Effects of feeding by diets supplemented with grass meal and sugar beet pulp meal on growth, slaughter performance and some blood parameters in geese*

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SUMMARY

The study was conducted to investigate the effects of feeding by diets supplemented with grass meal and sugar beet pulp meal on growth performance, carcass traits, pH (glandular stomach, duodenum, jejunum, ileum, ceacum), lengths (small intestine, ceacum), weights (glandular stomach, gizzard, small intestine, ceacum) of gastrointestinal tract sections and some blood serum parameters (cholesterol, total lipid, total protein, albumin, glucose, AST, ALT) of geese. Two hundred and twenty-five day-old native Turkish goslings were divided at random into 3 feeding groups, each of which was 5 replicated, consisting of 15 chicks. A group was fed by a starter (0-6 weeks) and a grower diet (7-12 weeks) during the study (Group I), complete parts of these diets were replaced with grass meal (Group II) or dried sugar beet pulp meal (Group III) by 10 % at starter and 20 % at grower period. After the sixth and twelfth weeks, 6 randomly selected geese, from each subgroup were slaughtered. The feeding regimes did not affect live weight, live weight gain and feed consumption but, feed conversion was better in Group I than that of Group II and III. Considering only the general findings at the 0-10 weeks period, feed conversion was not differ. The breast, breast skin, back and heart percentages of Group I, and the leg skin percentage of Group III were higher than that of other groups at sixth weeks. The leg and leg skin percentages of Group II and III were higher than that of Group I, whereas the back percentage was opposite in twelfth weeks. Apart from the more acidic pH detected in the duodenum and ceacum in Group III in twelfth weeks, no differences was observed in all examined gastrointestinal tract sections of geese in sixth weeks. Length and weight of examined gastrointestinal tract sections were not affected by feeding regimes both weeks. Except for the total lipid, there were no differences measured blood serum parameters in sixth weeks, serum cholesterol, total lipid, total protein and albumin levels were lower, while AST and ALT levels were higher in the Group II and III than that of Group I in twelfth weeks. As a result, supplementation of grass and dried sugar beet pulp meal at above percentages in diet can be suggested for growing geese feeding.

Keywords : Grass - Sugar beet - Growth performance - Carcass composition - pH - Blood composition - Goose.

RÉSUMÉ

Effets de l'alimentation par des régimes complétés avec le repas d'herbe et le repas de pulpe de betterave sur la croissance, la conformation des carcasses et quelques paramètres sanguins chez les oies. Par C. ARSLAN.

Cette étude a été entreprise pour étudier les effets de la supplémentation de l'aliment par de l'herbe ou de la pulpe de betterave chez les oies. Pour cela, deux cents et vingt-cinq oisons d'un jour nés en Turquie ont été divisés au hasard en 3 groupes de 15 animaux recevant des régimes différents. L'expérimentation a été reproduite 5 fois en totalité. Un groupe a été alimenté par un aliment démarrage (de 0 à 6 semaines) et un aliment croissance (de 7 à 12 semaines) pendant l'étude (groupe I). Des parties de ce régime ont été remplacées par un repas d'herbe (le groupe II) ou un repas de pulpe de betterave (groupe III) à raison de 10 % de l'aliment démarrage et 20 % de l'aliment croissance. Après six et douze semaines, 6 oies choisies au hasard dans chaque sous-groupe ont été abattues. Plusieurs paramètres ont été analysés : la croissance, la conformation de la carcasse, le pH (estomac, duodénum, jéjunum, iléum, caecum glandulaire), la taille (petits intestin, caecum), les poids de sections d'appareil gastro-intestinal (estomac glandulaire, gésier, intestin grêle, caecum) et quelques paramètres sanguins (cholestérol, lipides totaux, protéines totales, albumine, glucose, AST, ALT). Les régimes testés n'ont pas affecté le poids vif, le gain de poids et la prise alimentaire mais, la conversion alimentaire s'est révélée être meilleure dans le groupe I que dans les groupes II et III. Si toutefois on considère seulement les résultats obtenus pendant les 10 premières semaines de l'expérimentation, cette conversion alimentaire n'est pas significativement différente entre les animaux traités et les témoins. Parmi les éléments de conformation des carcasses étudiés, nous avons observé que les pourcentages de muscle pectoral, de peau pectorale, de dos et de coeur du groupe I, et le pourcentage de peau de cuisse du groupe III étaient plus importants que ceux des autres groupes après 6 semaines. A l'exception d'un pH duodénal et caecal plus acide chez les animaux du groupe III après douze semaines de traitement, aucunes différences n'a pu être observée sur l'appareil digestif. Les longueurs et les poids des sections examinées de l'appareil gastro-intestinal n'ont pas été affectés par les régimes alimentaires testés. De même, à l'exception d'une modification de la concentration en lipides totaux, aucune différence significative n'a été observée dans les paramètres sanguins étudiés après 6 semaines. Par contre, après 12 semaines, le cholestérol, les lipides totaux, les protéines totales et l'albumine étaient plus bas dans les groupes II et III par rapport aux animaux témoins, alors que les niveaux d'AST et d'ALT étaient plus élevés. Par conséquent, cette étude montre qu'il est possible de supplémenter l'alimentation d'oie en croissance par d'herbe et/ou de la pulpe de betterave sans altérer de façon importante les performances zootechniques des animaux.

Mots-clés : Herbe - pulpe de betterave - croissance - conformation des carcasses - pH - biochimie sanguine - oie.

Introduction

Geese are herbivore poultry and they can derive a considerable amount of their nutrients from bulky feeds (i.e. grass, alfalfa, clover). Because feed is the major cost encountered intensive management programs, utilising from the bulky feeds could be more efficient and economical for the producer. Several researcher obtained positive influence on growth performance feeding by bulky feeds in geese [5, 16, 24].

TIMMLER and JEROCH compared the results obtained with a commercial starter diet and this diet replaced by 5, 10 and 15 % grass meal during the starter period and 10, 20, 30 % grass meal during the grower period in German geese. They found that diet replacement with grass meal did not alter growth and slaughter performance. They also observed an important reduction in the abdominal fat of geese fed 30 % grass meal compared to ones fed by concentrate only [22].

Carcasses of geese have high fat content, which might be modified by feeding regime. It has been showed that feeding by bulky feeds decreased subcutaneous and abdominal fat deposition in geese [9, 24]. It has also been reported that serum cholesterol, triglyceride and total protein levels were lowered by feeding with fibrous diets [5, 12].

Although there have been several research concerning the effect of feeding by grass meal on growth and carcass performance in geese, there is no reported data on dried sugar beet pulp meal usage in geese feeding and its effect on growth performance, carcass traits, pH of gastrointestinal tract section and blood parameters. Moreover the above mentioned parameters had not been compared between the starter and grower periods. The aim of this study was to investigate the effects of feeding diets supplemented with grass meal and dried sugar beet pulp meal on growth and slaughter performance, pH, length and weight of some part of the gastrointestinal tract and some blood serum parameters of native Turkish geese during both the starter and the grower periods.

Materials and methods

ANIMALS, DIETS AND TREATMENTS

Two hundred and twenty five day-old native Turkish goslings were used in this study. They were divided randomly into 3 feeding groups of 15 animal each and the complete experiment was repeated 5 times. The study was conducted over a period of 12 weeks ; with 6 weeks consisting in the starter and 6 weeks of a grower periods. One of the groups (Group I) was fed only concentrate diets (Table I) formulated to meet the dietary requirements of starter and grower geese [19]. Complete parts of these diets were replaced with a mixture of grass meal (Group II) or dried sugar beet pulp meal (Group III) at concentrations of 10 % during the starter period and 20 % during the grower period. Metabolisable energy content of grass meal and dried sugar beet pulp used were 3.9 and 7.0 MJ/kg, respectively (unpublished data). Goslings were placed in electrically heated battery brooders from 0-14 days under continuous incandescent light. At 15 days of age, they were transferred to a metallic feeding platform (1m x 2m x 85cm), which is 2 cm mesh wire floored, over a concrete floor. After the second week the study was conducted at room temperature (20°C). Feed and water were offered *ad libitum* during the experimental period. At the end of the sixth and twelfth weeks, 6 randomly selected geese, from each subgroup were slaughtered for determination of carcass traits, pH (glandular stomach, duodenum, jejunum, ileum, ceacum), lengths (small intestine, ceacum), weights (glandular stomach, gizzard, small intestine, ceacum) of gastrointestinal tract sections and some blood serum parameters (cholesterol, total lipid, total protein, albumin, glucose, AST, ALT). Therefore, all reported values are those obtained in 30 animals (experiment done 5 times)

DATA AND BLOOD SAMPLE COLLECTION, DETERMINATION OF pH, WEIGHTS AND LENGTHS OF SOME GASTROINTESTINAL TRACT SECTIONS AND CARCASS DISSECTION

Live weight and feed consumption of goslings were determined at fortnightly. Feed conversion was also calculated at the same interval. At the slaughtering, blood samples were taken and serums were separated, labelled and stored in a deep freezer (-20°C) until analysed. After the slaughtering, pH, empty weight and length of gastrointestinal sections were immediately determined. Carcass dissections were made according to the method of Jones [14].

ANALYSES OF DIETS AND BLOOD SERUM SAMPLES

Dry matter, crude protein, crude fibre, ether extract, and ash content of diets were determined according to AOAC procedures [2]. Serum cholesterol, total lipids, total proteins, albumin, glucose, AST and ALT levels were determined by autoanalyser (Abbot Alcyon 300i, Illionis, USA) as recommended by the manufacturer.

STATISTICS

Data analysis of groups were subjected to analysis of variance using " one-way ANOVA " procedures and significant differences among the treatments were determine by Duncan's multiple range test and data analysis of the same groups at 6 and 12 weeks was performed by " t test " with SPSS software (SPSS/ PC + V2.0). Differences were considered to be significant at the 5 % probability. Values were expressed as mean ± pooled standard errors of means (Mean ± SE).

Results

The applied feeding regimes did not affect live weight development of geese during the experimental period ($P>0.05$). Final live weights of geese were found to be 3918.6, 3737.3 and 3871.6 g in Group I, II and III respectively (Table II). Although the daily weight gain of goslings slightly differed among the groups after the fourth ($P<0.05$), eighth ($P<0.05$) and twelfth weeks ($P<0.001$), there was no statistical difference in overall the study. The daily feed consumption was higher in Group II and III, at six ($P<0.01$) and eigh ($P<0.001$) weeks. However, the average daily feed consumption, found to be 170.7, 201.9 and 194.9 g in Group I, II and III respectively, was not statistically different (Table II). Group II showed better feed conversion than other groups after four weeks. But it is worthy to note that feed conversion fluctuated among the groups after twelve weeks. Indeed, at this time, Group I showed better performance for feed conversion than Group II and III ($P<0.05$). Average

Ingredients	*Starter diet*			*Grower diet*		
Maize	59.55			64.80		
Soybean meal	30.00			16.40		
Fish meal	5.00			-		
Barley	2.95			10.40		
Wheat bran	-			6.00		
Limestone	1.25			1.20		
Dicalcium phosphate	0.65			0.60		
Salt	0.25			0.25		
Vit. Min. Prem.*	0.35			0.35		
Analysed nutrients	Group I	Group II	Group III	Group I	Group II	Group III
ME, MJ/kg**	12.1	11.3	11.6	12.1	10.5	11.1
Dry matter	92.95	93.47	93.67	93.08	94.08	94.76
	---------- % of dry matter ----------					
Crude protein	23.63	20.85	20.91	16.34	14.09	14.23
Ether extract	3.80	3.72	3.52	3.49	3.04	2.98
Crude fibre	3.71	6.39	6.43	4.42	9.60	9.74
Ash	7.70	7.75	8.21	6.10	6.43	6.72

* Each 2.5 kg of vitamin-mineral premix contained : 4505 mg Vit A ; 37.5 mg Vit D_3 ; 20000 mg Vit E ; 3000 mg Vit K_3 ; 3000 mg Vit B_1 ; 5000 mg Vit B_2 ; 3000 mg Vit B_6 ; 15 mg Vit B_{12} ; 25000 mg Nichotin amid ; 750 mg Folic acid ; 50 mg D-Biotin ; 10000 mg Cal-D-Pantothenat ; 60000 mg Fe ; 60000 mg Zn ; 5000 mg Cu ; 500 mg Co ; 2000 mg I ; 150 mg Se ; 80000 mg Mn.
** Metabolisable energy, provided by calculation.

TABLE I. — Composition of goslings starter and grower diets in %.

feed conversion was found to be 5.97, 14.57 and 12.44 kg/kg in Group I, II and III respectively, overall the study (P<0.01). In this regard, if only the 0 to 10 weeks period is considered, no statistical difference among the groups can be found.

The percentages of breast, breast skin, back and heart were lower in Group II and III than in Group I after six weeks (P<0.05). The leg and leg skin percentages of Group II and III were significantly higher than that of Group I (P<0.01), whereas it was the opposite for back percentage after twelve weeks (P<0.001). By contrast, no difference was found at both 6 and 12 weeks for carcass traits of the three groups (Table III).

The pH, weight and length of examined gastrointestinal tract sections were not affected by feeding regimes at week 6 (Table IV). With exception of the lower pH measured for duodenum and caecum in Group III (P<0.05) ; the pH, weight and length of examined gastrointestinal tract sections did not differ among the groups at week 12. There was also no statistical differences in length and weight of gastrointestinal tract sections in all groups whatever the time of examination.

With exception of a higher total lipids measured in geese fed with grass meal, the feeding by bulky feeds did not affect serum parameters measured at week 6. However, at week 12, the serum cholesterol, total lipids, total proteins and albumin levels were lower in Group II and III compared to control birds, whereas the AST and ALT levels were higher. No difference was found in glucose level measured in the three groups (Table V).

Discussion

Both grass and sugar beet pulp supplementation in diet did not affect live weights of geese after a 12 weeks experiment period. Although grass and sugar beet pulp supplementation decreased energy and nutrient content of diets, they did not adversely affect live weight development of geese. Therefore, it seems that grass and sugar beet pulp or other less costly bulky feed ingredients can be used at 10 and 20 % in starter and grower diets of geese. Because of the herbivore character of geese, bulky feeds are also suitable for feeding physiology. Results of this study are in agreement with those previously reported [9, 11, 16, 22]. Goslings showed very rapid live weight gain during the starter period, after that live weight gain was gradually reduced. Especially after ten weeks, poor feed conversion was observed in all groups due to the low weight gain compared to the high feed intake. The results indicated that slaughtering may be more appropriate at the end of the tenth week for native Turkish geese. Similarly, GRUNDER *et al.,* reported that geese have reached complete bone development after 8 weeks and that development of breast muscle lasts between 9 and 10 weeks [8]. Therefore, it confirms that the most proper age for slaughtering is at the end of the tenth weeks.

Supplementation of diet by grass and sugar beet pulp did not statistically affect feed consumption. However, one could note that geese fed with grass and sugar beet pulp meal showed a slightly increase feed consumption compared to control animals. This observation might be related to the decreased energy content of diets containing grass and sugar

Weeks	Group I	Group II	Group III	Importance
Live weight [g]				
Hatching	98.4 ± 2.9	99.2 ± 2.8	97.4 ± 2.9	NS
2	634.8 ± 186	665.1 ± 24	590.6 ± 193	NS
4	1736.2± 39	1639.2 ± 42	1680.6 ± 88	NS
6	2934.8 ± 63	2823.2 ± 78	2852.8 ± 73	NS
8	3347.7 ± 59	3490.0 ± 18	3521.0 ± 166	NS
10	3669.9 ± 88	3685.0 ± 26	3791.2 ± 213	NS
12	3918.6 ± 104	3737.3 ± 28	3871.6 ± 234	NS
Live weight gain [g/d]				
2	38.3 ± 1.3	40.3 ± 1.9	35.2 ± 1.5	NS
4	78.7 ± 2.9ab	69.6 ± 2.5b	81.7 ± 3.6a	*
6	85.6 ± 1.8	84.8 ± 4.8	83.7 ± 4.8	NS
8	29.5 ± 2.8b	49.1 ± 5.6a	47.7 ± 6.9a	*
10	22.6 ± 4.1	13.9 ± 2.7	19.3 ± 6.0	NS
12	18.2 ± 1.9a	3.7 ± 0.5b	5.7 ± 1.7b	***
0-12	45.5 ± 1.3	43.5 ± 0.4	45.6 ± 2.7	NS
Feed consumption, [g/d]				
2	46.3 ± 5.4	48.8 ± 9.6	28.9 ± 1.5	NS
4	150.2 ± 11.9	170.9 ± 8.4	165.4 ± 7.5	NS
6	207.8 ± 4.1b	256.3 ± 7.8a	251.1 ± 11.5a	**
8	178.5 ± 1.9b	281.0 ± 12.3a	300.7 ± 14.5a	***
10	222.4 ± 12.3	245.3 ± 8.8	248.3 ± 21.5	NS
12	219.1 ± 5.5	209.3 ± 18.9	174.7 ± 10.6	NS
0-12	170.7 ± 27.3	201.9 ± 34.4	194.9 ± 39.2	NS
Feed conversion [kg/kg]				
2	1.19 ± 0.2	1.18 ± 0.2	0.83 ± 0.0	NS
4	1.92 ± 0.1b	2.47 ± 0.1a	2.03 ± 0.1b	*
6	2.64 ± 0.0	3.05 ± 0.1	3.03 ± 0.2	NS
8	7.00 ± 0.2	6.06 ± 0.4	6.93 ± 0.3	NS
10	9.42 ± 0.3	22.91 ± 5.85	19.35 ± 6.27	NS
12	13.64 ± 0.5b	51.75 ± 7.7a	42.45 ± 1.1a	*
0-10	4.43 ± 1.6	7.13 ± 4.0	6.43 ± 3.4	NS
0-12	5.97 ± 0.2b	14.57 ± 1.4a	12.44 ± 2.6a	**

NS : Non significant.
a, b : Indicates statistical differences among the means within the same row (*: P<0.05, **: P<0.01, ****: P<0.001).

TABLE II. — The effects of feeding regimes on the live weight, live weight gain, feed consumption and feed conversion of geese (Mean ± SE, n= 30).

beet pulp supplementation, that led goslings to consume more feed to reach their energy requirement. The results of this study are in accordance with those of other researchers [11, 22, 24]. If concentrate feed consumption is considered to be 100 unit in Group I, the values calculated for groups II and III would be 99.30 and 95.68, respectively. These results reflected that sugar beet pulp meal supplementation was more economic than grass meal.

There was no differences on the carcass parameters whatever the time of observation (Table III). Carcass yield ranged between 66.4 and 71.0 % among the groups after 12 weeks. These findings are in agreement with reports by TILKI, [21] and ARSLAN and INAL, [3] on native Turkish geese. The significant increase in the leg percentage and decrease in the back percentage in Group II and III, at week 12 could be considered as positive effects. Geese are characterised by the genetically predisposition to the fatness [4]. Today, the consumers usually prefer low fat content foods. Abdominal fat weight may be used as a marker of total body fat in poultry [20]. Although the differences are not statistically relevant, the slight decrease in the abdominal and mesenteric fat percentages in bulky feed groups showed that, grass and sugar beet supplementation may induce a decrease trend in fat deposit compared to a concentrate diet. These results are also in agreement with those of other researchers [5, 9, 22]. The heart and liver percentages to carcasses weight was not affected by tested feeding regimes as reported by others [5, 15, 22].

In birds, the pH tends to increase from glandular stomach to ileum and slightly decreased in ceacum (Table IV). The increase in pH from glandular stomach to ileum is due to the secretion of HCl by glandular stomach and enzymatic secretion by small intestine and pancreatic enzymes. The decreases in pH in the ceacum is related to short chain fatty acid synthesis. The measured pH in whole groups were in normal range reported for geese [6, 10]. The lengths and weights of the intestines and individual segments were not affected by tested feeding regimes.

Parameters	Weeks	Group I	Group II	Group III	Importance[1]
Live weight [g]	6	2647 ± 95	2853 ± 104	2913 ± 92	NS
	12	3852 ± 118	3591 ± 98	3819 ± 239	NS
Carcass weight [g]	6	1548 ± 71	1653 ± 76	1690 ± 63	NS
	12	2648 ± 77	2568 ± 279	2529 ± 141	NS
Carcass ratio [%]	6	58.4 ± 1.3	57.8 ± 0.7	58.0 ± 1.2	NS
	12	68.8 ± 0.1	71.0 ± 5.7	66.4 ± 1.5	NS
Carcass parts [% of the carcass weight]					
Breast	6	21.83 ± 0.3a	20.73 ± 0.4b	19.87 ± 0.5b	*
	12	26.01 ± 0.5	26.12 ± 1.7	25.47 ± 0.9	NS
Breast skin	6	7.73 ± 0.2a	5.43 ± 0.3b	5.84 ± 0.2b	***
	12	7.01 ± 0.3	6.09 ± 0.6	6.33 ± 0.6	NS
Leg	6	31.67 ± 0.6	31.30 ± 0.6	33.01 ± 0.5	NS
	12	20.03 ± 0.6b	24.76 ± 1.6a	26.49 ± 0.7a	**
Leg skin	6	6.13 ± 0.2b	5.64 ± 0.4b	7.10 ± 0.4a	*
	12	3.83 ± 0.3b	5.54 ± 0.5a	6.33 ± 0.5a	**
Wing	6	15.62 ± 0.4	16.76 ± 0.6	16.99 ±0.5	NS
	12	15.13 ± 0.5	15.91 ± 1.1	17.56 ±0.7	NS
Neck	6	9.14 ± 0.4	9.55 ± 0.3	9.07 ± 0.3	NS
	12	8.70 ± 0.1	8.03 ± 0.7	9.63 ± 0.8	NS
Back	6	19.78 ± 0.3a	18.83 ± 0.3b	18.2 ± 0.4b	*
	12	25.66 ± 0.7a	18.24 ± 1.0b	18.21 ± 0.8b	***
Liver	6	5.90 ± 0.5	4.87 ± 0.2	5.54 ± 0.3	NS
	12	2.14 ± 0.1	2.70 ± 0.4	2.92 ± 0.3	NS
Heart	6	1.24 ± 0.0a	1.06 ± 0.0b	1.11 ± 0.0b	*
	12	1.02 ± 0.0	1.03 ± 0.1	1.03 ± 0.1	NS
Abdominal fat	6	2.47 ± 0.3	2.03 ± 0.3	1.95 ± 0.2	NS
	12	3.47 ± 0.2	2.42 ± 0.5	3.11 ± 0.3	NS
Mesenteric fat	6	2.63 ± 0.3b	1.83 ± 0.4	2.36 ± 0.3	NS
	12	3.13 ± 0.4	2.58 ± 0.7	2.56 ± 0.4	NS
Importance[2]		NS	NS	NS	

NS : Non significant
[1] (a, b) Indicates statistical differences among the means within the same row (*:P<0.05,**:P<0.01,***:P<0.001).
[2] Means for the same parameters in the same columns comparing with that of 6th and 12th weeks did not statistically differ.

TABLE III. — The effect of feeding regimes on carcass quality parameters of geese (Mean ± SE, n = 30).

Although feeding regimes did not affect serum cholesterol levels in six weeks, grass and sugar beet pulp supplementation in diet significantly decreased cholesterol level after 12 weeks (Table V). This decrease can be related to higher crude fibre intake of the geese fed with grass and sugar beet pulp meal. FISHER and GRIMINGER reported that, crude fibre in the diet decrease the absorption of fatty acids and, consequently, cholesterol in poultry [7]. However, the cholesterol levels observed in this study were in physiological range for all groups [13, 17, 23]. Supplementation of bulky feeds significantly decreased total lipid levels at week 12. The total lipid levels measured in this study were in agreement with VETESI *et al.,* [23]. The glucose levels did show non significant decrease in grass and sugar beet pulp groups when compared to control animals. Measured serum glucose levels in this study are in accordance with other results [18, 23]. The total protein and albumin levels were not found to be different among the tested groups after 6 weeks, whereas they were significantly lower in Group II and III after 12 weeks. These decreases might be attributed to lower crude protein intake of geese fed by grass and sugar beet pulp. These findings are similar to results of NIKODEMUZS *et al.,* [18] and JANAN *et al.,* [13]. Blood serum AST and ALT activity, indicates the physiological status of the liver, was normal in controls, but significantly higher in grass and sugar beet pulp groups at week 12. VETESI *et al.,* observed minor differences in AST activity in geese fed by *ad libitum* alfalfa and corn silage and concentrate [23]. AKIBA and MATSUMOTO observed a decrease in blood plasma AST activity in chickens fed diets supplemented with high fibre alfalfa meal, pure cellulose or rice husk [1]. Similar results were not observed in this study. The slight changes in serum parameters observed in our study could be related to the differences in energy, protein and cellulose intakes of geese.

In conclusion, diet supplementation by grass and sugar beet pulp at 10 % during the starter period and 20 % during the grower period did not affect live weight, live weight gain and feed consumption but, slightly decreased feed conversion of geese. Tested feeding regimes did not affect carcass weight and yield measured after 6 and 12 weeks of growth. Feeding by sugar beet pulp significantly decreased pH of the duodenum and ceacum at week 12. The length and weight of gastrointestinal tract sections were not affected by tested fee-

Sections	Weeks	Group I	Group II	Group III	Importance[1]
p H					
Glandular stomach	6	3.6 ± 0.1	3.5 ± 0.3	3.9 ± 0.5	NS
	12	4.4 ± 0.2	4.3 ± 0.2	4.1 ± 0.1	NS
Duodenum	6	5.7 ± 0.2^{B}	5.8 ± 0.2	5.4 ± 0.2	NS
	12	6.0 ± 0.1$^{A}{}_{a}$	6.0 ± 0.1$_{a}$	5.6 ± 0.1$_{b}$	*
Jejunum	6	6.3 ± 0.1	6.2 ± 0.1	5.9 ± 0.2	NS
	12	6.3 ± 0.1	6.3 ± 0.1	6.2 ± 0.2	NS
Ileum	6	6.6 ± 0.2	6.9 ± 0.1	6.9 ± 0.2	NS
	12	6.5 ± 0.1	6.8 ± 0.2	6.7 ± 0.1	NS
Ceacum	6	6.4 ± 0.3	6.1 ± 0.3	6.2 ± 0.1	NS
	12	6.5 ± 0.1a	6.5 ± 0.2a	6.0 ± 0.1b	*
Length, cm					
Small intestine	6	202.5 ± 8.1	209.2 ± 5.5	221.2 ± 3.3	NS
	12	223.8 ± 4.3	212.5 ± 2.4	223.8 ± 9.0	NS
Ceacum	6	22.7 ± 0.9	25.2 ± 0.8	26.8 ± 1.69	NS
	12	22.5 ± 1.0	26.6 ± 1.5	27.0 ± 1.9	NS
Weight, g					
Glandular stomach	6	9.7 ± 0.6	9.2 ± 0.9	10.2 ± 0.9	NS
	12	10.7 ± 0.6	9.7 ± 0.9	10.9 ± 0.9	NS
Gizzard	6	102.3 ± 8.5	122.7 ± 6.3	126.4 ± 6.5	NS
	12	135.6 ± 4.2	151.1 ± 8.4	148.2 ± 9.7	NS
Small intestine	6	83.3 ± 5.7	65.8 ± 3.6	73.7 ± 4.3	NS
	12	90.3 ± 1.7	73.2 ± 5.5	86.1 ± 1.9	NS
Ceacum	6	7.3 ± 0.3	8.5 ± 0.5	9.4 ± 1.0	NS
	12	9.2 ± 0.5	9.0 ± 0.6	10.2 ± 1.6	NS
Importance[2]		*	NS	NS	

NS: Non significant
[1] (a, b) : Indicates statistical differences among the means within the same row (*: P<0.05).
[2] (A, B) : Means for the same parameters in the same columns comparing with that of 6th and 12th weeks statistically differ (*:P<0.05).

TABLE IV. — The effects of feeding regimes on pH, weight and length of some gastrointestinal tract section of geese (Mean ± SE, n = 30).

ding regimes. Serum cholesterol, total lipids, total proteins and albumin levels were decreased whereas AST and ALT levels were increased, and glucose level was unchanged by a 12 week supplementation with grass and sugar beet.

Based on these results, we can suggest that supplementation of grass and dried sugar beet pulp meal at above percentages may be used for geese feeding.

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Parameters	Weeks	Group I	Group II	Group III	Importance[1]
Cholesterol, mg/dL	6	137.4 ± 4.1	150.5 ± 7.6	141.2 ± 2.7	NS
	12	188.5 ± 6.7a	151.6 ± 10.0b	159.2 ± 14.7b	**
Total lipid, g/dL	6	348.8 ± 5.5b	378.8 ± 6.3a	353.0 ± 7.0b	**
	12	628.0 ± 7.4a	387.3 ± 16.1b	345.6 ± 9.5c	***
Total protein, g/dL	6	3.44 ± 0.1	3.40 ± 0.1	3.62 ± 0.1	NS
	12	4.10 ± 0.11a	3.66 ± 0.12b	3.94 ± 0.1b	*
Albumin, g/dL	6	1.56 ± 0.0	1.43 ± 0.1	1.44 ± 0.0	NS
	12	1.60 ± 0.1a	1.42 ± 0.1b	1.54 ± 0.0b	*
Glucose, mg/dL	6	206.8 ± 16.0	242.7 ± 12.2	216.6 ± 22.3	NS
	12	185.5 ± 10.1	150.6 ± 6.5	174.8 ± 15.8	NS
AST, U/L	6	39.2 ± 8.4	34.3 ± 2.0	55.0 ± 11.6	NS
	12	25.5 ± 4.3b	71.8 ± 3.5a	58.8 ± 5.2a	***
ALT, U/L	6	47.4 ± 10.2	42.7 ± 5.2	66.0 ± 13.7	NS
	12	30.3 ± 5.5b	86.8 ± 4.4a	70.8 ± 5.9a	***
Importance[2]		NS	NS	NS	

NS: Non significant

[1] (a, b): Indicates statistical differences among the means within the same row (*: P<0.05,**: P<0.01,***: P<0.001).

[2] Means for the same parameters in the same columns comparing with that of 6th and 12th weeks did not statistically differ.

TABLE V. — The effects of feeding regimes on the blood serum parameters of geese (Mean ± SE, n = 30).

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