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The Effect of Voluntary Feed Intake on Plasma Parameters of Different Live Weight Lambs

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Abstract: In this study, the changes in the plasma parameters of different live weight animals were investigated when diet is constituted by the free choice of animals instead of feeding a standard diet. In experiment 1, 6-7 months old Karayaka male lambs (7 light and 7 heavy) were used. Sugar beet pulp, perennial ryegrass and alfalfa straw were used to feed lambs in the research lasting for 28 days. In experiment 2, 7-8 months old Karayaka male lambs (7 light and 7 heavy) were used. The ground barley, wheat bran, expeller cottonseed meal and alfalfa straw were used to feed. The second experiment was continued for 42 days. In roughage selection, heavy lambs consumed more feed (54%) than light lambs in total consumption (experiment 1). Besides, the Sugar beet pulp and alfalfa straw consumption of heavy lambs were higher than that of light lambs 64 and 30%, respectively. In experiment 2, total feed consumption of heavy lambs was higher (39.8%) than that of light lambs. Besides the feed consumption of heavy lambs was higher 15.7, 59.8, 124 and 27.3 % for ground barley, wheat bran, expeller cottonseed meal and alfalfa straw, respectively. In both experiments, there were no significant ($p>0.05$) differences between plasma glucose, triglyceride, total protein, albumin, globulin, amylase, sodium and potassium of groups. But, the cholesterol values were found to be higher ($p<0.05$) in heavy lambs in experiment 1 and 2. In both experiments, high plasma cholesterol of heavy lambs may depend on the increases in energy and protein consumptions per kg metabolic weight and in hormonal activities.

Key words: Voluntary feed intake, lamb, live weight, plasma parameters

INTRODUCTION

Knowledge of serum chemistry in animals is of great importance in the management, nutrition health status of animals. Serum chemistry carries valuable information on how nutritional and management factors affect blood parameters and how those parameters are related to the health status of animals[1]. Blood Parameters are influenced by many factors, such as live weight, breed[2,3], age, sex and nutrition[2].

In previous studies the changes on blood parameters of sheep were often investigated by feeding the groups with standard diets. However use of a standard diet may cause intake fewer or higher nutrients than needs. This situation may lead to deviations from normal blood parameters for a certain live weight, breed and sex. It was reported that animals can select diets according to their needs[4-6]. In this study, the changes in the plasma parameters of different live weight animals were investigated when animals are subjected to the free choice instead of feeding a standard diet.

MATERIALS AND METHODS

In experiment 1, Karayaka male lambs (7 light and 7 heavy), chosen among 6-7 months old lambs in a raiser flock were used. Dry Matter (DM) and Crude Protein (CP) (Kjeldahl-Nx6.25) of feed sources were determined by AOAC[7] procedures. Metabolizable energy (ME, Mcal kg^{-1}) of feeds calculated from feed composition Tables[8]. Sugar Beet Pulp (SBP), Perennial Ryegrass (PR) and Alfalfa Straw (AS) were used in the study. Some nutrient contents of roughages are given in Table 1. The mangers were divided to three parts and each roughage was placed in one of the parts. The experiment was continued for 28 days.

In experiment 2, 7-8 months old Karayaka male lambs (7 light and 7 heavy) were used. The experiment 2 was commenced a week after completing experiment 1. The lambs were trained to concentrate diets one week between experiment 1 and 2. The ground Barley (B), Wheat Bran (WB), expeller Cotton Seed Meal (CSM) and Alfalfa Straw (AS) were used in the research. Nutrient contents of feed materials are given in Table 1. The mangers were divided to four parts and each feed material was placed on one of the parts. The experiment was continued for 42 days. Limestone, salt and vitamin mineral premix were supplemented to each feed, except alfalfa straw, 15, 10 and 3 g kg^{-1}, respectively,

The blood samples were collected from each animal by disposable syringe through vein and were placed in heparinized tube. Then the samples were centrifuged at

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Table 1: Nutrient contents of feeds

	Experiment 1			Experiment 2			
Component	SBP	PR	AS	B	WB	CSM	AS
DM*, (g kg^{-1})	156.5	907.2	894.8	891.1	892.3	922.3	894.8
CP*, DM	94.6	106.0	173.6	111.5	170.3	298.4	173.6
ME**, (g kg^{-1})							
M,DM (cal kg^{-1})	2.68	2.09	2.04	3.15	2.46	2.69	2.04

* analysed values, ** Fom feed composition tables[8]

Table 2: Live weights (kg) of lambs in both experiments (M±SE)

	Experiment 1		Experiment 2	
Groups	Initial weight (kg)	Final weight (kg)	Initial weight (kg)	Final weight (kg)
Light	34.26±0.56	35.10±0.68	37.04±0.46	49.28±0.88
Heavy	40.56±0.99**	42.40±1.26**	43.53±0.99**	57.40±1.20**
p-value	0.01	0.01	0.01	0.01

**Within a column means differ (p<0.01)

3500 rpm for 5 min. The plasma obtained in each tube was separated and immediately frozen to -40°C until it was analysed. The following techniques were used to determine the biochemical parameters: An enzymatic colorimetric test for total plasma cholesterol (mg dL^{-1}; Boehringer Mennheim CHOD-PAP method) and triglycerides (mg dL^{-1}; Boehringer Mennheim GPO-PAP method)[9]. The total plasma protein content of sample and standard solution were determined by the Lowry method[10]. Plasma albumin, globulin, glucose, amylase, sodium and potassium were measured with an autoanalyzer (Advia™ 1650, Japan).

The data were assessed by Analysis Of Variance (ANOVA) and were compared by Independent Samples t-test with the help of the SPSS[11].

RESULTS AND DISCUSSION

The differences in initial weights between groups in beginning of the both experiments were also seen in final weights at the end of the experiments (Table 2).

Ruminants adapted to poor-quality forage have highly developed forestomachs[12]. Amount of intake is consequence either of rapid outflow or of increased rumen volume, or both[13]. The consumed amount of roughages and daily nutrient consumption of lambs are given in Table 3. It was seen in roughage selection that heavy lambs consumed more feed 54 % than light lambs in total consumption. Besides, the roughage consumption of heavy lambs was higher than that of light lambs; for SBP 64% and AS 30%.

In kg DM, ME content of daily chosen roughage diet of heavy lambs was higher than light lambs' with 1.7%, whereas CP content of the diet of light lambs was greater than heavy lambs with 3%. Besides daily CP and ME intake of heavy lambs per kg MW were higher than daily intake of light lambs with 15.9 and 22.2%, respectively (Table 3).

In the same way feed and daily nutrient consumptions of lambs in feed selection are given in Table 4 (experiment 2). It was reported that there was relationship between voluntary feed intake and live weight[14]. The experiment showed that heavy lambs consumed 39.8% more total feed than light lambs. Besides the feed consumption of heavy lambs was higher 15.7, 59.8, 124 and 27.3 % for B, WB, CSM and AS, respectively.

Daily CP and ME intake of heavy lambs per kg MW were higher than light lambs with 40.1 and 21.7%, respectively. However, CP content of daily chosen diet in kg DM of heavy lambs was found greater than light lambs' with 12%. High protein intake of heavy lambs may be due to their continuous protein deposition[6,15], since daily gain of heavy lambs was observed 330.3±25.6 g in fattening period. Whereas, ME content of daily chosen diet in kg DM of light lambs was greater (1.7%) than heavy lambs.

The plasma parameters of groups at the end of the roughage selection and feed selection are given in Table 5. Plasma data in the present study were in agreement of those reported values for sheep[16]. There were no significant (p>0.05) differences between plasma parameter values except cholesterol of heavy and light lambs.

It was reported that high-energy intake increases plasma glucose level[17-19]. Plasma glucose level increases with the increases in live weight during the months from birth to maturity in lambs[20]. But in our study, the plasma glucose level of heavy lambs tended to be higher in face of light lambs in experiment 1 (p<0.068) and 2 (p<0.089).

Plasma triglyceride values were not differ (p>0.05) between heavy and light lambs in both experiments. Sanson *et al.*[21] and Shetaewi and Ross[19] claimed that the increase of energy intake raises triglyceride level in blood.

The plasma cholesterol value of heavy lambs (40.57±1.76) was higher (p<0.05) than light lambs (33.14±2.54) at the end of the roughage selection. In the same way, the cholesterol value of heavy lambs (69.86±3.06) was found to be greater (p<0.05) than light lambs (55.43±4.75) at the end of the feed selection. The plasma cholesterol level increases by increasing the live weight when the animal reaches the adult live weight[20,22]. Plasma cholesterol of heavy lambs could be increased since cholesterol is the main precursor of testosterone[23]. The physiological signal linking the puberty phenomena of males appears to be directly related to testosterone secretion[23] and body weight of animal[23,24]. The cholesterol values were found to be higher in heavy lambs (p<0.05) in both experiments.

In addition, Bilal *et al.*[25] reported that cholesterol value increased when the SBP was consumed at the

Table 3: Daily roughage and nutrient intake and contents of daily chosen diets (Exp. 1)

	Daily roughage intake (g lamb^{-1})				Daily nutrient intake (/per kg MW*)**		Contents of daily chosen diets (/kg DM/lamb)	
Groups	SBP	AS	PR	Total	CP (g)	ME (Mcal)	CP (g)	ME (Mcal)
Light	3069	521	191	3781	10.15	0.18	129.3	2.31
Heavy	5029	678	127	5834	11.76	0.22	127.2	2.38

*MW: metabolic weight (live weight$^{0.75}$), **[(daily intake)]/[(initial MW + final MW)/2]

Table 4: Daily feed and nutrient intake and contents of daily chosen diets (Exp. 2)

	Daily feed intake (g lamb^{-1})					Daily nutrient intake(/per kg MW*)**		Contents of daily chosen diets (/kg DM/lamb)	
Group	B	WB	CSM	AS	Total	CP (g)	ME (Mcal)	CP (g)	ME(Mcal)
Light	918	251	215	77	1461	11.90	0.23	152.9	2.91
Heavy	1062	401	482	98	2043	16.67	0.28	171.3	2.86

*MW: metabolic weight, **[(daily intake)] / [(initial MW + final MW)/2]

Table 5: Plasma components of lambs in experiment 1 and 2 (M±SE)

	Experiment 1			Experiment 2		
	Light	Heavy	P	Light	Heavy	P
Glucose, mg dL^{-1}	41.00±2.93	49.36±2.96	0.068	61.28±2.20	66.00±1.11	0.089
Triglyceride, mg dL^{-1}	15.20±1.28	18.21±1.65	0.177	21.57±1.78	24.57±2.14	0.304
Cholesterol, mg dL^{-1}	33.14±2.54	40.57±1.76*	0.036	55.43±4.75	69.86±3.06*	0.028
Total Protein., g dL^{-1}	7.40±0.27	7.70±0.23	0.414	8.06±0.38	8.11±0.38	0.917
Albumin,g dL^{-1}	3.41±0.23	3.64±0.23	0.493	3.58±0.11	3.82±0.12	0.177
Globulin,g/dL	3.98±0.29	4.02±0.26	0.903	4.47±0.31	4.37±0.27	0.813
Amylase, IU L^{-1}	23.60±2.97	26.78±2.75	0.447	19.28±1.72	16.14±1.26	0.170
Na, mmol L^{-1}	174.4±4.11	184.1±4.55	0.139	174.00±3.13	182.00±4.2	0.149
K, mmol L^{-1}	6.34±0.27	6.60±0.24	0.488	6.70±0.41	6.63±0.22	0.882

*Within a row means differ ($p<0.05$).

high amounts. Owing to the fact that heavy lambs consumed more SBP (64%) than light lambs, the plasma cholesterol value might have increased in experiment 1. Cholesterol value increases by high-energy consumption[26,27]. High-energy intake rate of 22% per kg MW in both experiments might have affected increasing plasma cholesterol levels of lambs as indicated in previous literature. Besides, Espinoza *et al.*[28], reported that when crude protein consumption increased from 14 to 16%, plasma cholesterol level of sheep was inclined to increase. Heavy lambs consumed higher crude protein (in experiment 1, 16% and in experiment 2, 40%) per kg MW than light lambs might have affected in increasing of the cholesterol levels.

Androgen stimulates protein anabolism during which it also causes increased nitrogen retention and this may account for the more rapid growth and greater adult weights of males[29]. But, in our study, plasma total protein values of lambs were not differ between groups in both experiments.

CONCLUSION

There were no differences in plasma components except cholesterol in groups in both experiments. Despite feed selection, it was thought that increases in cholesterol level depend on high energy and protein consumption per kg MW it may be due to increasing of hormonal activity of heavy lambs.

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