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EFFECT OF GROWTH PROMOTERS AND HIGH LEVEL OF FEEDING ON SOME BLOOD CONSTITUENTS OF GROWING BARKI EWE LAMBS

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ABSTRACT

This study aimed at investigating the effects of flavomycin (F) at 40 and 20 mg/h/d and monensin (M) at 20 and 10 mg/h/d on growing Barki ewe lambs. These additives were added to a nutritional level for 100 g daily gain. Other treatment was included which was a high level feeding (HL) covering the requirements of growth rate of 150 g/d. The hematological status and liver function were studied. Sixty Barki ewe lambs, averaged 140.3 $\pm$ 1.12 days old and 20.6 $\pm$ 0.37 kg live body weight, were randomly allotted on six groups including the control (C). According to the treatments, these groups were symbolized as C, F40, F20, M10, M20 and HL groups. The treatments lasted 7 months. At the end of the experimental period, the two flavomycin treatments resulted in the lowest ($p<0.01$) values of RBCs (8.6 and 7.4 x $10^6/mm^3$), while the control and HL groups showed higher values in the range from 10.3 to 14.1 x $10^6/mm^3$. Overall means of WBCs for all groups throughout the whole period were confined in a narrow range from 10.23 to 12.00 x $10^3/mm^3$, indicating that treatments did not cause any inflammations. The F20 and F40 groups had the lowest ($p<0.05$) mean hemoglobin (11.4 g/dl) while the other groups had values lied between 12.1 and 12.8 g/dl. The lowest overall mean of packed cell volumes were those of F20 and F40 groups (29.4 and 30.6%, respectively). High level feeding and monensin treatments kept this parameter (31.3% to 32.9%) near its level in the control group (32.4%). All treatments resulted in increasing the overall means of the corpuscles' volume (31.3 to 32.6 fl) as compared with that of the control group (28.7 fl). Flavomycin treatment led to increase the concentration percentage of hemoglobin within the red corpuscles. There were no differences in plasma total protein between treated and control groups. The overall mean along the experimental period was 6.2 g/dl. The values of albumin (A) and globulin (G) in the experimental ewe lambs indicated that the changes in plasma protein during growth stage were mainly due to alteration in plasma albumin. The experimental groups had no significant ($p<0.05$) differences in A/G ratio. The values of aspartate amino transferase (AST) enzyme were in the normal range of growing animals, either at the end (25.4 – 40.3 IU) or throughout the entire experimental period (29.1 to 34.4 IU). The values of alanin amino transferase (ALT) enzyme increased at the end of the experimental period (21.2 to 28.4 IU) indicating liver hyper function due to higher metabolic rate as the ewes began to get pregnant. The results indicate that flavomycin and monensin can be used safety in growing ewe lambs in order to enhance their growth rate.

Keywords: Barki ewe lambs, growth promoters, hematology, liver function

INTRODUCTION

The imperative need for animal protein in our developing country has created the interest towards increasing the productive efficiency by different methods in animal industry, including utilizing the growth promoters. Under harsh desert conditions, sheep suffer from different constraints. Such conditions result in decreasing the growth rate of the growing lambs, delaying age at puberty and sexual maturity, which lead to decrease the lambs' crop (Aboul-Naga and Aboul-Ela, 1986). Monensin and flavomycin were reported to increase daily gain in sheep (Aitchison *et al*., 1989; Murray *et al*., 1992; Paited *et al*., 1996 and Martini *et al*., 1996). These two antibiotic promoters were found to increase ruminal propionate concentration, in addition to decrease butyrate level (Lee *et al*., 1990; Flachowsky and Richter, 1991; Sun *et al*., 1991 and Haimoud *et al*., 1996). Monensin did not affect hemoglobin concentration, plasma total protein, globulin, albumin, serum alanin amino transferase and aspartate amino transferase in pregnant ewes, beef cattle and buffalo-heifers (Austin and Wilde, 1985; Duff *et al*., 1994 and Abdel-Rahman, 1998). However, monensin was found to increase significantly red blood cells count from 3.6 to 4.0 x 10^6/mm^3 and packed cell volume from 40.3 to 44.7% in pregnant Barki ewes (Abdel-Rahman, 1998). Flavomycin was found to increase red blood cells, hemoglobin concentration, packed cell volume, serum total protein and globulin in sheep and buffaloes (Said, 1987 and Saleh, 1988). In both species, albumin did not change or even decrease.

A trial was carried out using high level of nutrition as a kind of flushing and growth promoters in different levels to increase growth rate and feed efficiency of growing Barki ewe lambs to attain puberty at an earlier age with high body conditions in order to achieve early breeding, so as to increase lambs crop. The aim of this study was to investigate the effect of administrating growth promoters on the hematological status and liver function of Barki ewe lambs.

MATERIALS AND METHODS

This study was carried out at Maryout Research Station of the Desert Research Center, which locates 35 km southwest of Alexandria (Latitude 31.02°N, longitude 29.80°C).

1. Animals and management:

Sixty ewe lambs of 140.3 $\pm$ 1.12 days old with an average live body weight of 20.6 $\pm$ 0.37 kg, were divided randomly to six groups, 10 ewe lambs each. Five groups (from the 1^{st} to the 5^{th}) were fed on basic level covering the requirements of 100 g daily gain according to Kearl (1982), while the 6^{th} one was offered a high feeding level for the requirements of 150 g daily gain. Animals in the first (Control) and the 6^{th} groups were not given any additives. Animals in the 2^{nd} and 3^{rd} groups were given 20 and 40 mg flavomycin/h/d, respectively, while the animals in the 4^{th} and 5^{th} groups were given 10 and 20 mg monensin/h/d, respectively. Hence, the experimental groups were nominated as C, F20, F40, M10, M20 and HL, respectively. Flavomycin was provided by Hoechst, Germany, while Ilanco Company, Egypt, provided monensin. These treatments lasted for 7 months from July 1998 to February 1999. The levels of ration were given at 50% concentrate mixture and 50% Berseem (*Trifolium alexandrinum*) hay. The concentrate mixture was consisted of cotton seed cake 50%, wheat bran 18%, yellow maize 15%, rice polish 11%, molasses 3%, limestone 2% and common salt 1%. Fresh water was available twice daily in winter and 3 times daily in summer season for all experimental groups. During the experimental period, the animals were housed in shaded pens (4.5 x 5.5 meters) roofed with asbestos sheets at the height of 3.5 meters.

2. Measurements:

From all the experimental Barki ewe lambs, blood samples were obtained monthly throughout the experimental period. The whole blood was used for determining hematological parameters, while plasma was harvested and kept at -20°C for the chemical analysis.

2.1. Hematological Parameters:

Red blood cells count (RBCs) x 10^6, white blood cells count (WBCs) x 10^3, packed cell volume % (PCV%), and blood hemoglobin (Hb, g/dl) were measured using blood cell counter apparatus (Coulter Counter). Wintrobe indices were calculated according to Roth and Williams (1977) as follows:

$$\text{Mean corpuscular volume (MCV) FL} = \frac{\text{PCV\%}}{\text{RBCs X } 10^6} \text{ X } 10 \qquad \text{FL}=10^{-15}$$

$$\text{Mean corpuscular hemoglobin (MCH) Pg} = \frac{\text{Hb (g/dl)}}{\text{RBCs X } 10^6} \text{ X } 10 \qquad \text{Pg}=10^{-12}$$

$$\text{Mean corpuscular hemoglobin concentration (MCHC) \%} = \frac{\text{Hb (g/dl)}}{\text{PCV \%}} \text{ X } 100$$

2.2. Plasma constituents:

Specific kits for calorimetric assays provided by Sentinel CH. Co. Millano (Italy) were used to measure the plasma concentration of alanin amino transferase; ALT (GPT), aspartate amino transferase; AST (GOT) in IU/L (according to Reitman and Frankel, 1957), plasma total protein (g/dl) and plasma albumin (g/dl) (according to Henry *et al*., 1974). Globulin and albumin to globulin ratio (A/G) were calculated.

3. Statistical analysis:

Data were statistically analyzed to test the effect of treatments separately in each month using SAS software (SAS, 1998). The changes in the parameters under study with age advancing were illustrated by means of charts. Means at the start and at the end were tabulated for evaluating the magnitude of change throughout the experimental period. As well, the overall means of the entire experimental period (7 months) were given.

RESULTS

1. Hematological Parameters:

1.1. Red blood corpuscles (RBCs):

At start of the experiment, the overall mean of RBCs was 5.71 x $10^6/mm^3$ (Table 1). The highest value ($p<0.05$) was that of M20 group (6.8 x $10^6/mm^3$) and the lowest one was that of F20 group (4.8 x $10^6/mm^3$). The significant differences between groups were due to individual variation since the treatments were not applied yet. Values of RBCs increased with age to reach its plateau in all groups at the 7.5 months old (Fig. 1), then after showed slight slop to be in steady level until the age of 10.5 months. At the age of 11.5 months, the count of RBCs was in the range of 7.4 to 14.1 x $10^6/mm^3$ with overall mean of 10.78 x $10^6/mm^3$. Treatment differences were highly significant ($p<0.01$). The two flavomycin treatments resulted in the lowest ($p<0.01$) values of RBCs (8.6 and 7.4 x $10^6/mm^3$), while other groups including the control showed higher values in the range of 10.3 to 14.1 x 10^6 / mm^3. This range was near to the normal of sheep as demonstrated by Jain (1993) that is 9 to 15 x $10^6/mm^3$ with an average of 12.0 x $10^6/mm^3$. Overall means of the entire experimental period were varied in narrow range (9.98 to 11.45 x 10^6 / mm^3).

1.2. White blood corpuscles (WBCs):

The overall mean of all groups at the start of the experiment was 11.71 x $10^3/mm^3$ (Table 1). Figure (1) shows that WBCs decreased to the lowest level in all groups at the age of 8.5 months (November) then increased again to attain overall mean of 14.40 x $10^3/mm^3$ at the last month of the experiment (February). This increase could not be attributed to the effect of treatment since the control group showed the same trend, but might reflect an increase in the activity of bone marrow production of WBCs with advancing age. Moreover, the M10 group exhibited the lowest ($p<0.05$) value (10.4 x $10^3/mm^3$) during this month. Overall means of the different groups for the whole experimental period were confined in a narrow range from 10.23 to 12.00 x $10^3/mm^3$. This indicated that treatments did not cause any inflammations to stimulate the increase in WBC's count over the control group. Throughout the entire experimental period, the group had high feeding level (HL) showed the lowest overall mean of WBC's (10.23 x $10^3/mm^3$). This might indicate an improvement in animal's resistance to diseases by high feeding level. The normal range of WBCs in sheep was given by Jain (1993) to be 4.0 to 12.0 x $10^3/mm^3$ with an average of 8.0 x 10^3/ mm^3.

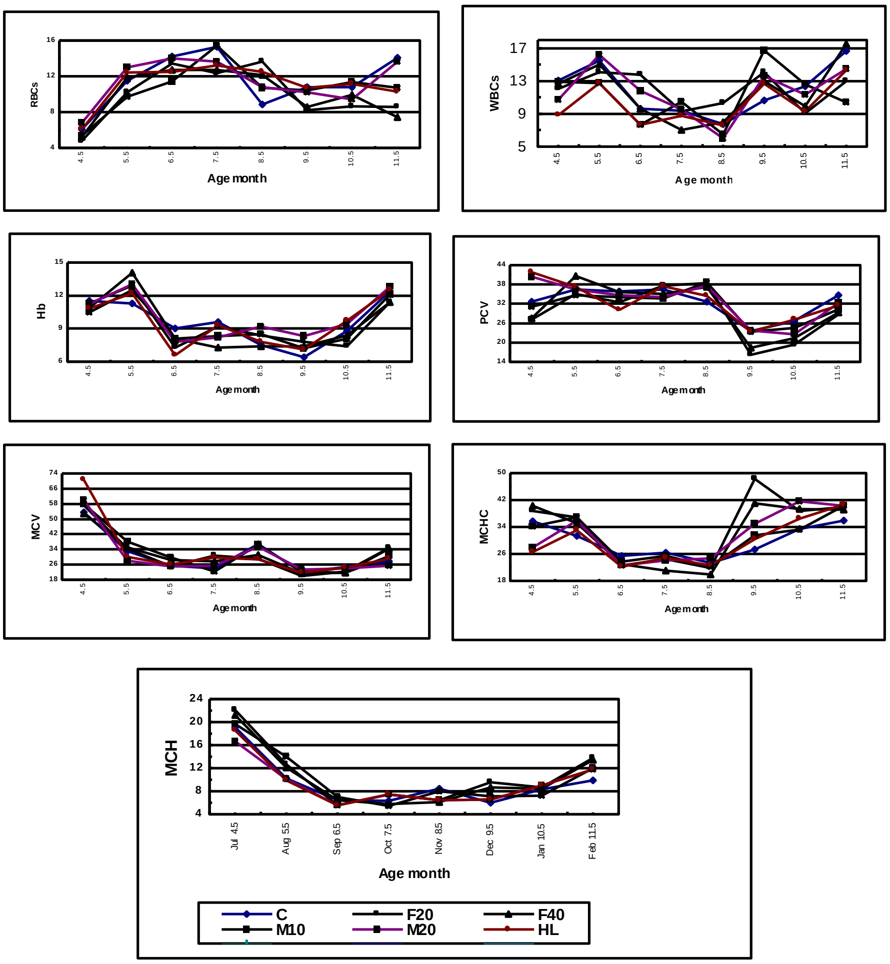
1.3. Hemoglobin concentration gm/dl (Hb):

Hemoglobin concentration varied insignificantly among groups at the start of the experiment (at 4.5 months of age). The overall mean in this age was 11.0 $\pm$ 0.15 gm/dl. The hemoglobin concentration increased in all groups to reach an overall mean of 12.1 gm/dl at the age of 11.5 months. This coincided with the increase in RBCs count in this month, but not to the same extent where RBCs increased nearly twofold (Table 1). However, treatment effect was significant ($p<0.05$). The F20 and F40 groups had the lowest value (11.4 gm/dl) as in RBCs. The other groups had values lied between 12.1 to 12.8 gm/dl. Overall means of the total experimental period demonstrated that treating growing ewe lambs with 20 mg monensin/h/d resulted in the highest Hb level (10.0 gm/dl). Contradictory, Abdel-Rahman (1998) found no effect due to monensin treatment on Hb of adult Barki ewes.

1.4. Packed cell volume (PCV) %:

As shown in Table (1), PCV% varied significantly ($p<0.01$) between groups at the start of the experiment (4.5 months of age). This was due to individual variation since the treatments were not applied yet. The same was observed in RBCs count. The overall mean at this age was 33.4%, the averages of all groups varied between 27.1% (F20) and 41.9% (HL). At the following month, the differences between the experimental groups were insignificant and the means of PCV lied in the range from 34.6% to 40.6%.

Figure 1: Changes of the hematological parameters with age



RBCs= red blood corpuscles X 10^6; WBCs=white blood cells X 10^3; Hb=hemoglobin concentration in g/dl; PCV= packed cell volume %; MCV= mean corpuscular volume in fl; MCHC= mean corpuscular hemoglobin concentration %; MCH= mean corpuscular hemoglobin in pg.

The PCV% decreased obviously in all groups at December (Fig. 1) to reach overall mean of 21.5, with the lowest ($p<0.01$) values were those of F20 (16.2%) and F40 (18.4) groups. Then after, all experimental groups showed increase in PCV with insignificant differences at the age of 11.5 months, when the averages varied from 28.7% to 34.7% with an overall mean of 31.1%. Overall means of the whole period revealed that the lowest values were those of F20 and F40 groups (29.4 and 30.6%, respectively). The same trend occurred with RBCs and Hb. The RBCs count is the main component affecting the value of PCV%. The highest values were those of HL group (32.9%), M20 group (32.7%) and the control (32.4%). Regarding the overall means, it seemed that both levels of flavomycin resulted in a decrease in RBCs count, PCV% and Hb concentration of growing ewe lambs. High feeding level and monensin treatments could keep these parameters near or slightly higher than its level in the control group. Monensin was found to have no effect on PCV and Hb (Fitzgerald and Mansfield, 1979 and Abdel-Rahman, 1998) but it had positive effect ($p<0.05$) on RBCs count (Abdel-Rahman, 1998).

2. Wintrobe indices:

2.1. Mean corpuscular volume fl (MCV):

The values of MCV varied ($p<0.05$) between groups at the start of the experiment. The overall mean in this age was 55.7 fl with a range from 53.6 fl (control) to 59.8 fl (M20), while the HL group showed extraordinary high value of 70.6 fl. Mean cell volume decreased in all groups with advancing age (Fog 1), reaching overall mean of 30.3 fl at the 11.5 month old (Table 1). The highest ($p<0.05$) averages at this month were those of F20 (34.7 fl) and F40 (34.4 fl) groups. The other groups had values between 27.8 and 30.4 fl (Table 1). El-Hassanein and El-Sherif (1996) reported higher values in growing Barki ram lambs at the same age (11 months old) being 50.25 fl. However, overall means of the whole experimental period showed that all treatments resulted in increasing the volume of the corpuscles (31.3 to 32.6 fl) as compared with that of the control group (28.7 fl).

2.2. Mean corpuscular hemoglobin concentration % (MCHC):

The values of MCHC varied significantly ($p<0.01$) among groups at the start of the experiment. Overall mean was 33.9 %. At this age the values ranged from 26.5% (HL) to 40.2% (F40). With advancing age, the values of MCHC decreased to reach the lowest levels at the age of 6.5 (September) being 23.2%. At December, the values of MCHC increased again (Fig. 1). At the end of the experiment (11.5 month of age), the difference between groups became insignificant with overall average of 39.4%. These values of MCHC were near to those reported in adult Barki ewes by El-Sherif and Assad (2001) being 29.64%, or growing Barki ram lambs by El-Hassanein and El-Sherif (1996) being 33.45%. In spite of insignificant differences, all treatments resulted in higher values (39.1 to 40.7%) than that of the control group (35.9%). The overall means of the whole period indicated that flavomycin treatment led to increase the concentration percentage of hemoglobin within the red corpuscles (hyperchromic erthrocytes). This trend was in contradiction to that of RBCs count and PCV%.

Table (1): Average values of hematological parameters of Barki ewe lambs as affected by treatment and age

Parameter	Age (month)	Treatment							±SE
		Control	F20	F40	M10	M20	HL	Overall means	
RBCs X 10 ^{6}	4.5 (July)	6.1 ab	4.8 b	5.2 b	5.4 b	6.8 a	6.1 ab	5.71	0.289*
	11.5 (Feb.)	14.1 a	8.6 c	7.4 c	10.7 bc	13.6 ab	10.3 c	10.78	0.483**
	Overall of the whole period	11.45	9.98	10.05	10.64	11.43	11.11	10.78	
WBCs X 10 ^{3}	4.5 (July)	13.06	12.08	12.65	12.88	10.73	8.84	11.71	0.996
	11.5 (Feb.)	16.7 a	13.0 ab	17.6 a	10.4 b	14.5 ab	14.3 ab	14.40	0.664*
	Overall of the whole period	12.0	12.0	11.60	11.26	11.72	10.23	11.47	
Hb g/dl	4.5 (July)	11.5	11.3	10.9	10.5	11.2	10.8	11.0	0.260
	11.5 (Feb.)	12.4 ab	11.4 b	11.4 b	12.1 ab	12.8 a	12.5 a	12.1	0.206*
	Overall of the whole period	9.6	9.5	9.4	9.4	10.0	9.5	9.6	
PCV %	4.5 (July)	32.6 b	27.1 b	27.5 b	31.0 b	40.4 a	41.9 a	33.4	1.585**
	11.5 (Feb.)	34.7	28.7	29.3	30.2	32.2	31.4	31.1	0.820
	Overall of the whole period	32.4	29.4	30.6	31.3	32.7	32.9	31.6	
MCV fl	4.5 (July)	53.6 b	57.2 b	53.0 b	57.9 b	59.8 b	70.6 a	55.7	2.480*
	11.5 (Feb.)	27.8 b	34.7 a	34.4 a	30.4 ab	25.5 b	29.2 ab	30.3	1.530*
	Overall of the whole period	28.7	31.7	31.6	32.4	32.1	32.6	31.3	
MCHC %	4.5 (July)	35.7 a	38.7 a	40.2 a	34.1 ab	27.9 bc	26.5 c	33.9	1.463**
	11.5 (Feb.)	35.9	39.9	39.1	40.3	40.3	40.7	39.4	1.175
	Overall of the whole period	29.9	33.9	32.3	30.9	31.5	29.6	31.4	
MCH pg	4.5 (July)	19.1	22.1	21.2	19.7	16.7	18.6	19.6	0.932
	11.5 (Feb.)	9.9 b	13.8 a	13.4 a	12.0 ab	11.8 ab	11.8 ab	11.9	0.148**
	Overall of the whole period	9.3	10.8	10.3	10.1	9.4	9.4	9.9	

F20 = Flavomycin 20 mg/h/d; F40 = Flavomycin 40 mg/h/d; M10 = Monensin 10 mg/h/d; M20 = Monensin 20 mg/h/d; HL = high level feeding, SE = standard error for treatment. Means in the same row with the same letter are not significantly different, * = P<0.05, ** = P<0.01.

2.3. Mean corpuscular hemoglobin pg (MCH):

The values of MCH varied but insignificantly among groups at the start of the experiment (4.5 months old). The overall mean at this age was 19.6 pg ranging from 16.7 pg (M20) to 22.1 pg (F20). The values of MCH decreased sharply with age (Fig. 1) to reach the lowest level at the age of 6.5 months (September) as in MCHC. Slight increase in MCH occurred at the 11.5 month of age with overall average of 11.9 pg. This value was lower than that reported by El-Hassanein and El-Sherif (1996) in growing Barki ram lambs, which was 16.97 pg. The trend of change in MCH was the same as that of MCV. The highest (p<0.01) values were those of F20 (13.8 pg) and F40 (13.4 pg). This confirmed the previous conclusion that flavomycin treatment resulted in hyperchromic erythrocytes as a compensation for decreasing RBCs count and PCV%. Overall means of the whole period showed that not only flavomycin but also monensin at the level of 10 mg/h/d resulted in increasing the concentration of hemoglobin in the red corpuscles as compared to that in the control group.

3. Plasma proteins:

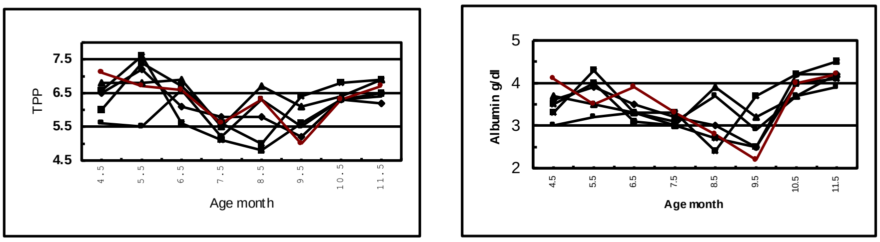
3.1. Plasma total proteins g/dl:

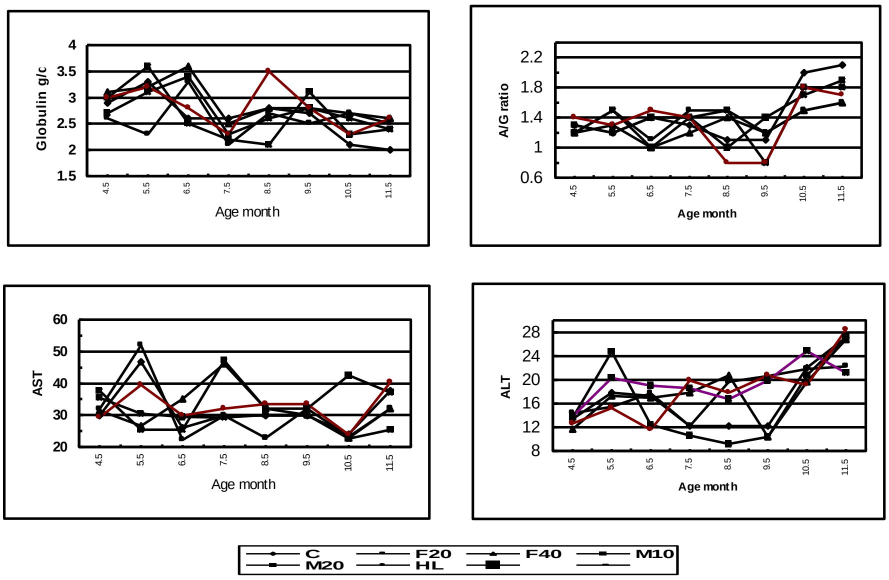
Results pertaining to plasma total proteins concentration in control and other treatment groups are presented in Table (2). Figure (2) demonstrates the change of these parameters with age advancing. There were insignificant differences in plasma total protein between treated and control groups either at the start, at the end or all over the experimental period. There was no sensible change with advancing age. The overall mean along the experimental period was 6.2 g/dl, with all overall averages in the range of 5.9 to 6.5 gm/dl. The F20 and M20 groups showed overall averages (5.9 and 6.0 g/dl) lower than those of the other treatments (6.3 to 6.5 g/dl), but comparable to that of the control group (6.1 g/dl).

3.2. Plasma albumin concentration g/dl:

Table (2) illustrates the effect of various treatments compared with control group on plasma albumin level in Barki ewe lambs. At the start there were significant differences ($p<0.01$) between treatments. The highest value was that of the HL group (4.1 g/dl) and the lowest one was that of the F20 group (3.0 g/dl). At the age of 8.5 months albumin concentration decreased in M10, M20 and HL groups (Fig. 2). At the 11.5 month of age, albumin concentration increased in all groups. The F20 group had the lowest ($p<0.05$) value (3.9 g/dl), Overall means of the whole period demonstrated that all groups had nearly the same level of plasma albumin as the range was between 3.4 and 3.6 g/dl. The overall means of the whole period were lower than in the 11.5 month of age and even lower than the values at the start (4.5 months of age) for almost all treatments. The same trend could be observed with total plasma protein. This was due to the occurrence of a decrease in albumin and hence total protein throughout the growth stage of the Barki ewe lambs, but it increased again at the end of the experiment. This trend was not observed in globulin indicating that the changes in plasma protein during growth stage were mainly due to alteration in plasma albumin. The increases in albumin from the start to the end were 0.6, 0.9, 0.5, 1.2, 0.6 and 0.1 gm/dl for the control, F20, F40, M10, M20 and HL groups, respectively. This might demonstrate that flavomycin and monensin at the level of 20 mg/h/d could help in building up plasma albumin.

Figure 2: Changes of blood plasma proteins and liver enzymes with age





TTP= total plasma proteins g/dl; A/G= albumin to globulin ratio; AST= aspartate amino transferase IU/L; ALT= alanin amino transferase IU/L

3.3. Plasma globulin concentration g/dl:

Neither growth promoters nor high level of feeding had a significant effect on plasma globulin level. At the start of the experiment, the overall mean value was 2.9 g/dl, and at the end it was 2.4 g/dl. The overall means along the experimental period were close to each other's and ranged between 2.6 to 2.9 g/dl. Figure (2) demonstrates that globulin level had little fluctuation in all groups along the experimental period.

3.4. Albumin/Globulin (A/G) ratio:

Table (2) shows that the various treatments had no differences when compared with the control group or with each other in A/G ratio, either at the start or at the end of the experimental period. However, the ratio increased obviously in all groups during the last two months of the experiment (Fig. 2). Referring to plasma proteins, monensin was found to have no obvious effects on serum total proteins, albumin and globulin concentration or A/G ratio (Shetaewi and Ross, 1990; Duff *et al*., 1994 and Abdel-Rahman, 1998).

Table (2): Average values of blood plasma components of Barki ewe lambs as affected by treatment and age

Parameter	Age (month)	Treatment							±SE
		Control	F20	F40	M10	M20	HL	Overall means	
Total plasma proteins (g/dl)	4.5 (July)	6.5	5.6	6.8	6.0	6.5	7.1	6.4	0.300
	11.5 (Feb.)	6.2	6.4	6.9	6.9	6.5	6.7	6.6	0.287
	Overall of the whole period	6.1	5.9	6.5	6.4	6.0	6.3	6.2	
Plasma albumin (g/dl)	4.5 (July)	3.6 ab	3.0 c	3.7 ab	3.3 bc	3.5 bc	4.1 a	3.5	0.105**
	11.5 (Feb.)	4.2 ab	3.9 b	4.2 ab	4.5 a	4.1 b	4.2ab	4.2	0.126*
	Overall of the whole period	3.5	3.4	3.6	3.6	3.4	3.5	3.5	
Plasma globulin (g/dl)	4.5 (July)	2.9	2.6	3.1	2.7	3.0	3.0	2.9	0.303
	11.5 (Feb.)	2.0	2.5	2.6	2.4	2.4	2.6	2.4	0.245
	Overall of the whole period	2.6	2.6	2.9	2.7	2.7	2.8	2.7	
A / G ratio	4.5 (July)	1.3	1.2	1.2	1.2	1.3	1.4	1.3	0.836
	11.5 (Feb.)	2.1	1.6	1.6	1.9	1.8	1.7	1.8	0.132
	Overall of the whole period	1.4	1.4	1.3	1.4	1.4	1.3	1.4	
AST (IU/L)	4.5 (July)	29.9	31.8	31.5	35.4	37.7	29.3	32.6	2.184
	11.5 (Feb.)	37.6 a	32.1 ab	32.0 ab	25.4 b	37.1 a	40.3 a	34.1	2.064*
	Overall of the whole period	31.8	30.8	37.0	29.1	33.7	34.4	32.8	
ALT (IU/L)	4.5 (July)	13.4	14.4	11.7	13.6	13.8	12.6	13.3	1.026
	11.5 (Feb.)	27.1	22.2	26.8	27.2	21.2	28.4	25.5	1.919
	Overall of the whole period	16.8	18.0	17.7	16.1	19.3	18.2	17.7	

F20 = Flavomycin 20 mg/h/d; F40 = Flavomycin 40 mg/h/d; M10 = Monensin 10 mg/h/d; M20 = Monensin 20 mg/h/d; HL = high level feeding, AST= aspartate amino transferase; ALT= alanin amino transferase; SE = standard error for treatment. Means in the same row with the same letter are not significantly different, * = P<0.05, ** = P<0.01.

4. Liver enzymes:

4.1. Plasma aspartate amino-transferase IU/L (AST/GOT):

Plasma AST concentration did not differ among groups at the start of the experiment (Table 2). The overall mean at this age was 32.6 ± 1.34 IU/L with values ranging from 29.3 (HL) to 37.7 (M20). Analysis of variance revealed highly significant (p<0.01) differences among groups at the 11.5 month of age. This significant difference was due to the higher values recorded by the control (37.6 IU), F40 (37.1 IU) and HL (40.3 IU) groups. However, these values were in the normal range of this enzyme (Reitman and Frankel, 1957) and lower than reported by El-Sherif and Assad (2001) in dry adult Barki ewes, indicating inexistence of stress on the animals' liver due to treatments.

4.2. Plasma alanin amino-transferase IU/L (ALT/GPT):

The level of ALT in plasma of Barki ewe lambs did not differ significantly between treatments and control group either at the start or at the end of the experiment. The overall mean at the start was 13.3 IU with a range from 11.7

IU (F40) to 14.4 IU (F20). Throughout the experimental period the level of ALT decreased in the control and M10 groups to lie between 9.2 and 12.2 IU/L (Fig. 2). Assad and El-Sherif (2002) found in Barki sheep a level of ALT ranged from 10.0 to 11.0 IU/L under normal condition, but under saline load the level increased up to 15.87 IU/L and increased more (18.67 IU/L) as the saline load was accompanied by feed shortage. At the age of 11.5 month, the level increased obviously in all groups including the control. The overall mean became 25.5 IU with a range of 21.2 (M20) to 28.4 (HL). All groups including control showed high values of ALT during the last two months (January and February). This enzyme might be affected by the increase in metabolic rate due to cold climatic weather during January and February. In addition, some animals in each group get pregnant during this period. Gluconeogenesis and pregnancy were stated to increase both AST and ALT (Bell *et al*., 1961; Allen and Harrison, 1979; and El-Sherif and Assad, 2001). The overall mean of the entire experimental period was 17.7 IU with a range of 16.1 to 19.3 IU. The highest values were recorded by F20 (18.0 IU), M20 (19.3 IU) and HL (18.2 IU) groups and might be due to their effect on metabolic rate, since these treatments were previously proved to achieve the highest growth rate in this study (El-Sherif *et al*., 2001).

DISCUSION AND CONCLUSION

The hematological characteristics of the experimental animals responded differently to the different treatments. While the animals of groups C, M10, M20 and HL increased RBCs count, the others (F20 and F40 groups) depended upon concentrating hemoglobin inside the cells. Finally, all groups attained similar level of blood hemoglobin concentration, which was 9.6 gm/dl as overall mean of the whole period. This level of Hb might be the one that was needed for optimum oxygen consumption by the experimental animals at this stage of growth. However, in this aspect M20 group showed the highest overall mean of Hb concentration for the whole period (10.0 gm/dl; Table 1). It seemed that monensin like high nutritional level helped the animals to increase the biosynthesis of the red corpuscles. Monensin was reported to increase significantly red blood cells count and packed cell volume in pregnant Barki ewes (Abdel-Rahman, 1998). In the present study, both type of growth promoters achieved improvement in MCV and MCHC over the control group. High level of nutrition increased MCV and the animals' immunity through increasing the production of WBCs over the control.

Previous works (Shetaewi and Ross, 1990; Duff *et al*., 1994 and Abdel-Rahman, 1998) reported that growth promoters did not affect plasma proteins. But here both flavomycin and monensin at the level of 20 mg/h/d resulted in increasing the level of albumin from start to the end of the experimental period by 0.9 and 1.2 g/dl, respectively, while the increase by the other treatments did not exceed 0.6 g/dl. Coinciding with the results of Austin and Wilde (1985) and Duff *et al*. (1994), the two types of growth promoters did not affect seriously liver function. Nevertheless, the level of 20 mg/h/d from both flavomycin and monensin in addition to the high level of feeding might increase the metabolic rate of the growing Barki ewe lambs, which reflected on increasing the concentration of ALT and AST, but to levels within the normal range that was suggested by Reitman and Frankel (1957). It follows that flavomycin and monensin can be used safely to enhance the growth of Barki ewe lambs.

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تأثير منشطات النمو ومستوى التغذية على بعض مكونات الدم فى حوليات البرقى النامية

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هدفت الدراسة استطلاع تأثير منشط النمو الفلافوميسين بمستويين ٢٠ و ٤٠ ملجم/الرأس/اليوم وكذا منشط المونسين بمستويين ١٠ و ٢٠ ملجم/الرأس/اليوم على صفات الدم ووظائف الكبد فى الحوليات البرقى النامية. أضيفت هذه المنشطات الى مستوى تغذية يغطى احتياجات نمو ١٠٠ جم/اليوم. شملت التجربة مجموعة أخرى غذيت على مستوى مرتفع يغطى احتياجات نمو يومى ١٥٠ جم بدون أى منشط. تضمنت التجربة ٦ مجموعات بما فيها مجموعة المقارنة (C) و بكل مجموعة ١٠ حيوانات متوسط أعمارها ١٤٠ ± ١,١٢ يوم و متوسط أوزانها ٢٠,٦ ± ٠,٣٧ كجم وطبقا للمعاملات أطلق على هذه المجموعات C, F20, F40, M10, M20, HL . أستمرت المعاملات لمدة ٧ أشهر وأظهرت النتائج ما يلى:

1- أنخفضت كرات الدم الحمراء معنويا على مستوى ١% فى المجموعات التى تناولت منشطات النمو (٧,٤ – ٦.٨ X ١٠ ٦) عن مجموعتى المقارنة والتغذية المرتفعة (١٠,٣ – ١٤,١ X ١٠ ٦).
2- لم تؤثر المعاملات على عدد كرات الدم البيضاء.
3- الحيوانات فى مجموعتى الفلافوميسين بمستوييه ٢٠ و ٤٠ ملجم/الرأس/اليوم انخفضت فيها قيم الهيموجلوبين (على مستوى ٥%) الى ١١,٤ جم/١٠٠ مللى عن بقية المجموعات التى أعطت تركيزات بين ١٢,١ و ١٢,٨ جم/١٠٠ مللى - كذلك أظهرت هاتين المجموعتين أقل متوسط عام لنسبة المكونات الخلوية فى الدم (٢٩,٣% و ٣٠,٦% على التوالى) بينما المعاملة بالتغذية المرتفعة و منشط المونسين حافظت على هذه النسبة (٣١,٣ – ٣٢,٩%) قريبة من مجموعة المقارنة (٣٢,٤%).
4- أدت جميع المعاملات الى زيادة حجم خلايا الدم لتكون فى المدى من ٣١,٣ الى ٣٢,٦ فيمتوليتر بالمقارنة بمتوسطها فى مجموعة المقارنة (٢٨,٧ فيمتوليتر) ، بينما أدت المعاملة بمنشط الفلافوميسين الى زيادة الهيموجلوبين داخل الخلايا.
5- لم تؤثر جميع المعاملات فى مستوى البروتين الكلى فى بلازما الدم ولكن كان التغير فى هذا المكون على مدار التجربة راجع أساسا للتغير فى مستوى الالبيومين دون الجلوبيولين.
6- كانت قيم انزيم الكبد أسبرتات أمينو ترانسفيراز تقع داخل المدى الطبيعى خلال التجربة بالكامل.

وقد اتضح من النتائج امكانية الاستخدام الآمن لكلا المنشطين فى تحفيز النمو فى حوليات البرقى.