and valuable essential oil sources. Spearmint species are belonging to the family Labiates (Lamiaceae) which is considered as medicinal and aromatic family (Guenther, 1949).

The aromatic plants constitute an important group of the plant kingdom. All aromatic plants posses an odor characteristic. They are important sources of essential oils which applied in many life activities such as drugs, food flavor, perfumes and cosmetics (Hag Ali, 1995).

The family Labiates includes 200 genuses and about 3200 species, which are distributed over almost all the temperate and tropical regions. It includes annual herbs, perennial herbs (Gershenzon *et al.*, 1999).

2.2 origin of Spearmint

Spearmint is cultivated in different parts of the world such as North America, England, Germany, Holland and the Mediterranean region (Guenther, 1949).

The origin of spearmint was suggested to be in Mediterranean area and entered the Sudan from the northern part through the River Nile movement (Salim, 1997).

The name "spearmint" is applied to several species and varieties of the genus mentha, such as mentha spicata labiatae, mentha vividis
and Mentha gentiles, possessing a distinct odour due to high carvone content (Guenther, 1949).

Although spearmint is a native of Europe and Asia, it is now widely distributed in tropical regions all over the world. In the United States of America it's grown as a culinary herb in home gardens. It is used for making mint tea, mint jelly, flavouring lamb sauce and now has become an important source of spearmint oil.

Spearmint (Mentha spicata) is a perennial herb known as "Nanaa baladi". It is widely known in the Sudan and many Arab countries for its medical aromatic and flavoring properties.

Spearmint is grown in different areas in Sudan, in Khartoum State it is grown widely in Kuku project, Halfaya, Shambat and Elezergab. Elsharafa is the famous place among other producing spearmint in Gezira State (Bashir, 2000).

2.3 Spearmint herb harvested

Spearmint harvesting requires special care, because improper methods might seriously lower the oil quantity and quality. It is practiced by cutting aerial parts of the plant either manually or mechanically, 8cm above the ground level. Some factors must be taken into account, the plant growth stage, time of harvesting and weather conditions during harvesting.

Harvesting duration and stage of harvesting differ among different species in various soils and seasons (Guenther, 1949). The best harvesting time giving the maximum plant oil was found to be at early flowering stage (50% flowering) (Guenther, 1949).
Herb harvesting could be either at early morning before 10'o'clock or at the evening before sunset. Noon cutting is not recommended because it causes oil reduction by volatilization (Guenther, 1949; El Gamassy et al., 1975a, Gul et al., 1990; Topalov and Zhelyazkov, 1991; Singh et al., 1992a; Ahmed et al., 1993).

2.4 Uses of spearmint herb and oil

The spearmint plants and their products are widely used throughout the world for different purposes. They can be used with diet, folk medicines and confectioneries. Fresh and dried leaves or pounded dried herb are traditionally used as a spice and flavouring agent (Murray et al., 1972).

The oil is carminative, and antispasmodic. It's widely used in sauces, jellies, hot and cold beverages and in chewing gum. The spearmint oil is widely used in medicines, and in the manufacture of tooth paste. It is observed to be effective as a fungicide and anti-molding agent against microorganisms from deteriorated syrups (Lord and Husa, 1954).

Recently the oil was utilized in India for improving water quality by removing of the toxic metals such as chromium and cadmium, it was found to be fairly effective in removing chrome and cadmium from water samples containing at concentrations ranging from 50-100 ppm within 24 hours (Mathur et al., 1985).

Essential oils have various uses for their therapeutic action, for the synthesis of other compounds (Treased and Evans, 1980; Abuzid, 1992). It can be extracted from different parts of the plant by
application of pressure by conventional steam distillation, solvent extraction or by briefly heating the leaves (Banthorpe et al., 1979).

2.5 Oil component

2.5.1 Characteristics and chemistry of spearmint oil

Spearmint oil consists of a number of major and minor components that differ quantitatively and qualitatively from one species to another. So in spearmint (*Mentha spicata*), the major constituent of its oil is the carvone which constitute 65.5% of the total oil content (Botta and Botta, 1956). Nevertheless, Japanese mint *mentha arvensis* vat. *Piperacens* contains methanol (8% of the total oil content) (Abuzid, 1992).

Spearmint oil is characterized by being colourless yellow or greenish-yellow liquid. Having the characteristic odour and taste of spearmint (Guenther, 1949).

On the other hand, oils in their normal site in the plant do not oxidize because there is some natural, anti-oxidative substance side by side with the oil, which prevent the oil from oxidation. Also essential oils with alcohol like gevanium oil are not affected by storage. Generally, to store any volatile oil, all the moisture must be removed by using anhydrous sodium sulphate, especially when the oil is extracted by steam distillation.

Chemical analysis revealed that the major components of eosin isolated from spearmint were, carvone, piperitenone oxide, piperitone oxide, a-caryophyllene, germacrene, limonene and trans-piperitol (Nori-shargh et al., 2000; Monfared et al., 2002; Rasooli and Rezaei, 2002). The analysis indicated variation in quantity and quality of the components among those collected from different geographical areas.
(Mimica-Dukic et al., 1996; Venskutonis, 1996; Karousal et al., 2000; Nori-shargh et al., 2000; Ghoulami, 2001; Monfard et al., 2002; Rasooli and Rezaei, 2002).

Microbiologically, herb Eros had powerful antimicrobial and antifungal activities against certain microorganisms known to be pathogenic to broiler chickens particularly, *E. coli*, *Clostridium perfringens*, *Staphylococcus aureus*, *Staphylococcus* spp and *Candida albicans* (Soliman et al., 1998; Sokmen et al., 2000; Mimica-Dukic et al., 2003). Using of whole Eros of herb has a greater antibacterial activity than the major components mixed (Gill et al., 2002; Mourney and Camillac, 2002).

### 2.5.2 Physiochemical properties

Physiochemical properties are used to add more identification properties beside the separation techniques of the volatile oils. Many of them are used depending on the purpose and uses of the oil.

### 2.6 Role of oil as flavour

Besides being antimicrobial and antioxidants, essential oils and their pure component are also used as flavour in human food. Cinnamaldehyde can be used as low as 8ppm in ice cream products and as high as 4900ppm in chewing gum (Furia and Bellanca, 1975). Thymol and beta ionone are also used as flavouring agents in food.

The characteristic flavours of essential oils can be advantageous in standardizing testes and smell of the diet if the diet ingredient is changed such as during weaning transition of piglets (Anonymous, 1998).
CHAPTER TWO

MATERIALS AND METHODS

3.1 Experimental (housing and management)

The experiment was conducted in the Poultry Experimental House, Faculty of Animal Production, University of Khartoum during the period (7th July to 18th August 2010). During the time of experiment, the ambient temperature ranged from 26.5-44.6°C.

The experiment was carried out in an open sided deep litter poultry house. The house was partitioned into 16 pens each of them one meter square with enough working space allowance. The house was cleaned, washed, burned and disinfected using formalin. After that every pen was covered with clean wood-shaving as litter. Each pen was provided with one round fountain drinker, and one tabular feed trough. Light was provided for 24 hours.

3.2 Experimental birds

A total of 128 one-day old unsexed commercial broiler chicks (Cobb), were purchased from AlGar Company. Chicks were weighed and randomly divided into (4) groups of 32 chicks. Each group was further subdivided into four replicates with 8 chicks’ per replicate. The initial weight of chicks ranged between 43.4 to 47.5g.

3.3 Adaptation period

First 7 days from the experiment was used as adaptation period, all the chicks were fed the control diet and the same management applied for all the groups.
3.4 Experimental diets

The experimental diets were formulated to evaluate the nutritive value of spearmint for broiler chicks. Table (1) shows the composition of the diet. Graded levels of spearmint were added to the basal diet at a rate of (0.0, 1, 1.5 and 2%), and refers to as diet A, B, C and D respectively.

The spearmint was purchased from Hillat Kuku, then dried under shade for three days and added in a powder form to the diet. Samples were taken and analyzed for their proximate composition (Table 2).

3.5 Management and medication

The same managements were applied for all the groups among the experimental period. The chicks were allocated randomly as (8 chicks/pen) with 4 treatment. Sugar and multivitamin were administrated in the water during first week to avoid the expected stress, the multivitamin repeated after each vaccination for 3-5 days. The birds were vaccinated against Newcastle disease and infectious bronchitis (IB) at 7 days of age, and at 21 day of age given the vaccine against Newcastle colony. Also the chicks were vaccinated against Gumboro disease at 13 day of age in drinking water, and given anti coccidia treatment in drinking water at 21 days of age and repeated after three days.

3.6 Parameters measured

3.6.1 Feed intake

Total feed offered and residue for each pen was recorded daily to calculate group feed intake by difference.
Table (1): Ingredient composition of experimental diets as percent (%)

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Spearmint level %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0)</td>
</tr>
<tr>
<td>Sorghum</td>
<td>63.79</td>
</tr>
<tr>
<td>S.M.</td>
<td>13.50</td>
</tr>
<tr>
<td>Super concentrate</td>
<td>5.00</td>
</tr>
<tr>
<td>Spearmint</td>
<td>0.00</td>
</tr>
<tr>
<td>Lime stone</td>
<td>1.00</td>
</tr>
<tr>
<td>NaCl</td>
<td>0.25</td>
</tr>
<tr>
<td>Lysine</td>
<td>0.10</td>
</tr>
<tr>
<td>Oil</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100</td>
</tr>
</tbody>
</table>

Composition of supper concentrate vitamins and minerals per kg of diet specification

- **Crude protein**: 40.00
- **Crude fat**: 5.00
- **Crude fiber**: 2.00
- **Calcium**: 10.00
- **Phosphorus**: 4.00
- **Lysine**: 12.00
- **Methionine**: 3.00
- **Meth. + Cyst**: 3.20
- **Met. Energy**: 2.150kcal/kg
- **Nicotinic acid**: 600.00 mg/kg
- **Sodium**: 2.60
- **Vit K3**: 30.00 mg/kg
- **Pantathonic acid**: 150.00 mg/kg
- **Choline chloride**: 5.00 mg/kg
- **Copper**: 100.00 mg/kg
- **Manganese**: 1.200 mg/kg
- **Zinc**: 800.00 mg/kg
- **B. H. T.**: 900.00 mg/kg
- **Selenium**: 2.00 mg/kg
- **Iodine**: 15.00 mg/kg
- **Cobalt**: 3.00 mg/kg
- **Folic acid**: 10.00 mg/kg
- **Nicotinic acid**: 600.00 mg/kg
- **B. H. T.**: 900.00 mg/kg
- **Salinomycin-Na**: 1.200 mg/kg
- **Iron**: 1.000 mg/kg

**Lysine composition**
- L. lysine HCl (min) 48.5%
- Lysine (min) 78.0%
- Moisture (max.) 1.0%

**Methionine composition**
- Methionine 99%
Table (2): Proximate analysis (%) of spearmint

<table>
<thead>
<tr>
<th>Compound</th>
<th>Dry spearmint</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td>94.06</td>
</tr>
<tr>
<td>CP</td>
<td>19.25</td>
</tr>
<tr>
<td>EE</td>
<td>2.10</td>
</tr>
<tr>
<td>CF</td>
<td>19.57</td>
</tr>
<tr>
<td>Ash</td>
<td>12.82</td>
</tr>
<tr>
<td>NFE</td>
<td>40.32</td>
</tr>
<tr>
<td>ME/Kcal/kg)</td>
<td>1775</td>
</tr>
</tbody>
</table>

Metabolizable energy values of spearmint were calculated using the following equation according to Lodhi et al. (1976).

\[
ME = 1.549 + 0.0102 \text{ CP} + 0.0275 \text{ EE} + 0.0148 \text{ NFE} - 0.032 \text{ Cf}
\]

ME for spearmint were 1775 Kcal/kg
3.6.2 Live weight gain

The chicks were weighted weekly using spring balance. Mortality rate and temperature were recorded throughout the experimental period. Feed conversion ratio (FCR) was also calculated.

At the end of 6 weeks (6 weeks experimental period) 4 birds from each replicate were selected at random and slaughter and internal organs were dissected out. The chicks were weighted before and after slaughtering to determine hot weight and carcass weight, and dressing percentage was determined by expressing hot carcass weight to live weight.

3.7 Chemical analysis

Samples of spearmint and experimental diets were approximate analyzed on dry matter basis for chemical components according to AOAC (1980) (Table 3).

3.8 Experimental design and statistical analysis

This experiment was conducted using a complete randomized design. The data for (feed intake, body weight gain, feed conversion ratio and dressing percentage) were collected and subjected to analysis of variance (one-way ANOVA) using SPSS. The difference between means were determined using Duncan's Multiple Range Test (DMRT) at (P=0.05) level of significance.
Table (3): Calculated crude protein and metabolizable energy value of the experimental diets

<table>
<thead>
<tr>
<th>Compound</th>
<th>Spearmint level %</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0)</td>
<td>(1)</td>
<td>(1.5)</td>
<td>(2)</td>
</tr>
<tr>
<td>Crude protein</td>
<td>22.78</td>
<td>22.71</td>
<td>22.72</td>
<td>22.73</td>
</tr>
<tr>
<td>Metabolizable energy (kcal/kg)</td>
<td>3110.36</td>
<td>3110.69</td>
<td>3110.31</td>
<td>3110.13</td>
</tr>
<tr>
<td>Calcium</td>
<td>1.135</td>
<td>1.110</td>
<td>1.106</td>
<td>1.105</td>
</tr>
<tr>
<td>Total phosphorus</td>
<td>0.665</td>
<td>0.658</td>
<td>0.656</td>
<td>0.654</td>
</tr>
<tr>
<td>Lysine*</td>
<td>1.119</td>
<td>1.114</td>
<td>1.113</td>
<td>1.111</td>
</tr>
<tr>
<td>Methionine*</td>
<td>0.519</td>
<td>0.512</td>
<td>0.511</td>
<td>0.51</td>
</tr>
<tr>
<td>Crude fiber</td>
<td>4.376</td>
<td>4.326</td>
<td>4.311</td>
<td>4.294</td>
</tr>
</tbody>
</table>

Determine chemical analysis of the experimental diets.

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude protein</td>
<td>23.26</td>
<td>23.34</td>
<td>23.49</td>
<td>23.52</td>
</tr>
<tr>
<td>Ether extract</td>
<td>7.71</td>
<td>7.91</td>
<td>7.02</td>
<td>7.11</td>
</tr>
<tr>
<td>Ash</td>
<td>6.97</td>
<td>6.09</td>
<td>6.94</td>
<td>6.56</td>
</tr>
</tbody>
</table>
CHAPTER THREE
RESULTS AND DISCUSSION

4.1 Feed intake

The effect of feeding graded levels of spearmint (*Mentha spicata*) on weekly feed intake is presented in table (4). The results revealed that the dietary treatment had no significant effect (P<0.05) on feed intake.

The highest feed intake was obtained by the birds fed 1% spearmint during second and third week. The increment in feed intake which was illustrated in this study may be due to the flavor effect of spearmint (Deyoe *et al*., 1962). The insignificant effect of addition of spearmint to the basal diet may be due to the fact that, the diets were isocaloric and it is expected that the feed consumption could be similar (Scott *et al*., 1982), or may be due to the similar environmental during this period.

4.2 Body weight

The results of body weight gain are given in table (5). The data is showing weekly body weight gain as affected by supplementation of spearmint. Birds fed 1% spearmint in the second and third week were grown better than those fed higher levels of spearmint (1.5%, 2%). The body weight gain was not significantly (P>0.05) affected by addition of spearmint.

4.3 Feed conversion ratio (FCR)

The data for feed conversion ratio is illustrated in table (6). The results showed the effect of spearmint on feed FCR which was found
Table (4): Feed intake of boiler chicks (g/bird/week) as affected by addition of spearmint (*Mentha spicata*)

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Spearmint level %</th>
<th>± SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0)</td>
<td>(1)</td>
</tr>
<tr>
<td>1</td>
<td>59.00</td>
<td>59.47</td>
</tr>
<tr>
<td>2</td>
<td>236.60</td>
<td>245.94</td>
</tr>
<tr>
<td>3</td>
<td>410.50</td>
<td>416.88</td>
</tr>
<tr>
<td>4</td>
<td>569.66</td>
<td>566.47</td>
</tr>
<tr>
<td>5</td>
<td>683.66</td>
<td>666.60</td>
</tr>
<tr>
<td>6</td>
<td>711.53</td>
<td>728.75</td>
</tr>
</tbody>
</table>

* Values are means of 4 replicate of 8 birds.
* SEM = Standard error of the means
Table (5): Body weight gain of boiler chicks (g/bird/week) as affected by addition of spearmint (*Mentha spicata*)

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Spearmint level %</th>
<th>± SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0)</td>
<td>(1)</td>
</tr>
<tr>
<td>1</td>
<td>51.72</td>
<td>47.91</td>
</tr>
<tr>
<td>2</td>
<td>124.72</td>
<td>128.41</td>
</tr>
<tr>
<td>3</td>
<td>281.63</td>
<td>292.85</td>
</tr>
<tr>
<td>4</td>
<td>335.25</td>
<td>316.75</td>
</tr>
<tr>
<td>5</td>
<td>371.36</td>
<td>325.97</td>
</tr>
<tr>
<td>6</td>
<td>260.69</td>
<td>270.35</td>
</tr>
</tbody>
</table>

* Values are means of 4 replicates of 8 birds.

* SEM = Standard error of the means
Table (6): Feed conversion ratio as affected by addition of spearmint (*Mentha spicata*)

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Spearmint level %</th>
<th>± SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0)</td>
<td>(1)</td>
</tr>
<tr>
<td>1</td>
<td>1.75&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.56&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>2</td>
<td>0.94&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.92&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>3</td>
<td>1.23&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.23&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>4</td>
<td>1.47&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.52&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>5</td>
<td>1.71&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.74&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>6</td>
<td>2.04&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.94&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

* Values are means of 4 replicates of 8 birds.

* SEM = Standard error of the means

*a,b,c* values with in rows with no common superscript differ significantly (P< 0.05)
Table (7): Pre-slaughtering weight, carcass weight and dressing percentage of broiler chicks fed spearmint during 6 weeks.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Spearmint level %</th>
<th>± SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0)</td>
<td>(1)</td>
</tr>
<tr>
<td>Pre-slaughtering weight</td>
<td>1481.63</td>
<td>1525.81</td>
</tr>
<tr>
<td>Carcass weight</td>
<td>1083.44</td>
<td>1131.75</td>
</tr>
<tr>
<td>Dressing percentage</td>
<td>73.12</td>
<td>74.17</td>
</tr>
</tbody>
</table>

* SEM = Standard error of the means
to be insignificant in the first five weeks of age, but it is significantly affected by addition of spearmint in the sixth week (P<0.05), with the ranking to be as follows (1.84, 1.89, 1.94 and 2.04) for diet 1.5, 2, 1 and A. This may be due to change in environment during this week and increasing of bird’s age.

4.4 Average pre-slaughtering weight, carcass weight and dressing%

Dressing percentage of broiler chicks during experimental period is illustrated in table (7). Four birds from each treatment were randomly selected and weighed before and after slaughtering to determined live weight and hot weight. The dressing weight to live weight. Dressing percentage for the four treatments found to be 73.12, 74.17, 73.08 and 73.47 respectively. The dressing percentage was not significantly (P>0.05) affected by addition of spearmint.

4.5 Effect of dietary spearmint (Mentha spicata) on overall performance

Data of overall feed intake, body weight gain, feed conversion ratio and dressing percentage are summarized in table (8). The data showed that the effect of addition of spearmint on broiler chicks on the following parameter were found to be not significant (P<0.05). The parameters are total feed consumption, feed conversion ratio, total body weight gain and dressing percentage. Feed intake increased with increasing level of spearmint in the basal diet with the following ranking, Birds fed diet 1.5% obtained the highest feed intake (2708.55 g/chicks), followed by birds fed diet 2% (2692.57 g/chicks), A (2680.2 g/chicks) and the least feed intake was obtained by birds fed diet 1% (2679.11 g/chicks).
Table (8): Effect of spearmint on overall performance throughout the experimental period (6 weeks)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Spearmint level %</th>
<th>± SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0)</td>
<td>(1)</td>
</tr>
<tr>
<td>Initial weight</td>
<td>45.22</td>
<td>44.78</td>
</tr>
<tr>
<td>Final body weight (g)</td>
<td>1481.63</td>
<td>1512.81</td>
</tr>
<tr>
<td>Body weight gain (g)</td>
<td>1436.41</td>
<td>1468.03</td>
</tr>
<tr>
<td>Total feed intake (g)</td>
<td>2680.20</td>
<td>2679.11</td>
</tr>
<tr>
<td>FCR</td>
<td>1.92</td>
<td>1.94</td>
</tr>
<tr>
<td>Dressing (%)</td>
<td>73.12</td>
<td>74.17</td>
</tr>
</tbody>
</table>

* SEM = Standard error of the means
Table (9): economic value of the experimental groups

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Spearmint level %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0)</td>
</tr>
<tr>
<td>Broiler chicks purchase</td>
<td>89.6</td>
</tr>
<tr>
<td>Feed costs</td>
<td>138.08</td>
</tr>
<tr>
<td>Management</td>
<td>98.13</td>
</tr>
<tr>
<td>Total costs (Sud. SDG)</td>
<td>325.81</td>
</tr>
<tr>
<td>Cost/bird (Sud SDG)</td>
<td>10.18</td>
</tr>
<tr>
<td>Final body weight of bird (kg)</td>
<td>1.483</td>
</tr>
<tr>
<td>Average weight of bird (kg)**</td>
<td>1.083</td>
</tr>
<tr>
<td>Price kg of bird (Sud SDG)</td>
<td>12.00</td>
</tr>
<tr>
<td>Total returns (Sud. SDG)</td>
<td>2.82</td>
</tr>
</tbody>
</table>
Body weight gain was also increased with increasing level of spearmint in the basal diet with the ranking found to be as follows, diet C recorded higher value for body weight gain when compared to diet A and diet B. Similar finding reported by (Yagoub, 2009).

It would be noted that as conclusion from the experiment, birds that fed diet (1.5% spearmint) were observed to have the best performance in terms of total body weight gain, total feed intake and economic value. These may attribute to the effect of some antimicrobial Components which may act as growth promoters (Al Ankari et al., 2004) and may be improvement of digestion and absorption of the nutrient (Brander, 1985). On the other hand Grieve, (1981) and Chopra et al.,(1992) referred the improvement in performance of the herb valued for its beneficial effect on the digestion.

The economic value of the study is showing in table (9). Data revealed the highest return was obtained from the birds fed Diet 1% spearmint when compared to birds fed diet 1.5% spearmint although it is of higher cost; the birds fed diet 1 had the highest cost while birds fed diet (A) obtained the lowest return.
CONCLUSION AND RECOMMENDATIONS

Conclusion

* Diet 1% spearmint improved feed intake and grown better during second and third week respectively.

* The study was emphasized that the best performance on birds fed diet 1.5% spearmint on body weight gain and total feed intake, but similar in feed conversion ratio with diet (A) control.

* The economic value of birds fed diet 1% spearmint was highest return, however the birds fed diet (A) control obtained lowest return.

* Feed conversion ratio was similar for birds fed 1.5% spearmint with diet a control, while bird fed diet 2% spearmint was lowest

Recommendation

From the experimental result the further research should be conducted on blood serum, meat flavouring and immunity of broiler chicks.
REFERENCES


Mimica-Dukic, N, Jakovljevic, V., Szabo, A., Parkov, R., Lukic, V.,
Gasic, O. and Jancic, R. (1993a). Evaluation some pharmco-
dynamic effects of Mentha longifolia extract. Planta Med.
(Suppl.), 59: 691-692.

Mimica-Dukic, N., Bozin, B., Sokoviae, M., Mihajloviae, B. and
of three Mentha species essential oils. Planta Med., 69: 413-
419.

Mimica-Dukic, N., Jakovljevic., V., Mira, P., Gasic, O. and Szabo, A.

carvone chemotype of Mentha longifolia (L.) Huds. From Iran

gastrointestinal system. University of Guelph.

activity of essential oils components of conifers. Food Cohnt.,

composition of Mentha arvinsis var. piperascens and four
hybrids with Mentha crispa harvested at different time in India
and Michigan Crop Science: 12, November, December 1972.


