Blood Components and Milk Production As Affected By Supplementing Ration With Thiamin In Ewe Sohagi Sheep.

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Abstract: This study aimed to evaluate the effect of vitamin B1 (thiamin) in Sohagi sheep 'rations on blood component and milk yield. Twenty-four lactating Sohagi sheep were assigned randomly into three experimental treatments (eight animals in each treatment). The experimental period lasted 12 weeks. Sheep received daily the basal diet plus 0, 20 or 40 mg/day thiamin for the control, treatment T20 and T40, respectively. The ewes were fed thiamin two weeks before lambing. The control diet consisted of berseem hay, wheat straw and concentrate feed mixture (as 1 : 1 : 2 on DM basis). Blood sample were taken before lambing and monthly after lambing to determined blood components (Total protein, Albumen, Glucose, GOT, GPT, Cholesterol, Triglycerides, Thyroid hormone (T3 and T4 hormones) and Milk yield were determined. The results indicated that total protein, Albumin and globulin increased significantly (P<0.01) in the T40 and T20 treatment compared with control. No significant differences were found among treatments concerning glucose, GOT, GPT, cholesterol, triglycerides and thyroid hormones (T3 and T4) with slightly increase in values in T40 and T20 treatments, respectively compared with control. Total milk yield (TMY) was significantly higher in T40 than other treatments. At the same time, TMY in T20 was higher than control. Positive coloration between blood component and total milk yield in ewes fed thiamin specially in third group (T40) which fed 40 mg thiamin. It could be concluded that thiamin supplementation to diets improved the blood component and increased milk production. The study recommends adding thiamine rate of 40 mg / head / day under Egyptian circumstances improved the physiological status and milk production in ewe .

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1. Introduction

Vitamin B1, also called thiamine or thiamin. It is named B1 because it was the first B vitamin discovered. All B vitamins help the body to convert carbohydrates into glucose which is used to produce energy. These B vitamins also help the body to metabolize fats and protein. B complex vitamins are needed for healthy skin, hair, eyes, and liver. They also help the nervous system function properly, and are needed for good brain function. All B vitamins are water-soluble, meaning that the body does not store them. Like other B complex vitamins, thiamine is sometimes called an "anti-stress" vitamin because it may strengthen the immune system and improve the body's ability to withstand stressful conditions. Thiamine is found in both plants and animals and plays a critical role in certain metabolic reactions. The body needs it to form adenosine triphosphate (ATP), which every cell of the body uses it for energy. Sapienza (1981) and Brent and Bartley (1984) reported that thiamine acts as a co-enzyme for various carboxylases and transketolase, and therefore has many functions: 1) It is indispensable to degradation processes in carbohydrate metabolism, 2) It is important for the function of neural and cardiac tissue, 3) It is necessary for the peristalsis of the stomach and intestine in the form of thiamine triphosphate, 4) It is a possible activating substance for the stimulation of peripheral nerves. Moreover vitamin B1 is necessary for healthy mucous membranes, helps in the digestion of food, provides strength to muscles and it is very useful for the proper functioning of heart (Mc Dowell 2000) .

Thiamin is concentrated in the outer layers of seeds. The richest animal sources of it are egg yolk and liver. Thiamin contents of some feeds and foods as reviewed by McDowell, (2000). Despite the ruminal microorganisms synthesize thiamin, it has been added to ruminants rations under certain conditions as suggested by some workers .So, the aim of present study is to evaluate the effect of vitamin B1 (thiamin) in Sohagi sheep 'rations on blood component and milk production.

2. Material and Methods

This study was carried out at the Agricultural Experiments Station, Faculty of Agriculture, Sohag University, in Sohag governorate in The Upper Egypt.

I- Experimental animals

Twenty-four lactating Sohagi sheep (Single lamb) were assigned randomly into three experimental treatments (three groups of eight ewes each). The experimental period lasted 84 days (12 weeks). Ewe weighed an average of 40.0 ±0.05kg, aged 4 years. Sheep received daily the basal diet plus thiamin at 0, 20 or 40 mg/day for the control, treatments T20 and T40, respectively. The control diet was Berssem hay, wheat straw and concentrate feed mixture (as 1 : 1 : 2 on DM basis). The animals received their requirements according to NRC, (1985). The ewes were fed thiamin two weeks before lambing. The experimental rations were offered twice a day at 8:30 a.m. and 3.00 p.m. Water was available at all times. The thiamin imported from China was obtained from ADWIA Company, Egypt. Thiamin was added to a portion of wheat bran then mixed thoroughly with the other concentrate ingredients. The chemical composition of feed ingredients is presented in Table (1).

Table (1): Chemical composition of feed ingredients .

		DM basis %					
Item	DM	OM	CF	CP	EE	NFE	Ash
CFM	92.24	91.97	17.12	16,85	3.29	54.71	7.76
Berseem hay	90.11	89.42	28.34	14.65	2.11	44.32	9.89
Wheat straw	89.23	87.57	37.87	2.12	1.65	45.93	10.77

CFM: Concentrate feed mixture consisted of 38% yellow corn maize, 20% wheat bran, 29%undecorticated cotton seed meal, 7 % rice bran, 3% molasses 2% limestone and 1% salt (sodium chloride).

II- Milk production

Milk yield (MY) of ewes during the 12 weeks of suckling period was estimated by the lamb suckling weight differential technique. Lambs were separated from their dams at 17:00 pm on the evening. In the following morning day at 07:00 am, lambs were weighed and allowed to suckle their dams for 15 minutes period. Then lambs weights were recorded and lambs were separated again until the next 17:00 pm. This procedure was repeated weekly during the whole suckling periods. Milk samples were taken for chemical analysis.

III-Sampling of blood

Blood samples from each animal in different treatments were collected at the beginning of experiment before lambing and then monthly intervals after lambing, Samples were taken after morning feeding from jugular vein. Blood samples were allowed to clot at room temperature and serum was then separated by centrifugation at 3000 rpm for 15 minutes. Blood serum samples were divided into two parts and then transferred into dry glass vials and stored at -20 °C until subsequent analysis. In the first part of serum, the concentration values of total protein (g/dl), albumin (g/dl), glucose (mg/dl), GOT (mg/dl) , GPT (mg/dl), cholesterol (mg/dl) and triglycerides (mg/dl), were determined by spectrophotometer using commercial kits. Globulin (g/dl) values were determined by subtracting albumin values from total protein values. The second part of the serum was used to determine the concentrations of triiodothyronine T3 (ng/dl) and thyroxin T4 (ng/dl) hormones using radioimmunoassay technique.

IV- Statistical analysis:

The results were statistically analyzed using the General Linear Model of SAS, (1998) for complete randomized design. Significant differences among treatments means were analyzed using Duncan, (1955).

3. Results and Discussion

Effect of thiamin treatments on blood serum components

Total protein:

The results from table (2) indicate that ewes fed thiamine showed an increase in the total protein (TP), albumen (Alb) and globulin (Glo) the differences were highly significant ($P<0.01$). The average of TP (mg/dl) values before and after lambing were 8.21 and 7.34 for T40 and T20, respectively, compared with control ration (6.73). The highest values of TP (mg/dl) after lambing showed in the 3rd month of lambing, being 8.40 and 7.45 for T40 and T20, respectively compared with control ration 6.75.

Total protein improved as a result of thiamin effect and milk production (Table 6) improved as a result of total protein improving in blood by 37.50% in T20 and by 24.98% in T40 in comparison with control. Kholif (1999) found a positive correlation between milk yield and blood serum total protein in lactating buffaloes. Data in Table (6) illustrate that total milk yield were 115% and 145 % for T20 and T40, respectively compared with control. Thus, milk yield improved with thiamin treatment. At the same time, thiamine treatment was increased albumin and globulin values compared with control ewes. The albumin and globulin had the same trend of total protein. The improvement in the milk yield

performance in the present study as a result of increases total protein in blood may be due to the positive effect of these treatments on the digestibility coefficient of different nutrients and nutritive values as suggested by Farahat *et al.* (2007).. These results indicate that there is an increase in the metabolism and decrease in the catabolism as a result of improve total protein in blood. Increasing of metabolism and decreasing of catabolism may be led to improve the milk yield performance. These results are in agreement with those of Sapienza (1981), Brent and Bartley (1984),Kholif (1999b), Majee *et al.* (2003), and Farahat *et al.* (2007).

Level of glucose, cholesterol and triglycerides

The presented results in Table (3) indicate that the blood serum glucose, cholesterol and triglycerides values in the different treatments (control, T20 and T40) are not significantly different (P>0.05). The highest values were determined in T40 followed by T20 and then control. Thiamin supplementation increased blood metabolite in T40 and T20 rations compared with that fed control. The improvements in blood components in T40 and T20 may be due to a positive effect of thiamin in body metabolism. These data are in agreement of Majee *et al.* (2003) and Farahat *et al.* (2007),

Table (2): Effect of thiamin treatments of ewes blood serum parameters before and after lambing

Treatments	Time (Month)	Total protein (mg/dl)	Albumin (mg/dl)	Globulin (mg/dl)	A/G ratio
	Before	6.81±0.09c	3.22±0.09c	3.59±0.06c	0.90±0.03a
Control	After1m	6.93±0.11c	3.27±0.08b	3.66±0.05c	0.89±0.02 ab
	After2m	6.61±0.11c	3.14±0.09c	3.46±0.10c	0.91±0.03a
	After 3m	6.76±0.08c	3.17±0.05c	3.60±0.06c	0.88±0.18b
	After 4m	6.56±0.12a	3.12±0.16b	3.44±0.09b	0.90±0.06a
	Average	6.73	3.18	3.55	0.89
T20	Before	7.45±0.09b	3.51±0.09b	3.96±0.06b	0.89±0.03a
20mg	After1m	7.32±0.11b	3.38±0.08b	3.94±0.05b	0.86±0.02 b
	After2m	7.40±0.11b	3.51±0.09b	3.89±0.10b	0.90±0.03a
	After 3m	7.45±0.08b	3.52±0.05b	3.90±0.06b	0.90±0.18ab
	After 4m	7.11±0.21a	3.20±0.16a	3.91±0.09a	082±0.06a
	Average	7.34	3.24	3.92	0.92
T40	Before	8.02±0.09a	3.87±0.09a	4.15±0.06a	0.93±0.03a
40mg	After1m	8.13±0.11a	3.95±0.08a	4.19±0.05a	0.94±0.02a
	After2m	8.36±0.11a	3.99±0.09a	4.38±0.10a	0.92±0.03a
	After 3m	8.40±0.08a	4.09±0.05a	4.33±0.06c	0.94±0.18a
	After 4m	8.16±0.22a	3.97±0.16a	4.19±0.09a	0.95±0.06a
	Average	8.21	3.97	4.25	0.93

a,b and c : means within the same row with different superscript differ (P<0.05).
T20 = Diet supplemented with 20 mg thiamin daily, T40 = Diet supplemented with 40 mg thiamin daily.

Table (3): Effect of thiamin treatments of ewes blood serum parameters (glucose, cholesterol and triglycerides) before and after lambing

Treatments	Time (Month)	Glucose	Cholesterol	Triglyceride
Control	Before	63.95±2.21b	187.58±8.80a	152.21±2.52a
	After1m	68.76±3.23a	194.59±4.13b	151.58±2.56a
	After2m	71.89±1.53a	199.91±5.19a	152.77±2.05a
	After 3m	70.73±1.38a	193.06±4.34a	154.54±5.83a
	After 4m	72.43±1.45a	196.89±3.60a	162.51±3.88a
	average	69.55	194.40	154.722
T20	Before	65.52±2.21ab	189.27±8.80a	150.98±2.52a
	After1m	75.38±3.23a	211.09±4.13a	152.18±2.56a
	After2m	78.59±1.53a	198.14±5.19a	154.44±2.05a
	After 3m	76.19±1.38a	199.73±4.34a	160.40±5.83a
	After 4m	75.27±1.45a	195.12±3.60a	159.70±3.88a
	average	74.19	198.67	155.54
T40	Before	64.49±2.21a	204.88±8.80a	152.03±2.52a
	After1m	80.83±3.23a	203.81±4.13ab	157.91±2.56a
	After2m	79.21±1.53a	207.54±5.19a	163.62±2.05a
	After 3m	75.87±1.38a	208.62±4.34a	160.81±5.83a
	After 4m	76.45±1.45a	207.09±3.60a	161.95±3.88a
	average	75.50	203.388	159.26

[a, b] and [c:] :Means within the same row with different superscripts differ (P< 0.05)
T20 = Diet supplemented with 20 mg thiamin daily, T40 = Diet supplemented with 40 mg thiamin daily.

Activities of GOT and GPT

The presented results in Table (4) indicate that the activities of GOT and GPT in the different treatments (control, T20 and T40) are not significantly differences (P>0.05). The highest values were determined in T40 followed by T20 and then control. Thiamin supplementation increased insignificantly (P>0.05) blood serum GOT and GPT in T40 and T20 rations compared with that fed control. The improvement of blood GOT and GPT in T40 and T20 may be due to a positive effect of thiamin in body metabolism. These data are in agreement of Majee *et al.* (2003) and Farahat *et al.* (2007).

Table (4): Effect of thiamine treatments of ewes blood serum parameters (GOT and GPT) before and after lambing.

Treatments	Time (Month)	GOT (UI)	GPT(UI)
Control	Before	32.00±4.30a	21.20±4.09a
	After1m	20.00±8.83a	17.20±7.08a
	After2m	42.00±6.20a	18.20±3.55a
	After 3m	33.80±7.23a	14.00±2.18a
	After 4m	29.40±12.68a	21.00±5.91a
	average	31.44	18.32
T20	Before	25.00±4.30a	17.60±4.09a
	After1m	43.00±8.83a	33.20±7.08a
	After2m	34.00±6.20a	15.80±3.55a
	After 3m	44.80±7.23a	19.00±2.18a
	After 4m	37.00±12.68a	16.00±5.91a
	average	36.76	20.32
T40	Before	46.20±4.30a	29.60±4.08a
	After1m	31.40±8.83a	30.40±7.08a
	After2m	30.00±6.20a	19.60±3.55a
	After 3m	49.00±7.23a	17.20±2.18a
	After 4m	37.20±12.68a	28.40±5.91a
	average	38.76	25.04

[a,] and [c] :Means within the same row with different superscripts differ (P< 0.05)
T20 = Diet supplemented with 20 mg thiamin daily, T40 = Diet supplemented with 40 mg thiamin daily.

Activities of thyroxin (T3 and T4 hormones)

The presented results in Table (5) indicate that the activities of T3 and T4 hormones in the different treatments (control, T20 and T40) are not significantly differences (P>0.05). The highest values were determined in T40 followed by T20 and then control. Thiamin supplementation increased insignificantly (P>0.05) blood T3 and T4 in T40 and T20 rations compared with that fed control. The improvement of blood T3 and T4 in T40 and T20 may be due to a positive effect of thiamin in body metabolism.

Table (5): Effect of thiamin treatments of ewes blood hormones(T3 and T4) (n g/dl) before and after lambing

Treatments	Time (Month)	T3	T4
Control	Before	3.10±0.48a	82.47±42.37a
after	After1m	3.33±0.74a	91.01±14.98a
	After2m	3.05±0.30a	76.32±14.90a
	After 3m	3.74±0.41a	119.87±12.40a
	After 4m	3.62±0.44a	91.33±44.13a
	average	3.36	92.2
T20	Before	3.19±0.48a	75.60±42.37a
after	After1m	4.05±0.74a	79.69±14.98a
	After2m	3.94±0.30a	88.07±14.91a
	After 3m	3.21±0.41a	119.30±12.40a
	After 4m	3.90±0.44a	112.09±44.13a
	average	3.65	95.55
T40	Before	3.25±0.48a	76.25±42.37a
after	After1m	3.94±0.74a	86.90±14.98a
	After2m	3.98±0.30a	88.05±14.91a
	After 3m	3.97±0.41a	119.65±12.40a
	After 4m	3.71±0.44a	113.87±44.13a
	average	3.77	96.94

[a,] and [c] :Means within the same row with different superscripts differ (P< 0.05)
T20 = Diet supplemented with 20 mg thiamin daily, T40 = Diet supplemented with 40 mg thiamin daily.

Effect of thiamin treatments on milk yield

The data in table (6) indicate that there was a significant increase in milk yield observed for T40 than other treatments in the 1st month. Data in the same table showed high significant differences among all treatments in the 2nd and 3rd month and

consequently total milk yield (TMY) and daily milk yield (DMY). In the 1st month, the difference between control and T40 was 31.3% and the different between T20 and T40 was 23%. The difference between control and T20 was 6.75%. In the 2nd month, the difference between control and T40 was 43.81% and the difference between T20 and T40 was 20.73%. The difference between control and T20 was 19,13%. In the 3rd moth, the difference between control and T40 was 78% and the difference between T20 and T40 was 42.3%, the difference between control and T20 was 25.1%. Concerning TMY, the difference between control and T40 was 45.36% and the difference between T20 and T40 was 26.63%, while the difference between control and T20 was 14.78%. These data are in agreement of Farahat *et al.* (2007), Kholif, *et al.* (2009), El-Shanti et al. (2012) and Solouma *et al.* (2013). Shaver and Bal, (2000) stated that dietary thiamin supplementation in dairy cattle tended to increase milk and component production when dietary concentration of NDF (neutral detergent fiber) and ADF (acid detergent fiber) were lower and water soluble carbohydrate was higher than recommended.

Table (6): Least square means (LSM±SE) of average milk yield at different lactation months, total milk yield and daily milk yield in Sohagi ewes.

Item	LSM±SE			Sig.
	Control	T20	T40	
M1(kg)	21.47±0.90b	22.92±0.85b	28.19±0.88a	**
M2(kg)	16.25±0.68c	19.36±0.67b	23.37±0.70a	**
M3(kg)	10.00±0.79c	12.51±0.78b	17.80±0.82a	**
TMY(kg)	47.72±1.98c	54.78±1.96b	69.37±2.05a	**
DMY(g)	0.568±0.02c	0.652±0.02b	0.826±0.02a	**

M1= Milk yield at the first month, M2= Milk yield at the second month, M3= Milk yield at the third month, TMY= Total milk yield, DMY= Daily milk yield

a, b and c: :Means within the same row with different superscripts differ ($P< 0.05$)

T20 = Diet supplemented with 20 mg thiamin daily, T40 = Diet supplemented with 40 mg thiamin daily.

Relationships between blood parameters and each others

Data in Table (7) represents correlation coefficients between blood parameters and each others in lactating Sohagi ewes. The data clearly indicate that serum total protein was positively correlated with Alb., Glo., A/G ratio and DMY ($P<0.01$), but negatively correlated with T4 ($P<0.05$). The same trend was noticed with Alb. At the same time, Glo. was positively correlated with cholesterol ($P<0.05$) and DMY ($P<0.01$), but negatively correlated with T4 hormone ($P<0.05$). Cholesterol was negatively correlated with A/G ratio and T3 hormone($P<0.05$). Triglycerides were positively correlated withT4 hormone($P<0.05$). These findings were agreed with those reported by Kholif (1999a) except correlation between blood serum glucose and DMY, which showed an opposite trend.

Table (7): Pearson correlation coefficients between different some blood parameters and DMY.

Item	TP	Albumen	Globulin	A/G Ratio	Glucose	GOT	GPT	Chol.	Trig.	T3	T4	DMY
TP	1.00	0.95**	0.94**	0.37**	0.06	-0.01	0.01	0.13	-0.05	-0.17	-0.27*	0.41**
Albumen		1.00	0.79**	0.63**	0.07	-0.07	-0.01	-0.02	-0.11	-0.18	-0.26*	0.40**
Globulin			1.00	0.02	0.06	0.06	0.02	0.31*	-0.03	-0.15	-0.25*	0.39**
A/G Ratio				1.00	0.03	-0.20	-0.03	-0.40*	-0.13	-0.10	-0.10	0.16
Glucose					1.00	-0.08	-0.19	-0.11	-0.07	-0.18	-0.08	-0.31*
GOT						1.00	0.18	0.19	0.22	-0.01	-0.16	-0.14
GPT							1.00	0.18	0.06	0.44**	-0.31	0.23
Cholesterol								1.00	-0.00	0.33*	0.14	0.06
Triglycerides									1.00	0.13	0.13	-0.15
T3										1.00	0.27*	-0.03
T4											1.00	-0.03
Daily milk yield												1.00

*Significant ($P<0.05$) - **Significant ($P<0.01$) N= 120 samples each value, DMY = Daily milk yield

Correlation coefficients among blood parameters and milk composition of Sohagi ewes

Data in Table (8) showed that total protein, Alb. and Glo. were negatively correlated with SCC, but positively correlated with DMY. Blood serum glucose was negatively correlated with milk lactose ($P<0.01$), while it positively correlated with milk fat percent and CV in milk ($P<0.01$). These finding are in agreement with those noted by Kholif (1999a) on lactating buffaloes except milk lactose.

Table (8): Pearson correlation coefficients (r) among blood parameters and milk composition of Sohagi ewes.

Items	Fat%	Protein	Lactose	Total Solid	SNF	CV	SCC	DMY
TP	-0.04	-0.21	0.17	-0.07	-0.08	-0.03	-0.36**	0.40**
Albumen	-0.03	-0.14	0.16	-0.03	-0.00	-0.03	-0.29*	0.39**
Globulin	-0.04	-0.30*	0.14	-0.08	-0.17	-0.04	-0.38**	0.39**
A/G Ratio	-0.00	0.12	0.10	0.07	0.21	0.00	0.02	0.16
Glucose	0.40**	0.19	-0.36**	0.09	-0.08	0.40**	0.05	-0.31*
GOT	0.11	0.10	-0.03	0.24	-0.14	0.10	-0.11	-0.14
GPT	-0.37**	-0.17	0.24	-0.00	0.02	-0.37**	-0.18	0.23
Cholesterol	-1.08	-0.14	-0.01	0.02	-0.17	-0.08	-0.19	0.06
Triglycerides	0.13	-0.03	0.12	-0.05	0.06	0.14	-0.23	-0.15
T3	-0.17	-0.11	0.15	0.01	0.01	-0.17	-0.07	-0.03
T4	0.12	0.08	-0.08	0.16	0.02	0.13	-0.32	0.03

*Significant (P<0.05) - **Significant (P<0.01)
N= 120 samples each value, DMY = Daily milk yield, SCC = Somatic cell count

From this study it can be concluded that thiamin especially at 40 mg / head/ day improved blood metabolites and significantly increased milk yield.

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