EFFECT OF USING SOME MEDICAL HERBS ON GROWTH PERFORMANCE AND BLOOD HEMATO-BIOCHEMICAL ATTRIBUTES OF MALE ZARAIBI GOATS

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ABSTRACT

This investigation research was performed to compare among Rosemary (Rosmarinus officinalis L.), Sage (Salvia officinalis) and their mixture in fed of growing male goats on total dry matter intake, feed conversion, body weight gain, and some blood parameters when fed 5g/100 kg live body weight from this additives. The concentrate roughage ratio for basal diet in all groups was 60%:40%. The first group G1 fed basal diet only while herbal additives were Rosemary, Sage and mixes Rosemary× Sage (G2, G3, and G4, respectively). The results indicated that the total DM intake was increased with added herbs in groups G2, G3 and G4 compared with G1 and it was the highest in G4(759 g/h) with a decrease in water consumption (1.95 l/h/d).The mix additive (G4) recorded highest significant values vs. control as final body weight, (kg); total body gain, (kg) and daily body gain, (g) whilst this differences were not significant with individual herbal additive groups (G2 and G3). Concerning feed conversion (as kg DM/ kg gain or kg CP / kg gain) all groups' feed herbal additives being improvement compared with control whilst this differences reflected on rising economic efficiency. The all measured blood parameters levels were within the normal ranges, serum creatinine cholesterol and enzymes liver activities were significantly decreased in herbs treatments (G2, G3 and G4) compared with the G1 so it is a good indicator of kidney and liver status reflected on animal health. The values of total antioxidant capacity (TAC) were higher with the three treated diets compeered with the control. The values of both T3 and T4 hormones tended to increase as a result to using of herbs especially G4 and the differences were significant in T4 hormone only. So, can be concluded that using of Rosemary or/ and Sage in growing male goats rations had positive effect not only on improving growth performance and daily gain, but also on feed conversion ratio and economic efficiency without any negative adverse on blood parameters.

Keywords: growth performance- Rosmarinus officinalis L.- Salvia officinalis- feed conversion- blood parameters- economic efficiency.

INTRODUCTION

Phytobiotics are produced from the parts of plants with a sufficiently high accumulation of active substances. These can be fruits, seeds, flowers, bark, rhizomes, leaves, or roots. Prophylactic and therapeutic characteristics of plants are contingent upon several factors, including the concentration of biologically active compounds, the stage of vegetation during harvest, the location of the harvest, the weather, and the drying and storing techniques used. If the post-production waste from the herbs industry still has the right amount of active ingredients, it can also be utilized as a feed addition. Research on goats revealed that the use of herbal supplements improved the digestive systems of the goats and increased the number of lactic acid bacteria (LAB), which strengthen microbial equilibrium in the gastrointestinal tract **(Foksowicz-Flaczyk *et al.*, 2022).** When fed to dairy goats, pure botanical phytobiotics like chamomile have been shown to improve the animals' immune systems, metabolism, and improving the milk production and composition, also on reducing the somatic cell counts (SCC) reflected on improving milk quality. **(Khattab *et al.*, 2021; Ahmed *et al.*, 2019 and El-Kholany *et al.*, 2017).** Rosemary, (Rosmarinus officinalis L.) has been the subject of documents, rosmarinic acid and carnosic acid possess the most medicinal effects among the mentioned phenolic compounds i.e. anti-inflammatory and antioxidants

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(Jayanthy and Subramanian, 2014 and Sedighi *et al.*, 2015), several studies that have demonstrated its ability to alter the rumen microbiota , which are intimately related to the digestion of protein and fiber as well as the production of ammonia and methane **(Cobellis *et al.*, 2016$_{a\&b}$). Amany *et al.*, 2021** reported that rosemary or laurel dry leaves could be used as natural feed additives in rations of growing lambs at level 1% of concentrate feed mixture with positive effect on nutrient digestibility, blood parameters, growth performance and economic efficiency. In the same direction, **Roy et al., (2014) and Cobellis *et al.*, (2015)** reported that the essential oils from medical herb have been shown positive effects (in vitro feed) on protein metabolism, volatile fatty acids (VFA), methane, and ammonia concentrations. Sage (Salvia officinalis), a member of the Lamiaceae family, is a fragrant and medicinal plant that has been used for ages to cure a variety of illnesses, particularly digestive system disorders like peptic ulcer and diarrhea **(Jedidi *et al.*, 2019; Jedidi *et al.*, 2020$_a$). Recently, Jedidi *et al.*, 2020$_b$ and 2022** demonstrated that the leaves have an important in vitro digestibility beneficial effect with decrease methane production, due to diversity of their phytochemical composition such as parietal constituents, phenolic compounds and total lipids. The aim of this work to investigate of adding Rosemary or/and Sage to the diet of growing Zaraibi kids on daily feed intake, feed conversion, growth performance and economic efficiency as affected by experimental treatments.

MATERIALS AND METHODS

This study was conducted at El-Serw Experimental Research Station, Animal Production Research Institute, Agricultural Research Center, Ministry Of Agriculture, Egypt.

Twenty eight male Zaraibi kids, of 14.79 kg average live body weight, the experimental period extended to 14 weeks, the animals were randomly assigned to four feeding groups of seven each:
Group 1 - control group was feed basal diet, 60% CFM + 40% (BH+ RS) no herbal additive.
Group 2 - receiving basal diet + 5g /100 kg LBW of herbal additive (Rosemary).
Group 3 - receiving basal diet + 5g /100 kg LBW of herbal additive (Sage).
Group 4 - receiving basal diet + mix herbal additive (2.5g /100 kg LBWRosemary×2.5g /100 kg LBWSage).

Allowances adjusted according to body weight every two weeks, according to **NRC (1981).** Diets were offered twice a day, at 8:00 a.m. and 3:30 p.m., and the amounts rejected were recorded every day. Animals were weighed at the beginning of the experiment and biweekly thereafter. Water was always accessible, the chemical composition of ingredients was analyzed according to **(A.O.A.C 2000)** Table 1, and the amount of drinking water used daily by each group was measured (ml/d).

Table (1): Chemical composition (as DM basis) of fed ingredients.

Item	DM	% on DM basis					
		OM	CP	CF	EE	NFE	Ash
CFM*	92.13	93.50	14.11	15.90	3.45	60.04	6.50
Berseem hay (BH)	90.39	85.70	11.01	30.10	2.30	42.29	14.30
Rice straw (RS)	89.91	82.50	3.15	39.50	1.40	38.45	17.50

**Concentrate feed mixture (CFM) consisted of 20% un-decorticated cottonseed meal, 41% yellow corn, 5% soybean meal, 21% wheat bran, 5% rice bran, 4% molasses, 2.5% limestone, 1.0% common salt and 0.5 minerals mixture.*

Blood samples were collected from three women from each group once during the last month of pregnancy and once during the first month of lactation from the jugular vein before lactation. Immediately, whole blood was used to evaluate hematology. The first part of the blood sample was frozen at −20°C until further biochemical study, while the other part was centrifuged at 4000 rpm for 20 minutes to separate the serum for enzyme and hormone analysis. All blood measurements were performed using commercial kits. The economic efficiency calculated based on kg of live body weight (LBW) and local diet ingredient prices:

Money output (price of kg LBW) ÷ input (total price of feed consumed) ×100. In addition, the economic efficiency (%) relative to control was calculated for G2, G3or G4 as following:

The economic efficiency amount of G2, G3 or G4 – economic efficiency amount of G1÷ economic efficiency amount of G1×100 +100 (considering economic efficiency of G1 100%).

One-Way Layout with Means Comparisons Procedures **SAS (2003)** was used to statistically analyze the data. The model that was applied to the parameter analysis was:

$$Yij = \mu + Ti + eij$$

Where:

Yij = the observation
μ = overall mean
Ti = Effect of treatment
e_{idk}= residual error.

RESULTS AND DISCUSSION

During the experimental period, total dry mater intake and CP intake as g/h as shown in (Table 2) tended to increase with G2, G3 and G4, respectively. The clear increase in total dry mater intake and CP intake (g/h) of groups fed diet including herbal additives compared with control may be due to the stimulating effect of herbs on the gastrointestinal system by enhancing diet palatability and appetite **(Allam and El-Elaime, 2020).** Dry mater intake, % BW among treated groups vs. control (G2, G3 and G4vs. G1) was slight decrease (3.94, 3.90, and 3.94vs. 3.97 % BW, respectively). While, Zaraibi kidsconsumed approximately similar quantity ofDM intake, g/kg$w^{0.75}$G1, G2 G3 and G4 (82.42, 82.10, 81.85 and 82.50 g/kg$w^{0.75}$, respectively) since all kids had similar metabolic body size, $w^{0.75}$. The current study's findings are consistent with other previous that demonstrated of feeding sheep, goats, and cows medicinal plants and herbs improved their feed intake and nutrients digestibility **(Mir et al., 1998, Aboul-fotouh *et al.*, 1999; Khattab *et al.*, 2018; Amany *et al.*, 2021).**

Table (2): Average daily feed intake* by male Zaraibi kids fed on the experimental treatments.

Item	G1	G2	G3	G4
No. of kids	7	7	7	7
Average body weight, kg	18.53	18.86	19.29	19.28
Metabolic body size, $w^{0.75}$	8.93	9.05	9.20	9.20
Average feed intake, g/h/d				
CFM	445	447	451	453
BH	144	145	149	151
RS	147	151	153	155
Total DM intake, g/h	736	743	753	759
DM intake, % BW	3.97	3.94	3.90	3.94
DM intake, g/kg$w^{0.75}$	82.42	82.10	81.85	82.50
Concentrate/ Roughage, C/R ratio	60:40	60:40	60:40	60:40
Average CP intake, g/h/d				
CFM	62.79	63.07	63.64	63.92
BH	15.85	15.96	16.40	16.62
RS	4.63	4.76	4.82	4.88
Total CP intake, g/h	83.27	83.79	84.86	85.42
CP intake, % BW	0.449	0.444	0.440	0.443
CP intake, g/kg$w^{0.75}$	9.32	9.26	9.22	9.28

* Group feeding

Growing Zaraibi kids were consumed the least amount of water when fed on mix herbal additive G4, (1.95, l/h/d), while recorded the highest consumption with control group G1 (2.13, l/h/d) without significant (P <0.05) as shown in Table 3. While the daily water consumption was related to DM intake (ml/ g DM intake), it kept the same trend above with significant where it ranged from 2.57 (G4) to 2.89 (G1). Similarly, daily water consumption as ml/kg BW and ml/kg w0.82 were differences with significant among dietary treatments G1, G3 and G4 except of G2 was insignificant with all groups (P <0.05), due to increase average body weight, kg and metabolic body mass, $w^{0.82}$. These results are in accordance with **Zeid and Ahmed (2004)** whose found that the using of Chamomile and Thyme in Zaraibi goats' diets resulted in reduced water consumption by 13.65 and 4.42%, respectively when compared with untreated diet, the total amount of excreted water was less with Chamomile and Thyme (22.55 and 6.32 ml/kg$w^{0.82}$, respectively) . According to these findings, it appears that utilizing some medical herbs in small ruminant feeds is more appropriate for desert environments with limited water supplies.

Table (3): Daily water consumption of male Zaraibi kids fed the experimental treatments.

Item	G1	G2	G3	G4	MSE
Average body weight, kg	18.53	18.86	19.29	19.28	
Metabolic body mass, $w^{0.82}$	10.96	11.12	11.32	11.32	
Daily water consumption					
l/h/d	2.13	2.05	2.01	1.95	0.07
ml/kg BW	115^{a}	109^{ab}	104^{b}	101^{b}	2.35
ml/kg $w^{0.82}$	194^{a}	184^{ab}	177^{b}	172^{b}	3.71
ml/g DM intake	2.89^{a}	2.75^{ab}	2.67^{b}	2.57^{b}	0.08

^{a,b} Means within the same row with different superscripts are significantly different at (P <0.05).

Table (4) summarized the growth performance of male Zaraibi kids feed Rosemary or Sage and their mixture (G2, G3 and G4). The highest significant was recorded with mix additive (final weight, kg; total body gain, kg and daily body gain, g) without significant between individual herbal additive (G2 and G3) vs. control depended on basal diet without additive (G1). The current results were in harmony with those obtained by **(Biricik *et al.*, 2012; Ozek *et al.*, 2000; and Amany *et al.*, 2021).**

Table (4): Growth performance for male Zaraibi goats fed the experimental treatments.

Item	G1	G2	G3	G4	MSE
No. of animal	7	7	7	7	
Feed period, weeks	14	14	14	14	
Initial weight, kg	14.61	14.66	15.01	14.89	0.25
Final weight, kg	22.44^{b}	23.05^{ab}	23.56^{ab}	23.66^{a}	0.73
Total body gain, kg	7.83^{b}	8.39^{ab}	8.55^{ab}	8.77^{a}	0.11
Daily body gain, g	79.91^{b}	85.59^{ab}	87.21^{ab}	89.45^{a}	0.97

^{a,b} Means within the same row with different superscripts are significantly different at (P <0.05).

Concerning feed conversion measurements, Table (5) shown all groups that feed herbal additives being an improvement (as kg DM/ kg gain or kg CP / kg gain) compared with control one. Likewise**, Çabuk *et al.* (2006)** recommended that the combination of herbal essential oils may be taken into consideration as a possible growth enhancer for innovative nutritional. These could be read as suggesting that essential oils and their combination could have a beneficial impact on the bacteria in the gut and, in turn, the condition of digestibility.

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Table (5): Feed conversion ratio for male Zaraibi goats fed the experimental treatments.

Item	G1	G2	G3	G4
Daily feed intake, g/h				
DM intake	736	743	753	759
CP intake	83.27	83.79	84.86	85.42
Daily body gain, g/h	79.91	85.59	87.21	89.45
Feed conversion ratio				
kg DM/ kg gain	9.21	8.68	8.63	8.48
kg CP / kg gain	1.04	0.98	0.97	0.95

Table 6 and figs (1 and 2) presents the data of hemato-biochemical parameter. The findings showed that the groups fed herbal additions (rosemary or/and sage) had slight variations without significant in Hb, RBC, and platelet concentrations; nevertheless, the differences were significant (P <0.05) when compared to the control group. At the same time, G1was higher level without significant in concentrations of Hct and WBC's ranged from (33.15-32.05 and 9.15-8.37, respectively). In the same line, serum protein, albumin and globulin tended to increase with herbs groups (G2, G3 and G4) and the differences were significant in total protein and globulin. Ahmed et al., (2019) indicated the same trend with using chamomile additives in fed of dairy Zaraibi goats. Mohamed *et al*. (2003) found that serum concentrations of total protein, alpha1, alpha2 beta1, beta2 and gamma 2 globulin were highly significantly as a result to using chamomile to ewe's rations. Also, serum Glucose increase with herbs groups (72.97, 73.35 and 75.31mg/dl for G3, G2 and G4, respectively) compare to G1 (71.50 mg/dl) without significant. Serum creatinine was significantly decreased with herbs groups compared with G1 (0.87, 0.83and 0.79 *vs.* 0.95mg/dl G2, G3 and G4 *vs.* G1, respectively). Thus, creatinine level in blood clearly presents goat's kidney status, so it can be a good indicator on the animal health as reported by **(Abdelhamid *et al*.,2011; El-Basiony *et al*., 2015; El-Kholany *et al*., 2017; Ahmed *et al*., 2019).** Moreover, serum cholesterol and activities of AST and ALT were significantly higher with the control ration (G1) compared with herbal additive groups. Similarly, **Tawfik *et al*. (2005)** was observed that the serum total lipids and cholesterol as well as the enzyme activity (ALP, AST and ALT) were reduced as a result to using of chamomile in sheep rations.

The values of total antioxidant capacity (TAC) were higher with the three treated diets (1.39, 1.43 and 1.43 for G2, G3 and G4, respectively) compeered with the control. and the differences were significant. The positive effect observed also in MDA as a result to using the different herbs in goats rations as shown in fig (1). The values are within the normal range as reported by **Nawito *et al*., (2016) and Hanan *et al*., (2020)** for healthy goats and sheep and in line with finding of **Amany *et al*., (2022)** when they used Rosemary and Laurel herbs as natural feed additives in goat's rations. As regard to thyroid hormone, the obtained values indicated that both T_3 and T_4hormones tended to increase as a result to using of herbs especially G4 (95.11 and 9.80, respectively) and the differences were significant in T_4 hormone only fig (2). Similar results were observed by **Kassab and Mohammed (2013)** with using some natural feed additives in sheep rations.

Finally, both calcium and phosphorus tended to increase with using herbal additives and the differences were not significant. On the contrary, the serum magnesium was insignificant increase among groups feed herbal additives (2.33, 2.31 and 2.21, mg/dl) G4, G3 and G2, respectively and this differences were significant with G1 (2.07 mg/dl) as shown in Table (6). The positive effect to some medicinal herbs on total protein and globulin and they stated that this increase may also due to an immune stimulate effect of used herbs. creatinine level in blood clearly presents goat's kidney status, so it can be a good indicator on the animal health as reported by **(Abdelhamid et al.,2011; El-Basiony et al., 2015; El-Kholany *et al*., 2017; Ahmed et al., 2019). Tawfik *et al*. (2005)** was observed that the serum total lipids and cholesterol as well as the enzyme activity (ALP, AST and ALT) were reduced as a result to using of chamomile in sheep rations.

Table (6) Effect of experimental additive on some blood parameters in male Zaraibi goats.

Item	G1	G2	G3	G4	MSE
Hemoglobin (Hb), g/dl	12.13^{b}	12.75^{a}	12.81^{a}	12.90^{a}	0.17
Hematocrite (Hct), %	33.15	32.51	32.30	32.05	0.57
Red blood cell (RBC's)×10^{6}/ul	6.29^{b}	6.73^{ab}	6.70^{ab}	6.89^{a}	0.25
White blood cell (WBC's) ×10^{3}/ul	9.15	8.75	8.51	8.37	0.63
Platelets (×10^{3}/ul)	433^{b}	457^{ab}	470^{ab}	495^{a}	25.51
Total protein, mg/dl	6.63^{b}	7.01^{a}	7.07^{a}	7.15^{a}	0.19
Albumin, mg/dl	3.60	3.65	3.70	3.76	0.10
Globulin, mg/dl	3.03^{b}	3.36^{a}	3.37^{a}	3.40^{a}	0.05
Glucose, mg/dl	71.50	73.35	72.97	75.31	4.01
Cholesterol, mg/dl	60.33^{a}	55.73^{b}	54.11^{b}	53.50^{b}	2.35
Creatinine, mg/dl	0.95^{a}	0.87^{b}	0.83^{b}	0.79^{b}	0.04
AST, IU/L	51.53^{a}	47.10^{ab}	47.21^{ab}	46.35^{b}	1.35
ALT, IU/L	25.31^{a}	23.05^{b}	23.11^{b}	22.71^{b}	0.71
Calcium, mg/dl	10.55	10.73	10.81	10.79	0.21
Phosphorus, mg/dl	5.50	5.59	5.70	5.73	0.11
Magnesium, mg/dl	2.07^{b}	2.21^{ab}	2.31^{ab}	2.33^{a}	0.05

^{a,b} *Means within the same row with different superscripts are significantly different at (P <0.05).*

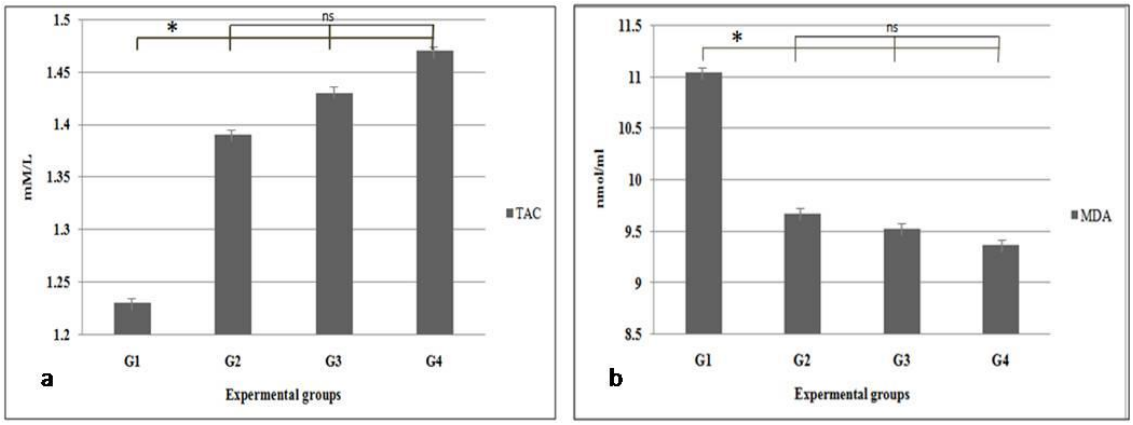

Fig (1): Effect of experimental additive on Total antioxidant (TAC), mM/L and Malondialdehyde (MDA), nmol/ml in male Zaraibi goats.

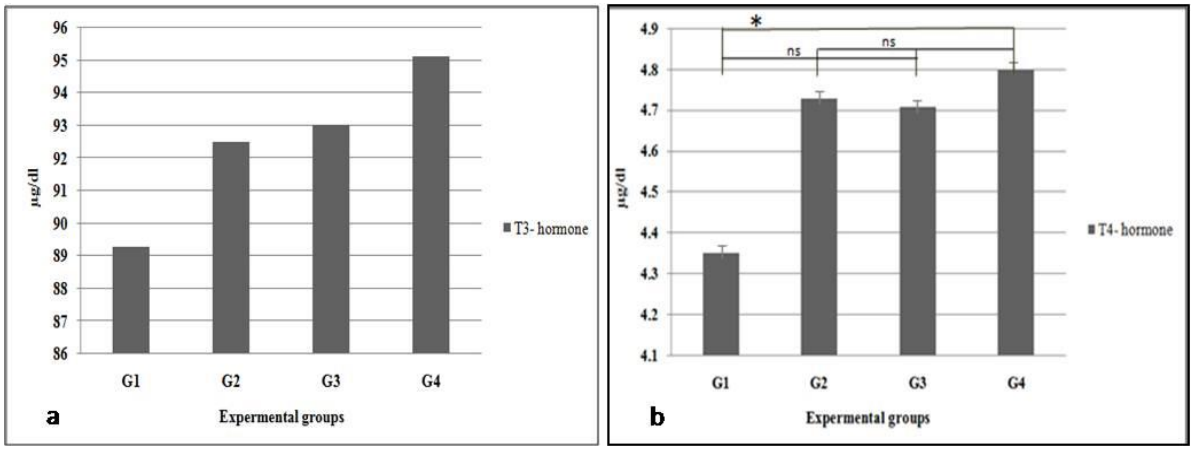

Fig (2): Effect of experimental additive on thyroid hormones T3 and T4 (µg/dl) in male Zaraibi goats.

Table (7) Economic efficiency of male Zaraibi kids fed the different experimental treatments.

Item	G1	G2	G3	G4
Cost of feed consumed, LE/h	5.228	5.254	5.304	5.338
Price of weight gain, LE/h	7.991	8.559	8.721	8.945
Feed cost/Kg gain, LE	65.42	61.39	60.82	59.68
Economic efficiency	1.53	1.63	1.64	1.68
Relative improve, %	100	106.54	107.19	109.80

The prevailing prices, per ton, at time of the study period were: CFM = 10000 LE.; BH = 1500 LE.;RS = 500 LE.; live weight= 100000 LE.. Finally, the price for different herbs were = 85 LE./kg.

Table (7) presented the economic efficiency, which indicates that the daily feed cost (L.E.) rose when herbal testing additives were used in comparison to the control group. Feed cost per kilogram growth and weight gain price were significantly higher with rations (G4, G3, and G2) containing 5g of mix (Rosemary × Sage) or Sage and Rosemary, respectively, than with G1. The relative improve (%) was occurred with G4, followed by G3 and G2 in comparison with the lowest one (G1). In the end, the clearly reflected in terms of economic efficiency, with G4 was the highest profitability, fold by G3 and G2 were moderate profitability, while G1 was the lowest value. The present results in the same line with those recorded by **Allam and El-Elaime (2020)** reported that the supplementing rosemary leaves into the diet of growing lambs had increased the economic efficiency based on the control ration.

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CONCLUSION

It could be concluded that adding Rosemary or/ and Sage in growing goats feed had positive effect on growth performance and daily gain, and feed conversion ratio (kg CP/kg gain) so that reflected on rising economic efficiency. Moreover, some hemato-biochemical parameters were better with treated groups especially enzyme activity of kidney and liver with the mixed from Rosemary and Sage.

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الملخص العربي

دراسة تأثير بعض الاعشاب الطبية على الاداء الانتاجى و صفات الدم الهيماتو- بيوكميائية فى ذكور الماعز الزرايبى

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تم إجراء هذا البحث للمقارنة بين استخدام إكليل الجبل (Rosmarinus officinalis L.) والميرامية (Salvia officinalis) وخليطهما في تغذية ذكور الماعز النامية وتاثير ذلك على المادة الجافة المأكولة، والتحويل الغذائي، ومعدل الزيادة الوزنية ، وبعض قياسات الدم وذلك عند التغذية عليها بمعدل ٥ جم / ١٠٠ كجم وزن حى، وكانت النسبة بين العلف المركز الى العلف الخشن في العليقة الأساسية لكل المجموعات ٦٠ :٤٠%. المجموعة الأولى مج١ كانت مجموعة المقارنة بينما تم اضافة اكليل الجبل والميرامية وخليطهما للمجموعات مج ٢، مج٣ و مج٤على التوالي.

اظهرت النتائج زيادة المادة الجافة الماكولة فى مجموعات المعاملة مج ٢، مج٣ و مج٤ مقارنة بـ مج١ وكانت مج٤ اعلاها (٧٥٩ جم/راس) مع انخفاض معدل استهلاك المياه (١.٩٥ لتر/راس/يوم). سجلت مج ٤ فرقا معنويا مقارنة مع مج١ فى كلا من وزن الجسم النهائي (كجم) و إجمالي الزيادة فى الجسم (كجم) وزيادة وزن الجسم اليومية (جم) في حين لم تكن الفروق معنوية مع مج٢ و مج٣ . اظهرت المجموعات التى استخدم فيها الاعشاب تحسن فى معدل تحويل الغذاء (كجم مادة جافة / كجم زيادة وزنية أو كجم بروتين مأكول /كجم زيادة وزنية) مقارنة مع مج١ مما ادى الى زيادة الكفاءة الاقتصادية. كما اظهرت نتائج تحليلات الدم ان جميع القياسات كانت فى الحدود الطبيعية، مع انخفاض معنوى فى مستوى الكوليسترول والكرياتينين وأنزيمات الكبد مج٤، مج٣و مج٢مقارنة بـ مج١ مما يعكس حالة الكلى والكبد الجيدة مما انعكس ايجابا على الحالة الصحية للحيوان. ارتفعت القدرة الكلية لمضادات الأكسدة (TAC) فى المعاملات التجريبية الثلاثة باستخدام الاعشاب الطبية مقارنة مع مج١. كما ارتفع مستوى هورمونات الغدة الدرقية T3و T4 باستخدام الأعشاب وخاصة فى مج٤وكانت الفروق معنوية مع T4 فقط.

لذا يمكن الاستنتاج أن استخدام اكليل الجبل و/أو الميرامية في علائق ذكور الماعز النامية كان له تأثير إيجابي ليس فقط على تحسين معدلات النمو والزيادة اليومية، ولكن ايضا على كفاءة التحويل الغذائي والكفاءة الاقتصادية دون أي تأثير سلبي على قياسات الدم.