



Vital impact of using ginger roots powder as feed additive to the rations of local Friesian dairy cows and its effect on production & economic efficiency of milk and physiological of blood

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Abstract

Three non pregnant local Friesian dairy cows were at same live weights, fourth production season and during first month of calving, they were divided into three treatments .2nd and 3rd treatments were reared on standard ration supplemented with 75 or 150 g. of ginger roots powder /cow /day ,respectively, while the 1st treatment reared on standard ration only. Cows were fed individually on standard ration during three periods (28 days/period) in 3x3 Latin square design. The results indicated that feed intake, daily quantities of uncorrected, corrected milk yields , fat, protein and lactose ,milk lactose %, red & white blood cell counts, hemoglobin concentration, packed cell volume ,lymphocyte %, total protein and globulin were increased significantly, while the percentages of milk fat and blood glucose were decreased significantly in T2 and T3 s as compared to those in T1.The present study was carried out to determine the effect of supplementation of ginger root on milk production and composition and physiological of blood.

Keywords: Friesian dairy cows, ginger roots ,milk production and composition and physiological of blood

التقييم الحيوي لاستخدام مسحوق جذور الزنجبيل كإضافات غذائية في علائق أبقار الفريزيان الحلوبية المحلية وتأثيرها في الكفاءة الإنتاجية والاقتصادية للحليب والفسلجية للدم

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الخلاصة:

استخدمت ثلاثة أبقار مكررة حلوبة غير حوامل متقاربة في أوزانها وفي موسمها الإنتاجي الرابع وفي شهرها الأول بعد الولادة، غذيت على ثلاث علائق خلال ثلاث فترات (كل فترة أربعة أسابيع) وخلال ثلاث فترات تجريبية (28 يوم/ فترة) في تصميم المربع اللاتيني (3×3) وغذيت المعاملة الأولى على عليفة خالية من مسحوق

جذور الزنجبيل (مجموعة السيطرة)، في حين تم إضافة مسحوق جذور الزنجبيل وخلطها يوميا مع ألبانها القياسية بمعدل 75 أو 150 غم /يقرة /اليوم للمعاملتين الثانية والثالثة على التوالي. أشارت النتائج أن الكميات الناتجة اليومية من الحليب غير المعدل والمعدل والدهن والبروتين واللاكتوز ونسبه لاكتوز الحليب وعدد خلايا الدم الأحمر والبيض وتركيز الهيموكلوبين وحجم الخلايا المرصوصة والبروتين الكلي والكلوبيولين ونسبة الخلايا اللمفاوية في مصل الدم ارتفعت معنويا، في حين انخفضت معنويا نسبيته دهن الحليب وكلوكرز الدم في معاملتي الأبقار الثانية والثالثة مقارنة بتلك الأبقار في المعاملة الأولى. أجريت الدراسة الحالية لمعرفة تأثير إضافة جذور الزنجبيل في إنتاج وتركيب الحليب وبعض الصفات والفسلجية لدم أبقار الفريزيان المحلية.

Introduction:

There are about 53885 herbs kinds in the world (1) and about 360-370 herbs kinds in Iraq, are used in folk medicine and its named as medical herbs (2). In the last ten years the researchers in the field of animal sciences in Iraq inspection for use the alternative natural material such as medical herbs in feeding dairy cattle (3), to substitute or minimize the use of chemicals compounds like antibiotic in animal nutrition, because those chemicals compounds can caused unfavorable side effects and hazards to animal and human (4), and this may be due to the harmful risk of appearance of their residues in milk and meat and threaten their health on the long-run, development of multi-drug bacteria (5), and promote the spreading of resistance gene (6), this have lead to prohibition for use of antibiotics in animal feed in European Union's by European Union's Agricultural ministry since the first of January 2006(7). On the other hand, attempts to use the natural materials such as herbaceous plants are widely accepted, so the world health organization (WHO) encourages using medicinal herbs and plants to substitute or minimize the use of chemicals compounds through the global trend to go back to nature(8) to ameliorate health and promote the body condition to counteract the stress of illness(9), these nontraditional protein and economic sources must have privilege to ameliorate the animal health represented in supporting a good immunity and animal production represented by the meat production and the animal fertility, improve the economic input (10) for production, are not harmful to animal and not left risk residues in milk and meat and consumer safety(11) and to provide alternative sources or support the chemical medicine(12).

Ginger root or rhizome (*Zingiber officinale* L.) belong to botanical family Zingiberaceae. (13). The plant is cultivated in tropical regions, in various parts particularly in China, India and Philippine. Ginger root has been subject to

chemical analysis have 10% moisture, 8.5% crude protein, 35% fat and 2.4% crude fiber (14). The ginger roots are commonly used as medicinally used for its antioxidant (15), androgenic (16) and hypoglycemic(17) activities which are reported in different animals. The active ingredients of ginger root such as zingerone, gingerdiol, zingibrene, gingerols and shogaols produced antioxidant activity (18). Also, some studies indicated that ginger root stimulate the appetite of animal and improvement the nutrients palatability (19), had favorable effects on digestion and absorption of lipids(20) and promote milk production in human (21). The objective of this study was to evaluate effects of Ginger root as feed additives in the rations of lactating dairy cows on the yield and composition of their milk and physiological of blood.

Materials and Methods:

This study was conducted at the dairy cattle farm, Department of Animal Production, Technical Agriculture College, Mosul, during August to November, 2013, by using three clinically healthy, non pregnant dairy cows, in good nutritional condition, at same live weights (390 ± 22 kg.), fourth production season and during first month of lactation. The cows were divided randomly into three groups and housed in a naturally individual pen with cement floored, facility for individual feeding and watering, during the trial, all the animals were kept under natural photo-period and ambient temperature. All animals were free from internal and external parasites before and during the study and their health status was evaluated during the experiment period by veterinarians. Cows were assigned randomly into 3 experimental rations and 3 periods (4 weeks each) using Latin square design (3×3), each experimental period consisted of 14 days of adaptation to the diet and 14 days for data collection. Between each experiment period, a wash out of 7 days was used.

The treatments included, 1st (T₁) treatment reared on the control ration consisted of concentrate feed mixture and the chemical composition of the ingredients is shown in table(1), 2nd(T₂) and 3rd (T₃) treatments were reared on control ration supplemented with 75 or 150 gm.ginger roots powder /head/day, respectively. Ginger root powder were mixed daily with control ration for morning meal. The

feeds was offered individually and were assessed to cover the maintenance and production requirements for each animal(22) during three periods (28 days/period). All rations and wheat straw (2-3 cm)were offered at 2.5% and 1.5% of their body weight, respectively, for the experimental animals and fed twice daily at 7:30 a.m. and 5. p.m. Minerals blocks were freely available at all times.

Table 1:Feedstuffs (gm./kg.feed)and chemical analysis (%) of experimental ration

Feed stuffs		Chemical analysis determined (DM% basis)(16)		
Ingredients	gm./kg.feed	items	ration	straw
Barley grain	400	Dry matter (DM)	92.33	93.67
Wheat bran	400	Crude protein (CP)	16.10	2.94
Soy bean meal	70	Ether extract (EE)	2.72	0.64
Yellow corn	105	CF)(calculated Crude fiber	6.54	38.38
Urea(42% N)	5	Crude ash	5.69	9.9
NaCl (Salt	10	Nitrogen free extract (NFE)	2861.	41.81
Limestone(Caco3)	10	Calculated analysis ME.* (Kcal./kg)	2744	1375

*Calculated from chemical analysis tables for Iraqi feed stuffs (23) .

During the data collection period (2 weeks) ,cows were milked twice(06:30 a.m. and 05: 30 p.m.),daily by means of a milking machine , and milk yield were recorded daily for each animal during 14 days of collection period. Individual milk samples were collected every 7 days from all animals, immediately after each milking, the samples(10% of production) were collected. The sample of each animal for two consecutive (morning and evening) milk-ing ,mixed in proportion to yield appropriate composted samples. Milk samples were taken for pH determination and milk samples were also analyzed to determine the milk composition for fat,protein,lactose and solid not fat using a Milko-scan analyzer(EKO Milk analyzer, Finland) according to (24).Total solids was determined by using equation of (25),ash and water were determined according to (24) .Fat corrected milk (4%fat)was calculated by using the equation according to (26) .

Blood samples were individually collected early in the morning at the end of each collection periods via jugular vein using a 10 ml plastic disposal syringe. About 10 ml of blood were obtained from each cows by using two vacutainer tubes. The first 5ml of the blood was put in vacutainer tubes containing ethylene-diamine tetra-acetic acid (EDTA) ,the tubes were inverted several times to ensure adequate mixing of the blood with anticoagulant and transported to the laborat-ory for hematological analysis, the

samples were analyzed within 2 hours after collection, the hematological analysis included ,total of erythrocytes (RBC's $\times 10^6$ cells/ul) and leukocytes (WBC's $\times 10^3$ cells/ ul) counts were determined manually by using the hemocytometer as described by (27),the differential distribution of leukocytes was determined by counting 100 cells per slide using the method described by (28) and using the method described by (28) and expressed as a percentage(%), hemoglobin concentration (Hb,g/ dl) was determined according to (27) , packed cell volume (PCV%) was estimated by the use of the microhemat-ocri method according to (28) and expressed as a percentage. The second 5 ml of the blood Data were statistically analyzed in a 3 \times 3 Latin square design by analysis of variance run the PROC GLM of (32) .The results are presented as mean values and standard error put in non heparinized glass tubes, blood samples were centrifugation at 4000 rpm /15 minutes, and the obtained serum samples were divided into two parts and stored at -20C⁰ until biochemical analysis, the first part of blood serum was used to determined the total protein (T.P) , albumin(AL), globulin (GL), glycerol (G) ,triglycerides(TG) ,urea blood (BU)and blood glucose (BG) in serum by using commercial kits (Biolabo Merieux, France) according to the procedure outlined by the manufacturer and by automatic spectrophotometer. Also Aspartate amino transferase (AST) and Alanine amino transfe-rase (ALT) enzymes activities in the serum were determined accor ding

to (29) and Alkaline Phosphates (ALP) was measured according to (30). The second part of blood serum was used to determine the concentrations of some minerals such as sodium (Na), chloride (Cl) and (K) by flame photometer based on method described by (31), and the serum concentrations of calcium (Ca), phosphorus (P) and magnesium (Mg) were determined by using commercial kits (Biolabo Merieux, France) according to the procedure outlined by the manufacturer by a automatic spectrophotometer

Data were statistically analyzed in a 3×3 Latin square design by analysis of variance run the PROC GLM of (32). The results are presented as mean values and standard error of the mean. Differences between treatment means were determined Duncan's multiple Range

Tests (33). Differences among means with $P \leq 0.05$ were accepted as representing statistically significant differences.

Results:

Data in Table (2) clearly indicated that daily intake of concentrate ration, straw and total feed were significantly ($P \leq 0.05$) affected by supplementation with ginger root powder to treatments. The supplementation of ginger root powder to T2 & T3 (control ration + 75 or 150 gm ginger root powder / cow / day) respectively, which result increased significantly ($P \leq 0.05$) the daily intake of concentrate ration, straw and total feed intake this increment was 2.53 and 2.96 kg, which mark 23.08% and 27.01% respectively in total feed intake, and also this reflect on increasing

Table 2: Effect of supplementation ginger root on some performance traits (Mean ± S.E.)

Studied traits	Treatments		
	T1	T2	T3
Concentration intake (kg/cow/day)	7.340 ± 2.14 b	9.130 ± 2.38 a	9.510 ± 2.52 a
Straw intake (kg/cow/day)	3.620 ± 0.12 b	4.360 ± 0.16 a	4.410 ± 0.19 a
Total feed intake (kg/cow/day)	10.960 ± 2.24 b	13.490 ± 2.41 a	13.920 ± 2.58 a
Protein intake from Concentration (kg/cow/day)	1.182 ± 0.12 b	1.470 ± 0.16 a	1.531 ± 0.19 a
Protein intake from Straw (kg/cow/day)	0.106 ± 0.08 b	0.128 ± 0.05 a	0.130 ± 0.07 a
Total Protein intake (kg/cow/day)	1.288 ± 0.61 b	1.598 ± 0.17 a	1.661 ± 0.22 a
Energy intake from Concentration (kg/cow/day)	2.01 ± 0.18 b	2.51 ± 0.27 a	2.61 ± 0.29 a
Energy intake from Straw (kg/cow/day)	0.50 ± 0.02 a	0.60 ± 0.03 a	0.60 ± 0.03 a
Total energy intake (kg/cow/day)	2.51 ± 0.28 b	3.11 ± 0.35 a	3.21 ± 0.41 a
Weight of dairy cow at beginning experiment (kg.)	390 ± 25 a	388 ± 27 a	391 ± 26 a
Weight of dairy cow at ending experiment (kg.)	389 ± 27 a	395 ± 26 a	397 ± 25 a

*Means in the same row bearing different letters that different significantly with different at $P \leq 0.05$

significantly ($P \leq 0.05$) the protein and energy intake as compared with 1st treatment (control ration only). While no significant differences was found between 2nd and 3rd treatments in daily intake of concentrate, straw, total feed protein and energy. Also the data in Table (2) indicate that no significant effect from supplementation with Ginger root powder to treatments on live weight of dairy cows during experimental periods, which mean that rations were assessed to cover the maintenance and production requirements for each animal (22) during three periods and without adverse effect on the live weight of dairy cows during experiment.

Uncorrected and corrected milk (4% FCM) yields were significantly higher in T2 and T3 fed experimental additives as compared to the T1 (Table 3). In other world, supplementation ginger root powder to T2 and T3 increased uncorrected milk yield significantly by 2.46 kg. (30.91%) and 4.63 kg. (58.17%) respectively as compared to the T1 (control ration), also supplementation of ginger root powder to T3 increased uncorrected milk yield mathematically by 1.17 kg. (10.25%) as compared to the T2. The data of milk composition of the experimental periods are also summarized in Table (3). These data revealed that milk lactose% was increased significantly, while milk fat % was

decreased significantly for cows fed ginger root powder supplement-ation to T2 and T3 as compared with the control treatment (T1).Although milk pH and the percentages of milk protein, milk total solids, milk sold not fat and milk ash were not significantly affected by ginger root powder supplementation. Also

supplementation ginger root powder to T2 and T3 has caused significantly increased the daily quantities of fat (104.06 and 136.11 gm), protein (105.26 and 138.79 gm) and lactose (196.44 and 260.77 gm) yields as compared to the T1 (Table 3).

Table 3:Effect of ginger root on milk yield and composition (Mean±S.E.)

Treatment Studied traits	Treatments		
	T1	T2	T3
yield(kg/day) Daily			
uncorrected milk	7.96 ± 1.86 b	2.61 a ± 11.42	12.59 ± 2.95 a
corrected milk (4%FCM)	7.56 ± 1.54 b	2.71 a ± 10.69	11.65 ± 2.63 a
Milk composition(%)			
Milk pH	6.64 ± 0.12 a	6.49 ± 0.12 a	6.47 ± 0.13 a
Moisture	87.7 ± 2.2 a	87.5 ± 2.2 a	87.6 ± 2.1 a
Fat	3.81 ± 0.27 a	3.57 ± 0.32 b	3.49 ± 0.38 b
Protein	3.24 ± 0.08 a	3.18 ± 0.11 a	3.15 ± 0.13 a
Lactose	4.49 ± 0.19 b	4.85 ± 0.22 a	4.91 ± 0.18 a
Ash	0.73 ± 0.08 a	0.72 ± 0.09 a	0.71 ± 0.09 a
Total solid	12.27 ± 0.54 a	12.65 ± 0.64 a	12.71 ± 0.60 a
Total solid not fat	8.46 ± 0.42 a	8.89 ± 0.45 a	9.12 ± 0.48 a
Quantity of Milk composition			
Fat	303.28 ± 29.14 b	407.66 ± 32.66 a	439.39 ± 35.93 a
Protein	257.28 ± 22.37 b	363.16 ± 25.72 a	396.59 ± 29.33 a
Lactose	357.40 ± 41.88 b	553.87 ± 49.65 a	618.17 ± 51.89 a

S.E=standard error

T1=control ration; T2= control ration+75gm.ginger/head/day ; T3= control ration+150gm.ginger/head/day.

*Means in the same row bearing different letters that different significantly with different at $P \leq 0.05$

Data in Table (4) indicated that was a considerable cost saving with supplement-ation profit showed that diet containing ginger root had the best values, that adverse on increasing the net gross profit from supplementation ginger root and this profit was 1682 (47.11%) and 1826(51.13%) I.D /cow/ day for T2 and T3 respectively, as compared to T1. So adding ginger root is advisable to achieve a good performance in dairy cows.

ginger root to T2 and T3 as compared to the control treatment (T1),The differences in

Supplementation of ginger root powder to T2 and T3,respectively were significantly ($P \leq 0.05$) increased the RBC, WBC, Hb ,PCV% and lymphocyte % as compared to T1 (Table 5). Although no significant difference were found between T2 and T3 in all studied hematological traits.

Table 4:Economical evaluation for experimental rations

Treatment Studied traits	Treatments		
	T1	T2	T3
Concentration intake(kg/cow/day)	7.34	9.13	9.51
Concentration cost(450 I.D/kg)	3303	4109	4280
Straw intake(kg/cow/day)	3.62	4.36	4.41
Straw cost(300 I.D/kg.)	1086	1308	1323

ginger root intake(kg/cow/day	-	0.075	0.150
ginger cost(10000 I.D/kg.)	-	0.750	1.500
Total feed intake cost(I.D/ kg /cow / day)	4389	6167	7103
Milk yield(kg/cow/day) Daily	7.96	11.42	12.59
Milk cost (1000 I.D/kg.)	7960	11420	12590
Net gross profit (I.D/cow/day)	3571	5253	5397

Table 5: Effect of supplementation ginger root on some biochemical traits (Mean±S.E.)

Treatment Studied traits	Treatments		
	T1	T2	T3
Blood pH	6.8±0.12 a	6.9±0.11 a	6.9±0.12 a
Hb(g/ dl)	9.16± 0.18	9.92±0.22 a	9.95±0.24 a
RBC's (×10 ⁶ cells/ul)	9.38±0.26 b	10.71±0.38 a	10.75±0.41a
PCV(%)	27.33±0.28 b	30.05±0.38 a	30.24±0.41 a
PL's (× 10 ³ / ul)	0.40±0.08 a	0.42±0.08 a	0.41±0.08 a
WBC's(× 10 ³ cells/ul)	8.67±0.27 b	9.89±0.38 a	10.14±0.36 a
Lymphocytes(%)	51.67±2.31 b	53.69±3.36 a	53.72±3.42 a
Esinophils (%)	8.96±1.89 a	8.73±1.71 a	8.55±1.77 a
Neutrophils(%)	33.49±1.10 a	32.95±0.91 a	31.98±0.64 a
Monocytes(%)	4.99±0.48 a	4.75±0.54 a	4.89±0.57 a
Basophils(%)	0.89±0.07 a	0.88±0.07 a	0.86±0.07 a

S.E=standard error

T1=control ration; T2= control ration+75gm.ginger/head/day ; T3= control ration+150gm.ginger/head/day.

*Means in the same row bearing different letters that different significantly with different at $P \leq 0.05$

Data in Table (6) clearly indicated that total protein ,globulin and blood glucose were significantly ($P \leq 0.05$) affected by supplementation with ginger root powder to 2nd and 3rd treatments, respectively as compared to 1st treatment. While the values of albumin, cholesterol, triglyceride, blood urea ,AST, ALT and ALP were not significantly affected by the experimental supplementation. Total protein and globulin values were increased while blood

glucose was decreased significantly with the ginger root powder supplementation (Table6). Although no significant difference were found between 2nd and 3rd treatments in all studied biochemical traits.

The data of some blood minerals of the experimental treatments are summarized in Table 7. Blood minerals percentages were not significantly affected by supplementa-tion with ginger root powder to the treatments.

Table 6:Effect of supplementation ginger root on some biochemical traits (Mean±S.E.)

Treatments Studied traits	Treatments		
	T1	T2	T3
Total protein(g/dl)	8.23 ± 0.23 b	8.74 ± 0.25 a	8.81 ± 0.28 a
Globulin(g/dl)	4.42 ± 0.16 b	4.88 ± 0.19 a	4.99 ± 0.21 a
Albumin(g/dl)	3.81 ± 0.15 b	3.86 ± 0.18 a	3.98 ± 0.20 a
Cholesterol(g/dl)	125.61 ± 4.11 a	126.28 ± 4.42 a	126.42 ± 4.76 a
Triglyceride(mg/dl)	37.55 ± 3.23 a	37.86 ± 3.54 a	37.72 ± 3.18 a
Urea (mg/ dl)	47.34 ± 0.89 a	46.87 ± 0.71 a	46.56 ± 0.68 a
Glucose (mg/ dl)	61.79 ± 3.48 a	56.54 ± 2.76 b	55.34 ± 2.218 b
AST(Units/ml)	8.91 ± 1.21 a	9.12 ± 1.23 a	9.33 ± 1.23 a
ALT(Units/ml)	0.63 ± 3.92 ±	4.12 ± 0.57 a	4.21 ± 0.62 a

ALP(Units/ml)	35.67 ± 3.54 a	35.73 ± 3.32 a	35.98 ± 3.12 a
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S.E=standard error

T1=control ration; T2= control ration+75gm.ginger/head/day ; T3= control ration+150gm.ginger/head/day.

*Means in the same row bearing different letters that different significantly with different at $P \leq 0.05$

Table 7:Effect of supplementation ginger root on some blood minerals (Mean±S.E.)

Treatment Studied traits	Treatments		
	T1	T2	T3
Calcium(mmol.l ⁻¹)	8.19 ± 0.67 a	8.25 ± 0.71	8.29 ± 0.69
Phosphors(mmol.l ⁻¹)	4.48 ± 0.26 a	4.71 ± 0.26 a	4.70 ± 0.25 a
Sodium(mmol.l ⁻¹)	138.88 ± 2.21 a	139.79 ± 2.35 a	140.11 ± 2.44 a
chloride(mmol.l ⁻¹)	95.21 ± 2.71 a	95.34 ± 2.83 a	95.33 ± 2.85 a
Potassium(mmol.l ⁻¹)	4.30 ± 0.04 a	4.33 ± 0.05 a	4.35 ± 0.05 a
Magnesium(mmol.l ⁻¹)	2.21 ± 0.12 a	2.27 ± 0.14 a	2.26 ± 0.13 a

S.E=standard error, C.=control ration; C.+75gm.G.R.= control ration+75gm.gingerr root; C.+150gm.G.R.= control ration+150gm.gingerr root d.

*Means in the same row bearing different letters that different significantly with different at $P \leq 0.05$

Disssuion

The significant increase in the daily intake of concentrate ration , straw and total feed in T2 &T3, respectively as compared to T1 (Table 2),this may be due that ginger roots contains ingredients like Aryl alkanes that give ginger pungent taste that enhancing the appetite of animal and improvement the nutrients palatability which finally caused increased of feed intake (19),or may be attributed to that ginger enhance the synthesis of bile acids in the liver and their excretion in bile,which beneficially effects the digestion and absorption of lipids (20) ,or may be due to that ginger increase the secretion of saliva which caused increased secretion and activity of digestion enzymes which finally increased the digestion processes (34), or may be due to that ginger help to increase the absorption of essential nutrients, thus improving the growth of the animal (35),or may be accelerate the digestion and shorten the time of feed passage through the digestive tract (20) ,or may be due to that ginger increase stability of feed and beneficially influence the gastrointestinal ecosystem through inhibition of pathogenic microorganisms growth (36).The obtained results are in accordance with those reported by(37)they found that supplementation with 2ml.of ginger oil/head/day to ration of Damascus does goat had significantly increased the dry matter intake as compared to those in basal ration .

Supplementation of ginger roots to T2 and T3 that enhancing the appetite and feed intake which resulted a significant increased in the uncorrected and corrected (adjusted milk yield at 4%fat) milk yields that produced from cows in T2 & T3 as compared to those in T1(Table 3), this may be due that ginger root that caused higher ruminal TVFA and propionate proportion and the reduction of methane production (38).The obtained results are in accordance with those reported by (3) they reported a significant increased in daily milk yield of Holstein cows fed ration supplemented by 50 or 100 gm of ginger root/head/day as compared to those in basal ration, and in accordance with those reported by (37) they found that supplementation 2ml.of ginger oil/ head/ day to the ration of Damascus does goat had significantly increased the daily milk yield as compared to those in basal ration. The reduction in fat% (Table 3) in cow's milk that fed on rations supplemented with 75 or 150 gm ginger root powder/head/day ,respectively ,may be attributed to the an inverse relationship between milk yield and fat (39) ,or may be due to the lower ruminal acetate proportion and acetate : propionate ratio (40).similar results were obtained by (3) they founds that supplementation of ginger root to the ration of Holstein cows significantly decreased milk fat percentage. Milk lactose percentage were significantly higher in cows fed experimental supplementation as compared to the control (table 3),this may be due that ginger root supplementation that decreased

blood glucose (41). Similar results were obtained by (3) they reported that ginger root supplementation to Holstein cows rations had increased the milk lactose percentage. Although the price of ginger root was relatively expensive as compared with other feed ingredients (Table 4), but this reflect on increased the profit from milk production from cows in T2 & T3, respectively as compared to those in T1, so this encourage for using ginger root in dairy cows rations.

That supplementation supplemented with 75 or 150 gm ginger root powder to T2 & T3 respectively were increased significantly ($P \leq 0.05$) the total of RBC, Hb and PCV%, as compared to those in T1 (Table 5), this may be due that ginger root contain compound such as paradol and gingerol that have some properties as anti-thrombosis of blood (42), or may be due that ginger root contain good percentage of iron (43) which caused a positive reflect to increased the total of RBC, Hb and PCV%. The obtained results are in accordance with those reported by (44) they found that feeding ration contained 5% or 10% ginger root to female Awassi lambs had significantly increased the total of RBC, Hb and PCV%.

The significant increase in the total of WBC in T2 & T3 (Table 5) this may be due that ginger play a good role to increase the total of WBC through the stimulate the cells anti-inflammation (45), and ginger contained active ingredient such as gingerdiol and gingerols produced antioxidant activity (18). While the significant increased in the lymphocytes % may be due to active compound like gingerols that hence increasing the defense mechanism of the body especially the percentage of B-Lymphocytes cell which is responded for production of antibodies effective antibact-erial (46) and antifungal properties (47) and against infection (48). The obtained results are in accordance with those reported by (44) they found that feeding rations contained 5% or 10% ginger root to female Awassi lambs had increased significantly the total of WBC and the percentage of lymphocytes. The significant increased in the value of total protein in 2nd and 3rd treatments (Table 6) may be due that ginger roots stimulate the secretion of saliva and the function of digestion enzymes like pepsin and trypsin (49) and accelerate the digestion and metabolism and shorten the time of feed passage through the digestive tract (50&51), which result increased the absorption of protein in small intestine (52), or may be due that there was appositive correlation between dietary protein and plasma protein

concentra-tion (53). The obtained results are in accordance with those reported by (44) they found that value of total protein was increased significantly in serum blood of female Awassi lambs that fed on ration contain 5% or 10% ginger root as compared to control ration. While the significant increased in globulin value in 2nd group (Table 6) that fed control ration supplemented by 75 gm. ginger roots, may be due that ginger roots contained active ingredients such as zingerone, gingerdiol, zingibrene, gingerols and shogaols that increased the cellular antioxidant defenses activity (18) and anti-flammation (54), or may be also due to that ginger roots has caused increased immune response of the body especially types IgM and IgG (55) which results increased in plasma globulin. The obtained results are in accordance with (56) they reported that value of globulin was increased significantly in serum blood of local Iraqi black goat kids that fed ration contained 2.5% ginger roots as compared to control ration.

The significant decreased in the value of glucose in 2nd and 3rd treatments (Table 6) as compared to 1st treatment, may be related to increased of pancreatic insulin secretion due to dietary ginger roots supplementation (41) beside that ginger roots control the level of serum glucose (57). The obtained results

are in accordance with (44) who reported that value of glucose serum blood was significantly decreased of female Awassi lambs that fed on ration contain 5% or 10% ginger root as compared to control ration. The results in (Table 6) are in agreement with (58) they reported that supplementation with 5 or 10 or 15 gm. ginger root/kg .dry matter of feed respectively to the rations of Awassi lambs didn't significantly affect the concentration of cholesterol, triglycerides and blood urea.

The AST, ALT and ALP activity in blood serum of cows in the presented study (Table 6) were fitted between the reference levels (59). The obtained results are in accordance with (37) they reported that that no significant effect of supplementation ginger root on the activity of AST and ALT enzymes.

Minerals are the essential nutrients bearing a significant role in the animals, because their excess or deficiency produces detrimental effect on the performance of livestock (60). Data in (Table 7) revealed the blood minerals concentration were remained within the normal physiology ranges of dairy cows (61). The data in (Table 7) indicate that no significant effect of supplementation ginger roots on concentration

of calcium, phosphorus, potassium, sodium, chloride and magnesium of serum cows during experimental periods .

It can be concluded that supplementation 75 or 150 gm. ginger roots powder /cows/day had

improved the studied traits without adverse effect on the animal health however further studies are needed in this aspect .

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