J.Animal and Poultry Prod., Mansoura Univ., Vol.9 (6): 259 - 269 , 2018

Influence of Supplementing Some Medicinal Herbs to Zaraibi Goats Diets on Some Fermentation Activities in the Rumen Fluid, Blood Constituents and Productive Performance.

El-Deeb, M. M.[1] and E. S. H. El-Gohary[2]

[1]Nutrition Research

[2]Sheep and Goats Research Departments, Animal Production Research Institute, Agriculture Research Center, Ministry of Agriculture, Dokki, Giza, Egypt.

ABSTRACT

The objectives of this experiment were to investigate the effects of supplementation of four types of medicinal herbs on some rumen fluid parameters, fermentation gas production, activities of rumen bacteria, blood constituents of bucks and productive performance of does. Fifteen mature healthy goat bucks averaged 44.75 ± 3.6 kg live body weight and 33 months of age were divided into five similar groups (3 animals each). Another 5 experimental groups of does (7 does each) with an average live body weight of 56.38 ± 4.3 Kg were also used. All groups were fed similar basal diet consisted of 60% concentrate feed mixture (CFM) and 40% berseem hay (BH) on DM basis. Bucks and does in the 1st group was fed on basal diet without supplementation (control), while CFM in diets of the 2nd, 3rd, 4th and 5th groups were supplemented with 1 g/10 kg LBW, of Ginger powder (*Zingiber officinale*, L.) ZIN, Curcumin or Turmeric powder (*Curcuma longa*) CUR, Oregano leaves crushed (*Origanum vulgare*, L.) ORI or crushed *(Nigella sativa*, L. seeds) NSS. Results showed that all the tested feed additives, except ORI one, were significantly ($P<0.01$) increased pH values of rumen fluid in comparison with that of control that free from the additives. The highest values of VFA were obtained with groups received either ZIN or ORI followed by that from NSS group with insignificant differences between them and control one. Other with CUR-ration had significant lower total VFA value than that of control one. The supplementation with ORI produced the highest ($P<0.01$) NH_3-N value compared to those of NSS, ZIN, CUR and control groups. Also, the values of ZIN, CUR and NSS regarding NH_3-N were significant higher than that of control. The addition of CUR produced the highest value of *in vitro* gases with proteolytic bacteria and NSS gave the highest one with cellulolytic bacteria, while ZIN recorded the highest gas with amylolytic bacteria without significant differences for all. Differences among treatments in terms of Deoxy ribonucleic acid (DNA), Ribonucleic acid (RNA) and Olego nucleotide (ON) were not significant. The group received ZIN had the highest values for proteolytic, cellulolytic and amylolytic bacterial groups compared to the control ones or those received CUR, ORI or NSS ones. Animals received ORI gave the lowest significant ($P<0.01$) values of all studied blood constituents among the values of all experimental dietary treatments. Does in the experimental groups showed that supplementation improved and maintained their body weight from starting of the experiment at the last third of pregnancy period till after kidding with superiority for CUR, ORI and NSS over that recorded for ZIN and control groups. As for average total milk production during suckling period NSS group produced the highest value followed by ORI, CUR and ZIN compared to the control ones which produced the lowest average. Meanwhile, kids average birth weight was higher in NSS group followed by those of ORI, CUR and ZIN, respectively compared to that in the control group. On the other hand, kids of the control group and ORI ones attained more weaning weight than those of the other 3 groups although the average daily body weight gain of kids in the control group during the 90 days of suckling (g/h/d) was the lowest value. It can be concluded that the use of herbs as feed additives in a descending order (NSS followed by ORI, CUR and ZIN) according to the results obtained herein can participate in enhancing animal productivity, health and reducing the energy which can be lost from other feed constituents.

Keywords: Bucks**,** Does, Kids, Milk, Ginger, Curcumin or Turmeric, Oregano, *Nigella sativa*, rumen, bacteria, blood.

INTRODUCTION

Few decades ago, with increasing populations in the world, scientists used antibiotics as feed additives in dairy cows to improve animal's productivity to meet human needs. Nowadays from one point of view, with increasing health awareness its use became banned in different countries due to the fearing of appearance for residues in animal products (Russell and Houlihan, 2003). So that, attention has recently paid to natural antimicrobial sources as a safe means of modifying ruminal fermentation. For this reason, the interest in phytogenic feed additives has considerably increased recently. Phytogenic feed additives are commonly defined as plant-derived compounds incorporated into farm animals' diets, such as herbs, spices and essential oils (Windisch *et al.*, 2008 and Jacela *et al.*, 2010). From environmental point of view, herbs and essential oils of aromatic plants used as feed additives in order to reduce methane emission from livestock during last decade as discussed and reviewed by Papatsiros *et al.* (2012). According to this classification, Ginger (*Zingiber officinale*) and Oregano (*Origanum vulgare* L.) considered as flavouring additives, Turmeric (*Curcuma longa*) used as a spice, food preservative and colouring material and Black Common Seeds (*Nigella sativa*, L.) is classified as a mild spice. On the basis of plant organs used, ginger and curcumin are rhizomes, leaves for oregano and seeds for black common. All the four tested additives have antioxidant, antimicrobial, pharmaceutical and nutritional properties. Some plant extracts and pure forms of active compounds of plants were evaluated for their potential application as modifiers of rumen microbial fermentation. As VFA are the end products of rumen microbial fermentation and represent the main supply of metabolizable energy for the ruminant (Van Soest, 1982), a reduction in their production would be nutritionally unfavorable for the animal (Busquet *et al.*, 2005). These additives can modify diet fermentability and energy availability for ruminants.

Ginger (*Zingiber officinale*) "ZIN" contains compounds named gingerol, gingerol-related and diarylheptanoids. The chemical group of alkaloid compounds called capsaicinoids (CAPS) is the main source of pungency in peppers which are produced in its fruit. Similarity detected in the atomic structure of CAPS and zingerone (ginger's active component, *Zingiber officinale*). The CAPS is the most abundant Capsaicin which through antioxidant activity triggering the brain to release natural painkillers (endorphins), producing the mouth water, responsible for neutralizing cavity-causing acids. The thermic effects of food (TEF) (the slight increase in the body's metabolic rate after consumption of a meal) increases in foods containing CAPS. Accordingly, CAPS in a meal containing foods can increase the body's TEF up to 25% for three hours. *In vitro* gas production studies by Bunglavan *et al.* (2010) using *Zingiber*

officinale rhizomes water residue recorded a reduction in methane production by about 15.02%.

Turmeric (*Curcuma longa*) is rich in carbohydrates (69.4%) and steam distillation of rhizomes produce about 5.8% essential oil contains mainly 25% zingiberene and 53% sesquiterpines. Curcumin antioxidant activity was due to it works as a scavenger of oxygen free radicals and protects hemoglobin from oxidation. Masuda *et al.* (2001) and Chattopadhyay *et al.* (2004) said that this effect occurred by maintaining the activities of antioxidant enzymes like superoxide dismutase, catalase and glutathione peroxidase. The last authors added also that a wide spectrum of biological actions noticed, e.g. antioxidant, anticoagulant, antifertility, antibacterial, antifungal, antiprotozoal, antiviral and hypocholesteremic activities for curcumin (diferuloylmethane), the main bioactive yellow component of turmeric. The curcumin's yellow pigment and demethoxyylated curcumins found in both turmeric and ginger known to possess their potent antioxidant activity (Kikuzaki *et al.*, 1994; Kikuzaki and Nakatani 1993). Rios *et al.*, 1988 stated that tests of antimicrobial activity can be classified as diffusion, dilution or bioautographic methods.

Another one of the various herbal spices is Oregano (*Origanum vulgare* L.) "ORI" shows the highest antimicrobial activity. Oregano's essential oils named Carvacrol has been proved to be the most important fungitoxic compound. According to Holland *et al.* (1991) the dietary value of oregano is quite high, since it contains significant amounts of vitamins E, B6, riboflavin, niacin, folate, pantothenate and biotin. Lagouri and Boskou (1996) detected α-, β-, γ- and δ-tocopherol in a non-polar fraction of oregano extracts, with the α-tocopherol content being significantly higher than other tocopherol homologues. Oregano also has a relatively modest energy and fat content "66 kcal/100 g and 2 g fat/100 g, respectively" (USDA, NRCS, 2007). In a study of natural herbs as alternatives to antimicrobials, a decrease in sow and litter mortality occurred in an experiment in which sows were fed oregano leaf, flower, and essential oil-enriched food and no apparent ill effect was reported (Allan and Bilkei, 2005).

Black Common Seeds (*Nigella sativa*, L.) "NSS" contains over 100 an important component as well as such seeds contain 21% protein, 35% carbohydrates and 35-38% fats. In addition, *Nigella* seeds and its oil are known to possess several pharmacological properties such as detergent, sedative, anti-inflammatory and expectorant. Recent studies had revealed that NSS has antioxidant effect (Mahmoud *et al.*, 2002). El-Gendy *et al.* (2001) reported that DE and TDN of rations containing NSS were higher than those of other rations that free from NSS supplement. The same author concluded that NSS could be used successfully in ruminant rations to improve its nutrient digestibilities and the feeding values.

The application of feed additives (different kinds of medicinal herbs) had been implemented earlier by several authors on goats and proved to have positive influence on milk production and kids weights as discussed and reviewed by Allam *et al.* (1999 & 2007). They reported improvement in milk production and feed efficiency and significant ($P< 0.05$) litters weight during suckling period and at weaning age (90 days) in Zaraibi kids.

On the light of the beneficial properties and composition of the four mentioned sources of feed additives, the aim of the present investigation was to verify the desirable effects, if any, of using such medicinal plants (herbs) in rations of goats on the rumen environment as a pre-step for the last end of benefiting feeds. Blood constituents were considered as well to reflect some health parameters of Zaraibi bucks supplemented with the tested feed additives and some productive performance parameters of does and their kids were also studied.

MATERIALS AND METHODS

This study was carried out at El-Serw Experimental Station, at Domiat Governorate, belonging to the Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt.

Animals:

To achieve the goals of the present investigation two separate trials carried out using bucks and does. In the first trial fifteen mature healthy goat bucks averaged 44.75 ± 3.6 kg live body weight and 33 months of age were divided into five similar groups, 3 animals each. The trial lasted for 4 weeks, where the first three weeks were considered as preliminary period and the fourth one was employed for rumen fluid sampling and measurements. Blood samples were also collected from all experimental animals once at the last day of the experiment. Bucks within all experimental groups were housed under semi-open sheds and kept under the same feeding and managerial conditions.

Moreover, to achieve the second goal of this study, thirty-five mature healthy does averaged 56.38 ± 4.3 kg live body weight in the second parity were divided into five similar groups (7 dams each) according to LBW, parity and milk production. Does were housed under a semi-roofed yard and kept under the same managerial conditions. Does were fed the supplementation from the last third of pregnancy period till weaning their kids after 90 days from kidding.

Feeding system and treatments:

Bucks in all groups in the first trial as well as does in the second one fed a basal ration consisted of 60% concentrate feed mixture (CFM) plus 40% berseem hay (BH) on DM basis according to allowances of NRC (1981). All animals received the experimental feed additives "at the rate of 1g/10 kg live body weight" from Ginger powder, *Zingiber officinale* (ZIN), Turmeric powder, *Curcuma longa* (CUR), Oregano leaves, *Origanum vulgare* (ORI) or Black Common (*Nigella sativa*, L.) seeds (NSS) in the 2nd, 3rd, 4th and 5th groups, respectively while the 1st group fed the basal ration without feed additives. Such additives were mixed manually with some fine CFM and then supplemented with the whole amount of daily diets according to Chevallier (1996). Approximate chemical analysis for both CFM and BH according to the methods of A.O.A.C. (1995) was carried out. The bucks were kept at separated pens for about 28 days, in which the dry matter intake of the tested BH and CFM was adjusted and the tested additives were given once with every morning meal.

Diets were offered in two equal parts at 900 a.m. and 1600 p.m. along the experimental periods to all experimental animals. Fresh water was available for the animals at all times a day. Chemical composition of the experimental ingredients and calculated composition of the control and tested diets are presented in Table (1).

Table 1. Chemical composition of feedstuffs, calculated composition of experimental rations and its calculated feeding values (% DM).

Ingredient	Chemical composition (on DM basis, %)						
	DM	OM	CP	EE	CF	NFE	Ash
CFM*	91.20	87.50	16.10	4.29	14.01	53.10	12.50
BH	89.00	89.19	13.05	1.94	25.51	48.69	10.81
Zingiber officinale, L. (ZIN)	89.90	92.65	9.40	21.80	8.35	53.10	5.60
Curcuma longa (CUR)	90.14	62.99	7.01	8.51	7.60	39.87	7.81
Origanum vulgare, L. (ORI)	88.18	56.36	13.93	3.30	30.15	39.13	21.58
Nigella sativa, L. (NSS)	93.50	91.20	21.00	35.50	8.41	34.70	3.70
Calculated composition of the experimental diets (%)							
Group 1, Control (CR)	90.32	88.18	14.88	3.35	18.61	51.34	11.82
Group 2, (+ ZIN)	90.25	88.27	14.83	3.46	18.84	51.23	11.72
Group 3, (+ CUR)	90.32	87.92	14.80	3.35	18.50	51.22	11.78
Group 4, (+ ORI)	90.30	87.86	14.88	3.35	18.73	51.21	11.92
Group 5, (+ NSS)	90.35	88.21	14.94	3.69	18.50	51.16	11.74
Calculated feeding values of the experimental diets on DM basis							
Feeding values %	TDN	DCP	DE	ME	NE	GE	
G1	56.30	10.73	2.48	2.06	1.26	1.74	
G2	56.26	10.68	2.48	2.06	1.26	1.74	
G3	56.30	10.65	2.48	2.06	1.26	1.73	
G4	56.29	10.73	2.48	2.06	1.26	1.74	
G5	56.32	10.79	2.48	2.06	1.26	1.75	

*** CFM composed of 37.5% wheat bran, 27% yellow corn, 12.5% soybean meal (44% CP), 10.0% undecorticated cottonseed cake, 5% rice bran, 4% sugarcane molasses, 3% limestone and 1% sodium chloride.**

Total Digestible Nutrients (TDN) = 129.39- 0.9419 (CF+ NFE) (NRC, 1978).

Digestible Crude Protein DCP= 0.9596 CP - 3.55 (NRC, 1978).

Net Energy lactation (NE) = 0.0245 (TDN %) - 0.12 (NRC, 1978).

Gross energy (GE, MJ/Kg DM) = 0.0226 CP + 0.0407 EE + 0.0192 CF + 0.0177 NFE (MAFF, 1975).

Digestible energy (DE, Mcal/Kg DM) = % TDN x 0.04409 (NRC, 1978).

Metabolizable energy (ME, Mcal/Kg DM) = - 0.45 + 1.01 DE (NRC, 1978).

Rumen fluid parameters:

Some rumen fluid parameters, i.e. pH, ammonia-nitrogen (NH_3-N) and total volatile fatty acids (VFA) concentrations were determined in rumen liquor (RL) samples taken via the stomach tube of the three experimental bucks in each group. On each of the two sampling days about 50 ml of rumen fluid was collected just before offering the morning meal (0 time) and at 2, 4 and 8 hours after offering morning feed for determining the above-mentioned parameters. Rumen liquor pH was immediately measured and the rest of samples of rumen liquor were filtered through two layers of surgical gauze. Sub-samples of known volumes were used for the determinations of VFA and NH_3-N concentrations. The remained filtered rumen liquor was kept frozen at –20°C for microbiological studies. Rumen pH was read-off immediately using battery operated pH meter (CG 728 SCHOTT). The concentration of NH_3-N was determined according to the method of Conway and O'Malley (1957). According to Abou Akkada and El-Shazly (1964) a known volume of RL sample was acidified by concentrated orthophosphoric acid and 0.1 N HCl and kept frozen at –20°C until their analysis for the VFA concentration using the Markham apparatus for steam-distillation for about 10-15 minutes.

Microbial growth measurements:

Microscopic examination was used for direct counting of the bacterial cells in rumen fluid. Breed slide techniques was used as described by Collins and Lyne (1985). Approximate count of rumen bacterial population in appropriate dilution of rumen fluid was measured off-line at 600 nm in 1 cm cell using PYE Unicam SP6-400 UV spectrophotometer. Appropriate volume of rumen fluid was inoculated in a three different culture media under anaerobic conditions using vaspar broth method as described by West and Wilkins (1980). After the time of incubation at 39°C, the produced gas was measured using a ruler.

Determination of microbial enzymes produced in the rumen liquor:

About 10 ml portion of rumen fluid "liquid phase" was taken as interval samples. Centrifugation was carried out at 4000 rpm for 15 min to remove bacterial cells, cell debris and residues of rumen components. The supernatant obtained was used as a crude enzyme solution after appropriate dilutions. Cellulase activity was measured by using filter paper following the method described by Gadgil *et al.* (1995). Amylase activity in rumen fluid was measured by the method described by Kochhar and Dua (1990). Quantitative assay of proteinase activity was carried out using the modified casein digestion method described by Lupin *et al.* (1982). The determination of Deoxy ribonucleic acid (DNA), Ribonucleic acid (RNA) and Olego nucleotide (ON) carried out according to the technique of Maniatis *et al.* (1982) and Levine and Cooney (1973). The absorbency was measured at 260 and 280 nm using Milton Roy Spectronic 1201 spectrophotometer using distilled water as blank and the DNA and RNA calibration curve were setup and the following equations were adopted:

For **DNA:** $\mathbf{Y = a\,x + b}$

Where: a = 0.021 and b = 0.007 and r=1.0

For **RNA:** $\mathbf{Y = a\,x + b}$

Where: a = 0.018 and b = 0.033 and r=0.999

Blood samples:

Blood sampling were taken once at the last day of the experimental period from the jugular vein of the three bucks in each group with anticoagulant. Each sample was divided into two parts, the first to determine some haematological parameters including hematocrite (Ht)%, hemoglobin (Hb), Red Blood Corpuscles (RBC's) and White Blood Corpuscles (WBC's) immediately after blood samples collection. The 2nd sample was centrifuged at 3000 rpm for 20 minutes to obtain plasma which was stored at -20°C till the biochemical analysis. Concentrations of total protein, albumin and globulin (calculated by difference), creatinine, urea-N, energy glucose, total lipids, cholesterol,

triglycerides and cholesterol were estimated. In addition, activity of aspartate (AST), alanine amino-transferase (ALT) and alkaline phosphatase (Alk-P) enzyme activities was determine calorimetrically using commercial chemical reagent kits (Bio-diagnostic product Kit, Egypt).

Does and kids performance parameters:

Does were weighed biweekly starting from the last third of pregnancy period (at the start of experiment) until kidding to evaluate changes of live body weight of does.

Daily milk yield for each ewe was determined weekly using weight suckling-weight technique. During suckling period (90 days), milk yield measurements were commenced after the kids were allowed to suckle the dams for the first 7 days postpartum. The kids were separated from their dams for 12 h overnight and only reintroduced to their dams after hand milking and milk was collected and weighed thereafter. The daily milk yield was calculated by summing the weight of suckled milk, differences between kid's weight before and after suckling, and the weight of striped milk in both morning and evening milking.

After 7 days from kidding suckling milk were determined weekly and average daily milk yield during suckling period (Kg/doe) was calculated. Kids' average birth weight (Kg/h), average weaning weight (Kg/h) as well as calculated average daily body weight gain of kids during the 90 days of suckling (g/h/d) were also recorded.

Statistical analysis:

Data were subjected to factorial statistical analysis by the computer program of SAS (1996) using the General Linear Model (GLM). The data of rumen liquor, rumen liquor's bacteria activities, single cell protein concentration, dams' weight, milk yield and kids' parameters were subjected to analysis of variance for examining the effects of treatments, time of sampling and their interaction. Means were compared according to Duncan's Multiple Range Test at 0.05 level (Duncan, 1955).

RESULTS AND DISCUSSION

Herbs are medicinal plants valued for their medicinal and aromatic properties and are often grown and harvested for these unique properties. Ravindran *et al.* (2002) classified the herbs and spices according to its basic uses to flavouring, deodorizing/masking, pungency and colouring. Accordingly, the four tested herbs in the present study are of different properties that distribute them under different categories of its potent effects.

Effect of feed additives on some rumen liquor parameters:

From the chemical composition of the tested additives (Table 1) it could be noticed that tested rations with all tested feed additives, except that of ORI one, were significant higher respecting ruminal pH values than that of control ration, while ORI-ration was insignificant higher than the control and in the meantime the differences among all tested rations did not significant in respect of pH values (Table 2). Regarding sampling time effect, pH values followed the normal pattern since it started to decrease significantly ($P<0.01$) after 2 and 4 hours of feeding and back to increase after 8 hours. The obtained trend for the tested additives can be explained by its capability because its content of pungent compounds that initialize making the mouth water (more saliva), which helps to neutralize cavity-causing acids (Purseglove *et al*., 1981). Moreover, Bensky and Gamble (1993) documented that Ginger (ZIN) is a diaphoretic (causes much sweat) and effective as a digestive aid by increasing the production of digestive fluids and saliva.

The highest ($P<0.01$) value of VFA (Table 2) obtained with the group received either ZIN or ORI followed by those from the control and NSS groups, respectively. At the same time CUR group recorded the lowest VFA value. Such differences between each value of control, ZIN and ORI rations and that of CUR one were highly ($P<0.01$) significant, but the CUR-tested ration did not significantly differ than that for NSS group. As sampling time advanced, total VFA concentration increased significantly ($P<0.01$) compared to that recorded for 0 time (before feeding). In this concern, Busquet *et al*. (2005) reported that some plant extracts and pure forms of active compounds of plants were evaluated for their potential application as modifiers of rumen microbial fermentation. They added also that, as VFA are the end products of rumen microbial fermentation and represent the main supply of metabolizable energy for the ruminant, a reduction in their production would be nutritionally unfavorable for the animal.

Andoa *et al.* (2003) reported that adding herbs to rations of dairy cattle had no adverse effects upon ruminal fermentation and nutrient digestibilities. On the other hand, Busquet *et al.* (2005) found that plant extracts including ZIN and some active compounds of herbs and plants affected total volatile fatty acids (VFA's) concentrations and individual VFA's proportions as well as N fraction concentrations in high milk yielding cows.

Regarding NH_3-N concentration in the rumen fluid (Table 2), ORI supplement produced the highest ($P<0.01$) value among all the experimental dietary treatments, being the values of all tested rations were significant higher than that of control one. It is of worth mentioning that CUR recorded the lowest NH_3-N among the other tested additives. Sampling time showed significant ($P<0.01$) differences among the four tested intervals, but such difference was not significant between 2 and 4 hours of sampling. The obtained results showed that ZIN, CUR and NSS have the ability to reduce NH_3-N production more than that obtained in the ORI group. Such effect for the three tested feed additives (ZIN, CUR and NSS) could be referred to its antioxidant and nutritional prosperities. Since, regarding ZIN, the chemical group of alkaloid compounds called capsaicinoids (CAPS), which are produced in the fruit of pepper have the same atomic structure of zingerone (the active component of ginger, *Zingiber officinale*). Foods containing CAPS, e.g. ZIN, increases the thermic effects of food (TEF). The TEF is slight increase in the body's metabolic rate after consumption of a meal. A meal containing foods with CAPS can increase the body's TEF up to 25% for three hours. Regarding *Nigella sativa* seeds, it contains high nutritional compounds e.g. mono-saccharides in the form of glucose, rhamnose, xylose, and arabinose, non-starch polysaccharide components which is a useful source of dietary fiber and is rich in unsaturated and essential fatty acids (El-Saadany *et al.*, 2008). These results are on line with those recorded and discussed by Chaturvedi *et al.* (2015).

It is worthy to note that improvement in nitrogen digestion can take place with adding CUR to diets of goats, since less NH_3 is produced in the rumen and less urea is eliminated in urine (Rochfort *et al.*, 2008 and Santoso *et al.,* 2004).

Table 2. Effect of feed additives on some rumen liquor parameters of Zaraibi bucks.

Item	Time (hr)	Experimental rations					Time effect
		CR	ZIN	CUR	ORI	NSS	
pH	0	5.96	6.13	6.07	6.05	6.23	6.08^{A}
	2	5.78	5.76	5.88	5.77	6.07	5.85^{B}
	4	5.57	5.82	5.99	5.95	6.05	5.87^{B}
	8	5.85	6.30	6.31	6.08	6.18	6.15^{A}
	Treatment effect LSD = 0.19	5.79^{B}	6.00^{A}	6.06^{A}	5.96^{AB}	6.14^{A}	LSD = 0.17
Total VFA (meq. /100 ml RL)	0	6.82	4.57	4.53	3.57	3.40	4.57^{B}
	2	7.52	7.63	6.70	10.20	8.50	8.11^{A}
	4	8.30	9.40	4.80	7.30	7.47	7.45^{A}
	8	8.05	9.57	5.93	6.67	7.03	7.45^{A}
	Treatment effect LSD = 1.18	7.67^{A}	7.79^{A}	5.49^{B}	6.93^{A}	6.60^{AB}	LSD = 1.06
NH_3-N (mg/100 ml RL)	0	12.60	16.33	20.72	19.04	22.40	18.22^{C}
	2	19.37	27.53	25.20	49.84	29.87	30.36^{A}
	4	21.37	32.29	29.12	39.67	28.56	30.20^{A}
	8	16.73	25.76	20.35	28.93	25.20	23.39^{B}
	Treatment effect LSD = 4.62	17.52^{C}	25.48^{B}	23.85^{B}	34.37^{A}	26.51^{B}	LSD = 4.13

A, B, C Means within the same row or column with different superscripts are significantly different at P<0.01.

Effect of medicinal herbs on some bacterial growth measurements and activities:

In a previous report, Hegde (2010) mentioned that out of the total methane emitted, livestock contributes about 37% that amounting to 80 million tons per year globally. When the feed reaches the rumen, it is converted into short chain fatty acids, microbial biomass and fermentative gases, mainly carbon dioxide and methane, through microbial degradation that known as enteric fermentation. The proportion of these components produced in rumen varies to a great extent with the type of feed and microbes (Blummel *et al*., 2001). The variation in digested outputs occurs due to the type of feed, level of intake, retention time in rumen and type of present microbes. Moreover, the variability of end outcomes of ruminal fermentative processes was attributed to adaptation of the bacterial population, or to the use of low doses of essential oils (Horton, 1980). Moreover, the antibacterial properties of essential oils and their components are broken in its diverse commercial products as feed supplements and thereby the performance of lactating sows and weaned piglets could be adjusted favorably (Van Krimpen and Binnendijk, 2001; Ilsley *et al.*, 2002).

Depending on different species of microbes, nutrients and other chemical substances present in the feed, the degree of fermentation will vary and the volume of gases released will also change. Therefore, there is scope for reducing the production of gases by proper manipulation of these factors. Among these efforts, the efficiency of different species and strains of rumen microorganisms that likely to vary widely and therefore attempts carried out to identify different species and their strains present in the rumen which are considered as an efficient convertor of feed into amino acids and microbial biomass. In pertinent, Burt (2004) concluded that the action of EOs improved with low pH, low temperature and low oxygen levels.

Results in Table (3) indicated that gas production (GL) was not affected by herbs addition as well as Deoxy ribonucleic acid (DNA), Ribonucleic acid (RNA) and Olego nucleotide (ON) did not affected by the experimental herbal supplements. Gas length recorded during amylolitic bacterial activity was the highest among all bacterial activities' tests. Moreover, CUR produced the highest value of gases with proteolytic bacteria and NSS gave the highest one with cellulolytic bacteria, while ZIN recorded the highest gas with amylolytic bacteria without significant differences among dietary treatments in respect of the gas production by different bacterial activities as shown in Table (3). In the meantime, the different types of bacterial activities showed that group received ZIN had significantly the highest values for proteolytic, cellulolytic and amylolytic bacterial groups compared to the control one or those received CUR, ORI or NSS ones. Although CUR group recorded the highest (P<0.05) total bacterial count (TBC), it gave the lowest (P<0.05) optical density (OD) of the tested groups (Figure 1). Sampling time seemed to have no effect on TBC, gas production for the three bacterial activities, DNA, RNA and ON. In general, all tested parameters of rumen bacteria seemed to be high before feeding (0 time) and decreased with feeding time order advancement, except for TBC, DNA, RNA and ON which increased after feeding. Regardless ZIN, the herbs addition showed decreased values of OD, proteolytic, cellulolytic and amylolytic bacterial activities compared to these values recorded for the control group.

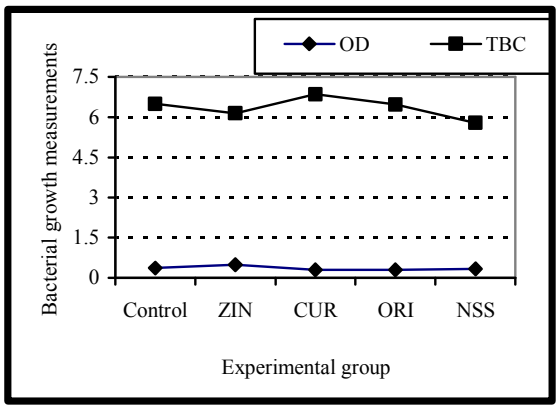

Figure 1. Bacteria growth measurements (OD, 600 nm and TBC, CFU x 10^7/ml) in the rumen fluid of bucks supplemented with feed additives.

Table 3. Effect of feed additives on some bacterial activities and single cell protein synthesis in the rumen liquor of Zaraibi bucks.

Item	Time	Experimental group					Time effect
		CR	ZIN	CUR	ORI	NSS	
Proteolytic activity (mg tyrosine/ml RL)	0	5.38	5.73	5.29	5.11	6.54	5.61^{A}
	2	4.78	6.96	3.32	4.06	3.36	4.49^{B}
	4	3.52	4.85	2.99	2.72	2.38	3.29^{C}
	8	4.06	6.60	2.89	2.69	3.87	4.02^{BC}
	Treatment effect LSD = 1.24	4.44^{B}	6.04^{A}	3.63^{B}	3.64^{B}	4.04^{B}	LSD = 1.11
Gas length from Proteolytic bacteria (Cm)	0	1.23	0.90	1.67	1.13	1.77	1.34
	2	1.09	1.47	1.00	0.80	0.40	0.95
	4	0.49	0.17	0.93	0.37	0.97	0.58
	8	0.69	0.50	1.17	0.40	0.23	0.59
	Treatment effect	0.87	0.76	1.19	0.67	0.84	LSD = 1.55
Cellulase activity (mg glucose/ml RL)	0	232.76	248.53	229.05	220.69	284.54	243.11^{A}
	2	206.09	303.47	140.88	173.92	142.56	193.38^{B}
	4	149.73	209.00	126.41	113.79	99.12	139.61^{C}
	8	173.92	287.32	121.77	112.67	165.38	172.22^{BC}
	Treatment effect LSD = 55.27	190.63^{B}	262.08^{A}	154.53^{B}	155.27^{B}	172.90^{B}	LSD = 49.43
Gas length from Cellulolytic bacteria (Cm)	0	1.00	0.97	1.20	0.83	1.90	1.18
	2	1.28	1.10	0.77	1.97	1.50	1.32
	4	0.59	0.77	1.00	0.00	0.90	0.65
	8	0.64	1.13	0.80	0.00	0.50	0.62
	Treatment effect	0.88	0.99	0.94	0.70	1.20	LSD = 1.53
Amylolitic activity (mg glucose/ml RL)	0	3.60	3.84	3.55	3.42	4.37	3.76^{A}
	2	3.21	4.65	2.24	2.73	2.26	3.02^{B}
	4	2.37	3.25	2.02	1.84	1.62	2.22^{C}
	8	2.73	4.42	1.95	1.82	2.60	2.70^{BC}
	Treatment effect LSD = 0.823	2.97^{B}	4.04^{A}	2.44^{B}	2.45^{B}	2.71^{B}	LSD = 0.74
Gas length from Amylolitic bacteria (Cm)	0	1.97	2.83	1.90	1.17	1.67	1.91
	2	1.20	1.10	1.83	0.67	1.17	1.19
	4	0.80	0.77	0.00	1.63	1.63	0.97
	8	1.74	1.63	1.83	1.77	0.00	1.39
	Treatment effect	1.43	1.58	1.39	1.31	1.12	LSD = 1.97
Deoxy ribonucleic acid, DNA (µg/ml)	0	42.11	41.56	43.04	41.74	46.72	43.03
	2	47.66	53.51	43.64	45.84	46.21	47.37
	4	45.58	46.32	42.28	48.14	45.41	45.55
	8	44.86	45.57	46.78	42.24	47.90	45.47
	Treatment effect	45.06	46.74	43.94	44.49	46.56	LSD = 9.97
Ribonucleic acid, RNA (µg/ml)	0	33.69	33.25	34.43	33.39	37.37	34.43
	2	38.13	42.81	34.91	36.67	36.97	37.90
	4	36.46	37.05	33.83	38.51	36.33	36.44
	8	35.88	36.45	37.42	33.79	38.32	36.37
	Treatment effect	36.04	37.39	35.15	35.59	37.25	LSD = 7.98
Olego nucleotide, ON (µg/ml)	0	16.85	16.62	17.22	16.69	18.68	17.21
	2	19.07	21.41	17.45	18.34	18.48	18.95
	4	18.23	18.53	16.91	19.26	18.16	18.22
	8	17.95	18.23	18.71	16.89	19.16	18.19
	Treatment effect	18.02	18.69	17.57	17.79	18.62	LSD = 3.98

A, B, C Means within the same row or column with different superscripts are significantly different at P<0.01.

The variable findings in TBC and OD can be explained by the findings of Burt (2004) who stated that essential oils (EOs) comprise a large number of components and it is likely that their mode of action involves several targets in the bacterial cell. The hydrophobicity of EOs enables them to partition in the lipids of the cell membrane and mitochondria, rendering them permeable and leading to leakage of cell contents.

The essential oils stimulate the intestinal endogenous enzymes. Essential oils from oregano are showing the greatest potential as an alternative to antibiotic growth promoters. Oregano contains phenolic compounds (e.g. carvacrol) that have antimicrobial activity (Akagul and Kivanc, 1988).

Oregano essential oils can modify the gut microflora and reduce microbial load by suppressing bacteria proliferation. This mode of action would increase the animal's maintenance energy requirement because enterocyte turnover is a major proportion of the basal metabolic rate. Bitter substances are found in herbs and stimulate the secretion of gastric juices. The pungent substances are found in plants such as paprika, garlic, and onion and are purported to function by increasing blood circulation, leading to faster detoxification of the whole metabolism (Papatsiros *et al.*, 2012).

The picture noticed from data of Table (2) and Table (3) clearly indicates that the tested additives does not alter the rumen environment and kept it in optimal state for

bacterial activities with tendency to increase microbial protein synthesis in forms of DNA, RNA and ON. Such positive action for the tested additives can be referred to their antioxidant, antimicrobial, pharmaceutical and nutritional properties. In this concern, however, Burt and Reinders (2003) and Chorianopoulos *et.al.* (2004) stated that the volatile oils of Oregano *in vitro* have antibacterial activity against a wide range of gram-positive and gram-negative microorganisms including Listeria, Pseudomonas, Proteus, Salmonella, Clostridium species and some methicillin-resistant staphylococci. On the other hand, Busquet *et al.* (2005) reported that Ginger and some active compounds of herbs and plants did not modify ration fermentability and energy availability and do not have an impact on rumen bacteria with low extractions doses

Organic acids could be established their antimicrobial effect in the intestines by suppressing fungal activity and maintaining an acidic environment (Dibner and Buttin, 2002). In addition, Castillo *et al.* (2004) stated that acidifiers might increase energy-efficiency and digestibility of crude protein, Ca, and P by lowering methane production and decreasing the numbers of harmful bacteria attached to the intestinal wall.

The reduction in TBC that recorded with NSS group can be attributed to its richness content of oils which have lipophilic nature and possess its action through interact with the cell membrane of bacteria, thus acquiring their toxic and antimicrobial effects, especially against Gram-positive bacteria. In the meantime, the external capsule of Gram-negative bacteria can protect them against essential oils (Griffin *et al.*, 1999 and Chao *et al.*, 2000), but some are small enough to enter the inner membrane and damage it. Burt (2004) reported that these oils can also cause coagulation of cytoplasmic material and Chao *et al.* (2000), Davidson and Naidu (2000) and Farag *et al.* (2004) added that these substances impair fungal, protozoal and viral growth. From practical point of view, McIntosh *et al.* (2003) and Newbold *et al.* (2004) reported generally that the effectiveness of commercial blends of essential oils depends on the protein source.

Effect of feed additives on some blood parameters:

Data in Table (4) clearly indicated that animals received ORI gave significant lower (P<0.01) values of all studied blood constituents than that of control one. While the animals received ZIN recorded almost by the highest significant (P<0.01) values among the tested treatments but not significant differed with those of control one. The animals received CUR came in the second order after ORI one in reducing values of all blood constituents, except for Ht%, Albumin, total lipids and its fractions and liver functions which were not significant compared to those from the control group.

Table 4. Effect of feed additives on some blood constituents.

Item	Experimental groups					LSD
	CR	ZIN	CUR	ORI	NSS	
Blood picture						
WBC, $x10^3/mm^3$	5.44^{AB}	5.56^{A}	4.70^{C}	4.61^{C}	5.11^{B}	0.36
RBC, $x10^6/mm^3$	13.65^{B}	14.40^{A}	12.16^{C}	11.31^{D}	13.23^{B}	0.61
Ht, %	42.67^{AB}	45.00^{A}	40.33^{BC}	37.33^{C}	41.33^{ABC}	3.89
Hg, g/dl	13.30^{A}	13.60^{A}	11.50^{C}	10.70^{D}	12.30^{B}	0.58
Protein fractions						
Total protein, g/dl	10.55^{A}	10.79^{A}	9.25^{C}	8.60^{D}	9.90^{B}	0.38
Albumin, g/dl	3.80^{AB}	3.89^{A}	3.54^{BC}	3.28^{C}	3.63^{AB}	0.32
Globulin, g/dl	6.75^{A}	6.91^{A}	5.71^{C}	5.33^{C}	6.27^{B}	0.47
Lipid fractions						
Total lipids, mg/dl	6.91^{AB}	7.14^{A}	6.09^{BC}	5.42^{C}	6.32^{ABC}	0.92
Triglyceride, mg/dl	140.59^{AB}	143.79^{A}	128.87^{BC}	119.33^{C}	132.06^{ABC}	13.05
Total cholesterol, mg/dl	166.38^{AB}	170.16^{A}	152.50^{BC}	141.22^{C}	156.28^{ABC}	15.44
Liver function						
AST, u/l	108.88^{AB}	111.36^{A}	99.80^{BC}	92.42^{C}	102.28^{AB}	9.39
ALT, u/l	58.47^{AB}	59.80^{A}	53.59^{BC}	49.63^{C}	54.92^{AB}	5.05
ALK-P, u/l	59.49^{AB}	60.87^{A}	54.36^{BC}	50.93^{C}	56.10^{ABC}	5.67
Kidney functions						
Creatinine, mg/dl	0.98^{A}	1.03^{A}	0.75^{C}	0.64^{D}	0.88^{B}	0.09
Urea-N, mg/dl	94.94^{A}	97.10^{A}	81.97^{C}	76.24^{D}	87.77^{B}	5.03
Glucose						
Glucose, mg/dl	106.83^{A}	110.95^{A}	93.66^{C}	87.11^{D}	101.89^{B}	4.58

A, B, C Means in the same raw with different superscript differ significantly at P< 0.01.

Results related to ZIN supplementation which developing the tonic of intestinal muscles, stimulates bile secretion from the liver, helping in fats digestion and promotes cardiovascular health by minimizing platelets aggregation and keep blood flowing on arteries (Bensky and Gamble, 1993). From another point of view the NSS oils could be used as antioxidant agent as it inhibits the non-enzymatic peroxidation (Saad, 2001) which may increase the immunity and help the animals to tolerate the heat stress (Azab Awad-Allah, 2002).

The obtained results in the present trial are in harmony with those recorded by El-Saadany *et al.* (2008) who reported that lactating goats supplemented Origanum (OV) and *Nigella sativa* seeds (NSS) increased (P<0.05) significantly the Hg values and RBC's count by 21.3% and 25.1% for OV and 34.4 and 25.3% for NSS. They

concluded also that liver and kidney functions were not negatively affected by either OV or NSS and supplementation improved the immunity function and decreased total cholesterol as well as glucose level of tested animals. Moreover, Habeeb *et al*. (2009) reported that Ht ratios and Hb values as well as RBCs count increased significantly in Zaraibi goats supplemented with ZIN and CUR. They added that liver and kidney functions were not affected with these supplementations. In the meantime, CUR decreased total cholesterol and improved animal immunity.

Papatsiros *et al.* (2012) documented that ration composition may modulate the response of rumen microbes to essential oil addition, so the simplest and most economically efficient method of delivering bioactive plant secondary metabolites to farm animals would be to feed them with either fresh or dried plant.

Effect of medicinal herbs on some productive performance parameters of does and their kids:

Data in figure (2) indicate that the starting weight as well as the weight of does after kidding were improved with adding herbs to their diets compared to those in the control group. The does in ORI and NSS groups were heavier than those in the other two groups and the control ones and they recorded the lowest values for weight loss after kidding. These results can be explained by the fact that herbs supplementation modify diet fermentability and energy availability for ruminants and might increase energy-efficiency to be utilized in forms of live body weight of does. The superiority of ORI group does in keeping weight after birth from loss may be due to the relatively modest energy and fat content of oregano (66 kcal/100 g and 2 g fat/100 g, respectively, USDA, NRCS, 2007). Similar trend was recorded by El-Saadany *et al.* (2008) reported that dams' weights were higher in the lactating Zaraibi goats supplemented with oregano or NSS in their diet than that of the control ones during experimental period. Moreover, Habeeb *et al.* (2009) found that adding Turmeric and Ginger to diets of Zaraibi goats gave higher body weights than that in the control group.

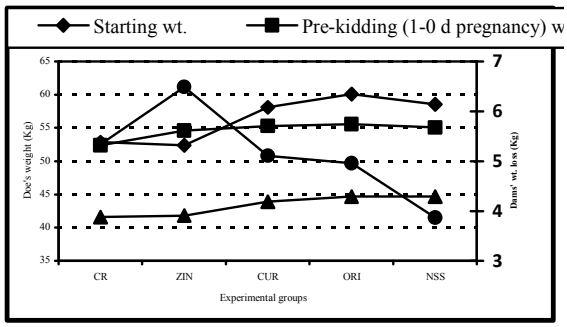

Figure 2. Does average live body weight changes of the five experimental groups during the experimental period.

Data in figure (3) clearly indicate that herbs supplementation improved the average of total milk yield (Kg/doe/day) during suckling period by about 31.17%, 27.59%, 14.06% and 9.24% and in the NSS, ZIN, ORI and CUR groups, respectively compared to the average of the control group. In the meantime, kids' average birth weight (Kg/head) was higher in the four supplemented groups NSS, ORI, CUR and ZIN in a descending order than that of the control. Although, kids' average weaning weight (Kg/head) recorded the highest values with ORI supplemented group followed by the control, NSS, ZIN and CUR groups in a descending order, respectively. Calculated average daily body weight gain of kids during the 90 days of suckling (g/h/d) showed that ORI group had the highest ($P<0.05$) gain followed by ZIN, CUR, NSS and control groups in a descending order, respectively.

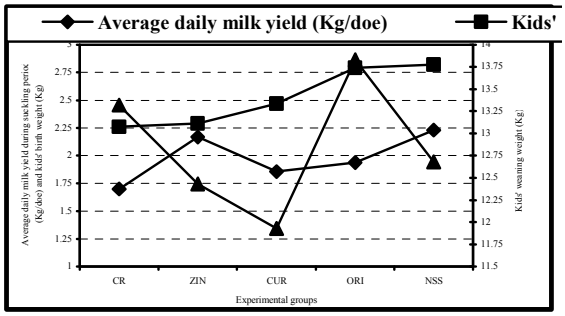

Figure 3. Average daily milk yield during suckling period (Kg/doe) and Kids' birth and weaning weights of the five experimental groups during the experimental period.

The results obtained herein regarding average milk yield goes on line with that reported by El-Saadany *et al.* (2008) who showed that supplementing diets of lactating Zaraibi goats during the summer season with oregano and NSS improved ($P<0.05$) significantly milk yield by 32.1% and 42.0 %, respectively. Moreover, Habeeb *et al*. (2009) reported similar significant ($P<0.05$) increase in milk yield by 29.4 and 16.4% with supplying ration of lactating Zaraibi goats during the hot season with Ginger or Turmeric, respectively.

As for kids' average birth and weaning weights, the attained enhancement in supplementation groups compared to the control one can be attributed to the positive change in their dams' body weights and the improvement in average total milk yield during suckling period. This explanation can be supported by Castillo *et al.* (2004) who stated that acidifiers might increase energy-efficiency and digestibility of crude protein, Ca, and P by lowering methane production and decreasing the numbers of harmful bacteria attached to the intestinal wall which can be reflected on animal performance.

It can be concluded that the use of such four tested additives (preferably ZIN followed by NSS, ORI and CUR) is permissible in ruminant feeds to reduce gas production and enhance feed energy utilization to improve animal productivity and health. Because of synergism and antagonism which can take place; the extent to which bacteria can adapt to the presence of active ingredients in herbs as feed additives considerably further research work is recommended. Moreover, before usage of herbs as feed additives for farm animals on a commercial scale, it is of importance to select the additives that have no negative interaction with feed constituents in order to achieve an access of positive associative effect and optimal doses from herbs to improve the efficiency of nutrient utilization and cost' effective use.

REFERENCES

Abou Akkada, A.R. and El-Shazly, K. (1964). Effect of absence of ciliate protozoa from the rumen on microbial activity and growth of lambs. Appl. Microbiol., 12: 384.

Akagul, A. and Kivanc, M. (1988). Inhibitory effects of selected Turkish spices and oregano compounds on some food-borne fungi. International Journal of Food Microbiology; 6: 264-8.

Allam, S.M., Hoda, M. EL-Hosseiny, A.M. Abdel-Gawad, S.A. EL-Saadany and A.M.M. Zeid (1999). Medicinal Herbs and plants as feed additives for ruminants. 1- Effect of using some medicinal herbs and plants as feed additive on zaraibi goat performance. Egyptian J. Nutrition and Feeds, 2: 349.

Allam, S.M., H.M El-banna and Randa R.E. Elamie (2007). Performance of Zaraibi kids fed diets supplemented with medicinal herbs. Egyptian J. Nutrition and Feeds, 10(2) special issue: 349-363

Allan, P. and Bilkei, G. (2005). Oregano improves reproductive performance of sows. Theriogenology, 63: 716-721.

Andoa, S., Nishida, T., Ishida, M., Hosoda, K. and Bayaru, E. (2003). Effect of peppermint feeding on the digestibility, ruminal fermentation and protozoa. Livestock Production Science 82; 245–248.

A.O.A.C. (1995). Association of Official Analytical Chemists. Official Methods of Analysis. 16th Ed. Published by the A.O.A.C. Washington DC., USA.

Azab, Awad-Allah M.M. (2002). Effect of supplementation with niacin and *Nigella sativa* seeds on Friesian calves under heat stress conditions. J. Agric. Sci., Mansoura Univ., 27, 2: 791-801.

Bensky, D. and Gamble, A. (1993). Fresh ginger has a worming effect on the exterior of body, while the dried ginger is APT to be recommended for warming the middle of the body. Chinese Herbal Medicine, Materia Medica, Revised ed. Seattle, W.A.: Eastland Press, pp. 300-301.

Blummel, M., Krishna, N. and Orskov, E.R. (2001). Supplementation strategies for optimizing ruminal carbon and nitrogen utlisation: Concepts and approaches. Proceedings of the 10th Animal Nutrition Conference: Karnal, India. Review Papers, November 9-11: 10-23.

Bunglavan, S.J., Valli, C., Ramachandran, M. and Balakrishnan, V. (2010). Effect of supplementation of herbal extracts on methanogenesis in ruminants. Livestock Research for Rural Development, 22 (11): 2010

Burt, S. (2004). Essential oils: their antibacterial properties and potential applications in foods—a review. International Journal of Food Microbiology, 94: 223–253.

Burt, S.A. and Reinders, R.D. (2003). Antibacterial activity of selected plants essential oils against Escherichia coli. Lett. Appl. Microbiol., 36:162-167.

Busquet, M., Calsamiglia, S. Ferret, A. and Kamel, C. (2005). Screening for effects of plant extracts and active compounds of plants on dairy cattle rumen microbial fermentation in a continuous culture system. Animal Feed Science and Technology 123–124: 597–613.

Castillo, C., Benedito, J.L., Mendez, J., Pereira, V., Lopez-Alonso, M. and Miranda, M. (2004). Organic acids as a substitute for monensin in diets for beef cattle. Animal Feed Science and Technology; 115: 101-16.

Chao, S.C., Young, D.G. and Oberg, C.G. (2000). Screening for inhibitory activity of essential oil on selected bacteria, fungi and viruses. Journal of Essential Oil Research; 12: 639-49.

Chattopadhyay, I., Biswas, K., Bandyopadhyay, U. and Banerjee, R.K. (2004). Review Articles; Turmeric and curcumin: Biological actions and medicinal applications. Current Science, 87(1): 44-53.

Chaturvedi, I., Dutta, T.K. and Singh, P.K. (2015). Effect of various herbal supplements on in vitro rumen fermentation using goat rumen liquor. Journal of Science, 1(1): 24-28.

Chevallier, A. (1996). The Encyclopedia of medicinal plants. DK Publishing, INC. New York 10016, U.S.A.

Chorianopoulos, N., Kalpoutzakis, E., Aligiannis, N., Mitaku, S., Nychas, G.J. and Haroutounian, S.A. (2004). Essential oils of Satureja, Origanum, and Thymus species: chemical composition and antibacterial activities against foodborne pathogens. J. Agric. Food Chem., 5: 8261-8267.

Collins, C.H. and Lyne, P.M. (1985). *Microbiological Methods*. 5th ed. Butterworths, London, 167-181 pp.

Conway, E.J. and O'Mally, E. (1957). Micro diffusion methods. Ammonia and urea using buffered absorbents. Biochem. J., 36: 655.

Davidson, P.M. and Naidu, A.S. (2000). Phyto-phenols. In A.S. Naidu editor. Natural food antimicrobial systems. CRC Press, Boca Raton, FL.; pp. 265–294.

Dibner, J. and Buttin, P. (2002). Use of organic acids as a model to study the impact of gut microflora on nutrition and metabolism. Journal of Applied Poultry Research; 11: 453-63.

Duncan, D.B. (1955). Multiple Range and Multiple F-Test. Biometrics, 11: 1-42.

EL-Gendy, K.M., Zaki, A.A., Faten F. Abou Ammo and EL-Gamal, M.F.A. (2001). *Nigella sativa* meal as a protein supplement in ruminant rations. Proc. 8th Conf. Animal Nutrition, Sharm EL-Sheikh, Egypt, Egyptian J. Nutrition and Feeds (Special Issue): 1-2 (Abstract).

EL-Saadany, S.A., Habeeb, A.A.M., EL-Gohary, E.S., El-Deeb, M.M. and Aiad, K.M. (2008). Effect of supplementation of oregano or *Nigella sativa* seeds to diets of lactating Zaraibi goats on milk yield and some physiological functions during summer season. Egyptian J. Anim. Prod.,45 Suppl. Issue, Dec. (2008): 569-587.

Farag, R.S., Shalaby, A.S., El-Baroty, G.A., Ibrahim, N.A. and Ali, M.A. (2004). Hassan EM. Chemical and biological evaluation of the essential oils of different Melaleuca species. Phytotherapy Research; 18: 30-5.

Gadgil, N.J., Daginawala, H.F., Chakrabarti, T. and Khanna, P. (1995). Enhanced cellulase production by a mutant of Trichoderma reesei. Enz. Microb. Technol., 17: 942-946.

Griffin, S.G., Wyllie, S.G., Marham, J.L. and Leach, D.N. (1999). The role of structure and molecular properties of terpenoids in determining their antimicrobial activity. Flavour and Fragrance Journal; 14: 322-32.

Habeeb, A.A.M., EL-Gohary, E.S. and EL-Saadany, S.A. (2009). Improving milk yield and some physiological body functions of lactating Zaraibi goats under heat stress conditions of hot summer season using supplemental diet with Ginger or Curcumin. Zag. Vet. J. (ISSN. 1110-1458) 37 (6): 54-67.

Hegde, N.G. (2010). Scope for reducing ill-effects of livestock husbandry on global warming. In Souvenir of the 52nd National Symposium on "Energising Rural India – A Challenge to Livestock Industry. Compound Livestock Feed Manufactures Association of India (CLFMA), Manesar, Haryana. Aug:138-142.

Holland, B., Unwin, I. and Buss, D. (1991). The Composition of Foods: Vegetables, Herbs and Spices, Bath, McCance & Widdowson's.

Horton, G.M.J. (1980). Use of feed additives to reduce ruminal methane production and deaminase activity in steers. J. Anim. Sci., 50: 1160–1164.

Ilsley, S., Miller, H., Greathead, H. and Kamel, C. (2002). Herbal sow diets boost pre-weaning growth. Pig Progress 18 (4), 8 –10.

Jacela, J.Y., De Rouchey, J.M., Tokach, M.D., Goodband, R.D., Nelssen, J.L. and Renter, D.G. (2010). Feed additives for swine: Fact sheets - prebiotics and probiotics, and phytogenics. Journal of Swine Health and Production; 18(3): 132-6.

Kikuzaki, H. and Nakatani, N. (1993). Antioxidant Effects of Some Ginger Constituents. J. of Food Science, 58 (6): 1407-1410.

Kikuzaki, H., Kawasaki, Y. and Nakatani, N. (1994). Structure of antioxidant compounds in ginger. In: Ho CT, Osawa T, Huang MT, Rosen RT (Eds) Food Phytochemicals for cancer prevention II (ACS Symposium, series No. 547). American Chemical Society, Washington, pp 237–243.

Kochhar, S. and Dua, R.D. (1990). Thermostable liquefying α-amylase from *Bacillus amyloliquefaciens*. Biotechnol. Lett., 12: 393-396.

Lagouri, V. and Boskou, D. (1996), 'Nutrient antioxidants in oregano,' Int. J. Food Sci. Nutr., 47(6): 493–497.

Levine, D.W. and Cooney, C.L. (1973). Isolation and characterization of a thermo tolerant methanol-utilizing yeast. Applied microbiology, 26: 982-990.

Lupin, L.V., Korner, D., Tanfel, A. and Kuttlof, H. (1982). Application of automatic protease determination in a fermenter. Enz. Microbiol. Technol., 4: 104-106.

MAFF (1975). Ministry of Agriculture, Fisheries and Food. *Energy Allowances and Feeding Systems for Ruminants*. Technical Bulletin, 33, H.M.S.O. London.

Mahmoud, M.R., EL-Abhan, H.S. and Saleh, S. (2002). The effect of *N. sativa* oil against the liver damage induced by Schistosoma mansoni infection in mice. J. Ethnopharmacology, 79(1): 1–11.

Maniatis, T., Fritsch, E.F. and Sambrook, J. (1982). Molecular doing. A laboratory manual. (Ed.), Cold Spring Harbor Laboratory, New York, PP. 468.

Masuda, T., Maekawa, T., Hidaka, K., Bando, H., Takeda, Y. and Yamaguchi, H. (2001). Chemical studies on antioxidant mechanisms of curcumin: analysis of oxidative coupling products from curcumin and linoleate. J. Agric. Food Chem., 49: 2339-2547.

McIntosh, F.M., Williams, P., Losa, R., Wallace, R.J., Beever, D.A. and Newbold, C.J. (2003). Effects of essential oils on ruminal microorganisms and their protein metabolism. Applied and Environmental Microbiology; 69: 5011-4.

NRC (1978). National Research Council. Nutrient Requirements of Dairy Cattle. 5th Rev. ed., Nat. Acad. Sci., Washington, DC.

NRC (1981). National Research Council. Nutrient Requirements of Sheep. 6th ed., Nat. Acad. Press, Washington, DC.

Newbold, C.J., McIntosh, F.M., Williams, P., Losa, R. and Wallace, R.J. (2004). Effects of a specific blend of essential oil compounds on rumen fermentation. Animal Feed Science and Technology; 114: 105-12.

Papatsiros, V.G., Katsoulos, P.D., Koutoulis, K.C., Karatzia, M., Dedousi, A. and Christodoulopoulos, G. (2012). Alternatives to antibiotics for farm animals.https://webcache.googleusercontent.com/search?q=cache:njJOxYbhnnkJ:https://www.scribd.com/document/363073220/Alternatives-to-antibiotics-for-farm-animals-Papatsiros-et-al-2012-doc+&cd=4&hl=ar&ct=clnk&gl=eg

Purseglove, J.W., Brown, E.G., Green, C.L. and Robbins, S.R.J. (1981). Spices, Vol. 1, Longman, London. In: *Peter, K.V. (2001), Handbook of herbs and spices*. CRC Press Boca Raton Boston New York Washington, DC. Handbook.of. Herbs. and. Spices. eBook- KINGDWARF.pdf

Ravindran, P.N., Johny, A.K. and Nirmal, B.K. (2002). Spices in our daily life. Satabdi Smaranika, Vol. 2. Arya Vaidya Sala, Kottakkal.

Rios, J.L., Recio, M.C. and Villar, A. (1988). Screening methods for natural antimicrobial products with antimicrobial activity: a review of the literature. Journal of Ethnopharmacology, 23: 127– 149.

Rochfort, S., Parker, A.J. and Dunshea, F.R. (2008). Plant bioactives for ruminant health and productivity, Phytochemistry; 69: 299-322.

Russell, J.B. and Houlihan, A.J. (2003). Ionophore resistance of ruminal bacteria and its potential impact on human health. FEMS Microbiol. Rev., 27: 65–74.

Saad, W.M. (2001). Effect of replacing *Nigella sativa* seed oil meal for soybean meal on performance of growing rabbits. M.Sc. Thesis. Dept. of poultry production. Fac. of Agric. Kafr. El-Sheikh. Tanta. Univ., Egypt.

Santoso, B., Mwenya, B., Sar, C., Gamo, Y., Kobayashi, T. and Morikawa, R. (2004). Effects of supplementing galactooligosaccharides, *Yucca schidigera* or nisin on rumen methanogenesis, nitrogen and energy metabolism in sheep. Livestock Production Science; 91: 209-17.

SAS (1996). SAS/Stat. User's Guide Static's Ver., 6.06, 4th Ed. SAS Institute Inc. Cary, NC.

USDA, NRCS (2007). *Origanum vulgare* L., the PLANTS Database (http://plants.usda.gov, 30 January 2007). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Van Krimpen, M.M. and Binnendijk, G.P. (2001). Ropadiar R as alternative for antimicrobial growth promoter in diets of weanling pigs. Lelystad, Praktijkonderzoek Veehouderij, May 2001. ISSN 0169-3689, p. 14.

Van Soest, P.J. (1982). Nutritional ecology of the ruminant. Cornell University Press, O& Books, Corvallis, OR, USA, pp. 253–280.

West, S.E.H. and Wilkins, T.D. (1980). Vaspar broth-disk procedure for antibiotic susceptibility testing of anaerobic bacteria. Antimicrobial Agent and Chemother., 17 (2): 288-291.

Windisch, W., Schedle, K., Plitzner, C. and Kroismayr, A. (2008). Use of phytogenic products as feed additives for swine and poultry. Journal of Animal Science; 86(14): 140-8.

تأثير إضافة بعض الأعشاب الطبية في علائق الماعز الزرايبي على بعض أنشطة التخمر في سائل الكرش ، مكونات الدم والمظاهر الإنتاجية

محمد محمد الديب[١] و عماد صلاح حسن الجوهري[٢]

[١] قسم بحوث تغذية الحيوان

[٢] قسم بحوث تربيه الأغنام والماعز ، معهد بحوث الإنتاج الحيواني والدواجن ، مركز البحوث الزراعية ، وزارة الزراعة ، الدقي ، الجيزة ، مصر.

كانت أهداف الدراسة الحالية لاختبار تأثيرات إضافة ٤ أنواع من الأعشاب الطبية على بعض مقاييس سائل الكرش ، الغازات الناتجة عن التخمر ، بعض أنشطة بكريا الكرش ، مكونات الدم في التيوس ، وكذلك بعض المظاهر الإنتاجية للإناث. تم استخدام ١٥ تيس ناضج مُعافى بمتوسط وزن ٤٤.٧٥ ± ٣.٦ كجم وزن حي بعمر ٣٣ شهر. تم تقسيم التيوس إلى خمس مجموعات متماثلة بكل مجموعة ٣ حيوانات ، بالإضافة إلى عدد ٣٥ عنز زرايبي في ٥ مجموعات إضافية (٧ إناث بكل مجموعة) بمتوسط ٥٦.٣٨ ± ٤.٣ كجم وزن حي ، لاختبار تأثير إضافة مسحوق الزنجبيل *(Zingiber officinale*, L.) ، مسحوق الكركم (*Curcuma longa*) ، أوراق البردقوش (*Origanum vulgare*, L.) أو بذور الحبة السوداء (*Nigella sativa*, L.) المطحوننتان إلى العليقة. تم تغذية الحيوانات في المجموعة الأولى للذكور أو الإناث على عليقة الكنترول الخالية من الإضافات الغذائية (كنترول) أو مع إضافة ١ جم / ١٠ كجم وزن حي من الزنجبيل ، الكركم ، البردقوش ، الحبة السوداء في المجموعات الثانية والثالثة والرابعة والخامسة ، على التوالي. وكانت عليقة الكنترول تتكون من ٦٠% علف مركز + ٤٠% دريس برسيم على أساس المادة الجافة. أوضحت النتائج المسجلة أن جميع الإضافات الغذائية المختبرة ، فيما عدا البردقوش ، رفعت معنوياً ($P<0.01$) قيم الـ pH في سائل الكرش مقارنة بمثيلتها في مجموعة المقارنة الخالية من الإضافات الغذائية. كانت أعلى قيمة ($P<0.01$) للأحماض الدهنية الطيارة في المجموعة التي غذيت على الزنجبيل أو البردقوش تلاهما القيم المسجلة في مجموعة الحبة السوداء بدون فارق معنوي بينهم وبين الكونترول. وسجلت عليقة الكركم أقل قيمة معنوية من الأحماض الدهنية الطيارة الكلية عن مجموعة الكونترول. أدت إضافة البردقوش إلى إنتاج أعلى ($P<0.01$) قيم لنتروجين الأمونيا في سائل الكرش مقارنة بتلك المسجلة بإضافة الحبة السوداء أو الزنجبيل أو الكركم ومجموعة الكنترول ، على التوالي. وكذلك كانت قيم الأمونيا لمجموعات الزنجبيل والكركم وحبة البركة أعلى معنوياً من مثيلتها للكونترول. أدت إضافة الكركم إلى إنتاج أعلى قيمة للغازات الناتجة معملياً مع مجموعة البكتريا المحللة للبروتين ، وأعطت الحبة السوداء القيم العالية مع البكتريا المحللة للسليولوز ، بينما سجل الزنجبيل القيم المرتفعة من الغاز مع البكتريا المحللة للسكريات ولم تكن الفروق بين المعاملات معنوية في حجم الغاز. كما كانت الفروق غير معنوية بين المعاملات في كل من كمية DNA ، RNA و ON. سجلت المجموعة المغذاة على الزنجبيل أعلى قيم نشاط في تحليل البروتين والسليولوز والسكريات مقارنة بالنشاط المسجل في مجموعة الكنترول أو التي أضيف لغذائها الكركم ، البردقوش والحبة السوداء. وسجلت الحيوانات التي تلقت البردقوش أقل القيم معنوياً ($P<0.01$) لكل مقاييس الدم المدروسة جميعاً فيما بين كل المعاملات الغذائية التجريبية. أظهرت الإناث في المجموعات التجريبية أن الإضافات رفعت معنوياً ($P<0.05$) وحافظت على أوزان أجسامها من بداية التجربة في الثلث الأخير من الحمل حتى بعد الولادة مع تفوق الكركم ثم البردقوش وبذور حبة البركة على تلك التي تلقت الزنجبيل أو مجموعة المقارنة. وفيما يتعلق بمتوسطة إنتاج اللبن الكلي أثناء فترة الرضاعة سجلت مجموعة حبة البركة أعلى القيم تلاها مجموعة البردقوش والكركم ثم الزنجبيل مقارنة بالكونترول التي سجلت أقل المتوسطات. في ذات الوقت ، كان متوسط وزن الميلاد للجداء في مجموعة حبة البركة أعلى قيمة تلاه المسجل لمجموعة البردقوش ثم الكركم ثم الزنجبيل على التوالي مقارنة بالكونترول. على الجانب الأخر اكتسبت جداء مجموعة الكونترول والبردقوش وزن فطام أكبر من مثيله للثلاثة مجموعات التجريبية الأخرى ، على الرغم من أن منوسط الزيادة الوزنية اليومية في مجموعة الكونترول خلال ٩٠ يوم الرضاعة (جم/رأس/يوم) كان أقل قيمة. يمكن استنتاج أن استخدام الأعشاب كإضافات غذائية بترتيب تنازلي (بذور الحبة السوداء المجروشة يليها أوراق البردقوش المجروشة أو مسحوق الكركم أو مسحوق الزنجبيل) يمكن أن يساهم في تحسين إنتاجية وصحة الحيوانات ويساهم في تقليل الفقد في الطاقة لبقية مكونات الغذاء.