The effect of tomato pomace on carcass traits, blood metabolites and fleece characteristic of growing Markhoz goat

Farzad Abdullahzadeh

Islamic Azad University, Boukan Branch, Boukan, Iran
Farzad.abdolahzadeh@gmail.com

Abstract: Twenty four male Markhoz kid goats were used in completely randomized design to study the effect of dried tomato pomace (DTP) on the carcass traits, blood metabolites and fleece characteristic. Markhoz goats (BW = 18.6 ± 0.7 kg) were assigned randomly to 1 of 4 treatments and were fed with different levels of DTP (10, 20 and 30% DTP) for 94 days. The first group was fed a basal diet without DTP and considered as control, while the other three groups fed the basal diet after substituting part of the diet with DTP at 10, 20 and 30%, respectively. There was significant ($P<0.05$) difference between different experimental groups in carcass fat and carcass protein, while no significant differences for empty (digesta-free) BW, hot carcass, dressing percentage and carcass length among treatments were observed. There was no significant difference in the glucose, total protein, urea, and cholesterol and triglyceride concentrations of goat's blood metabolites. The inclusion of DTP in Markhoz goats' diet was associated with a higher ($P<0.05$) greasy fiber, fiber diameter and Barbe length than control diet. It could be concluded that DTP can be utilized efficiently and safely in the diets of Markhoz male kid goats up to level of 20% without any adverse effect on the carcass traits, blood metabolites and fleece characteristic.
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1. Introduction

Many reasons may account for the recent interest devoted to the use of agro-industrial food by-products by developed and developing countries in different domains (e.g. livestock feeding, environment protection, pharmaceutical industry, etc.). Ruminants because of their rumen physiological adaptation can utilize inexpensive agro-industrial food by-products to meet their feed requirements for maintenance, growth, reproduction and production. The tomato pomace is one of the main agro-industrial food by-products which it is well-known as a protein resource in ruminant's diet (Abdollahzadeh et al, 2010; Fondevila, 1994; Bordowski and Geisman (1980). Markhoz goat (Iranian Angora) is the only single coat goat producing shiny fine fibers in Iran (Bahmani et al., 2011). Mohair fiber which is taken from Markhoz goat is pure protein thus, Markhoz goat has a high protein requirement due to their rapid hair growth compared to other ruminant species. Using tomato pomace as a protein supplement to replace imported commercial protein resources (soybean meal, etc.) could provide extra income by save energy in transportation, and at the same time reduce the waste disposal problem. The purpose of the experiment described here was to investigate the effect of different dietary levels of dried tomato pomace (DTP) as a protein supplement on the carcass traits, blood metabolites and fleece characteristic of Markhoz kid goats.

2. Materials and Methods

The present study was designed to evaluate the effect of different levels of DTP (0, 10, 20, and 30%) of complete diets as a non-conventional ingredient on the carcass traits, blood metabolites and fleece characteristic of Markhoz male kid goats. The feeding trial was carried out for 14 weeks (adaptation: 14 d and experimental period: 80 d).

2.1.Tomato pomace preparation

Fresh experimental pomace was collected from main factories in Urmia, Iran. The tomato pomace consists mainly of skins, seeds and hard tissues of the whole tomatoes. The tomato pomace was subjected to the sun-drying until complete removal of moisture (less than10%) then samples were taken for proximate chemical analyses.

2.2.Experimental diets

The experimental diets were prepared by thoroughly mixed the ingredients which composed of barley grain, soybean meal, wheat bran, chopped alfalfa hay, molasses and DTP. Four experimental diets were formulated to satisfy the nutrient requirements of growing kids according to AFRC (1998) guidelines to be isonitrogenic (CP, 16/00 % DM basis)and were offered twice daily in equal portions at 08:00 and 20:00 h to provide

approximately 10% feed refusal as fed basis. The first group was fed a basal diet (0% DTP) and considered as control, while the other three groups were fed the basal diet after substituting part of the diet with DTP at 10, 20 and 30% respectively. Each diet was mixed completely and feed sorting by goats was minimal. Ingredients and composition of diets used in the study are given in Table 1.

2.3.Animals, housing and feeding

Twenty four of Markhoz male kid goats of averaged 18.6 ± 0.7kg BW (4 months of age) were divided into four groups, of six each. Each treatment was assigned to one of four dietary treatments: 0, 10, 20 and 30% 0f DTP. Before initiation of the experiment, animals were allowed to adapt to treatment diets for 2 wk and were de-wormed with an effective anathematic and vaccinated against enterotoxaemia and foot and mouth disease. The goats were weighed before feeding in the morning at 14-d intervals throughout the experimental period and sheared before the beginning and at the end of the trials. They were housed and fed in individual metal-mesh cages and were adapted to human handling and the experimental setting. The floor area in each cage was 90*90 cm, and they were raised 85 cm from the floor. All the experimental animals were fed on the treatment diets ad-libitum. Fresh and clean water was available all time.

2.4.Blood samples and carcass characteristics

Individual blood samples were obtained from jugular vein at 3 hours after feeding on days 60 and 90. Samples were centrifuged at 1500×g for 20 min at 4oC. Plasma was removed and stored at -20oC pending analysis for glucose, cholesterol, triglyceride, total protein and urea by using an auto analyzer spectrophotometer (Unico, model S 2100 SUV, serial number 2165168, Japan).

At the end of fattening period (day 91), three animals of each treatment were randomly slathered according to local practices and skinned. All the abdominal and thoracic organs were removed and carcass was prepared. The hot carcasses were weighed immediately after dressing and removal of the offal parts. Weight of Cold Carcass (after 24 h), cavity fats (cardiac, renal, pelvic and gastrointestinal), meat and fat extracted from hot carcasses for all slathered animals were measured (Farid, 1989). By cutting between the 12th and 13th ribs of the back, the cross-section of the longissimus dorsi muscle was traced on paper, and then measured by digital planimeter. Fat-tail was removed, weighed and each cold carcass separated into two right and left side. Dissected fat and meat from the right side of carcass were completely minced. Minced meat and fat thoroughly mixed and a sample taken for determination of protein and fat (Association of Official Analytical Chemists 1975). The following plasma metabolites were quantified using kits from Zistshimi, Diagnostic Products (Tehran, Iran). Plasma glucose and urea concentrations were determined using an enzymatic, colorimetric-GOD-PAP and di-acetyl mono oxium procedures respectively. Data related to feedlot and carcass parameters were adjusted by analysis of covariance using start weight and cold carcass weight as the covariate respectively.

At the beginning (d 0) and end (d 90) of the trial all goats were sheared. At the latter clipping, grease mohair weights were recorded and a sample from the mid-side area (10 × 10-cm) of each fleece was meticulously sheared. The samples were bagged separately in moisture proof- plastic bags and taken to the Wool Laboratory for yield, staple length, and proportions of Medullated and Kemp characterized. The sub samples were prepared for measurement with the projection microscope technique in accordance with ASTM, (1991) short – section procedure to determine fiber diameter, as well was paralleled in fibro liner component of Almeter 100 (Peyer Texlab FDA 200 Siegfried Peyer Ltd. Ch-8832 Wollerau – Switzerland), to determine the Simi rigid Hautuer (fiberpercent/number) and Barbe (fiber percent/ weight) length.

2.5.Statistical analysis

Twenty four male kid goats arranged in balanced completely randomized design were used to evaluate the effects of feeding DTP on the growth performance, nutrient digestibility and mohair production. The collected data were subjected to statistical analysis using the Duncan procedure of SAS, (1998) (SAS Inst. Inc., Cary, NC). Level of significance was α=0.05, and the Duncan's multiple test was used to compare differences between treatments. The model used for this analysis was:

$$\hat{Y}ij = \mu + Ti + \sum ij$$

Where Y is the dependent variable; μ is the overall mean; T is the DTP effect level (i= 10, 20 and 30% of diet) and Σ is the random residual error term.

3. Results & Discussion

3.1.Blood metabolites and carcass traits

Blood metabolite concentrations of glucose, total protein, urea, cholesterol and triglyceride are shown in Table 4. Feeding DTP tended to be increased total protein and urea concentrations accompanied by increase of dietary levels of DTP, while there were no significant differences between

diets. The present results are in good accordance with those described by Belibasakis, (1990) and Belibasakis et al., (1995) when they fed dried and wet tomato pomace to dairy cow, respectively. Effects of dietary treatments on some carcass traits are summarized in Table 4. Analysis of these data showed no significant differences for empty (digesta-free) BW, hot carcass, dressing percentage and carcass length among treatments. The results showed that the crude fat and crude protein of carcass were influenced (P<0.05) by the addition of DTP in diet, however 20 and 30% groups had highest (p<0.05) carcass crude protein and crude fat respectively. The use of DTP promoted greater CP and fat when compared to animals that received soybean as CP source.

3.2.Mohair production, quantity and quality traits

Influence of diets differing in ratio of DTP on the quantity and quality of fiber produced by Markhoz kid goats are listed in Table4.

Goats fed DTP containing diets produced higher amount of greasy fiber, fiber diameter and Barbe length than control diet but, differences between amount of med and kemp fiber, clean fiber, staple length, Hautuer length and true fiber were not significant. The kind or quality of protein consumed by Markhoz goat, owing to their rapid hair growth is very important. The higher (P <0.05) produced mohair by goats fed DTP containing diets than control diet may have reflected enhance of microbial growth and thereby ruminal fermentation as well, provide a reasonable high quality source of amino acids by DTP to the intestines. Production efficiency would potentially be improved if a large proportion of feed proteins could get through the rumen without being degraded. Huston,et al., (1993) reported that, fishmeal are effective protein source for goats and may be of greater value than oilseed byproduct meals in stimulating mohair growth because of their comparatively low ruminal protein degradation.

Table 1. Ingredients and nutrient composition of experimental diets (DM basis)

	Diets (DTP levels)‡			
	Control	**1**	**2**	**3**
	0%	10%	20%	30%
Ingredients				
Alfalfa hay	39.00	37.60	31.14	30.00
DTP‡	00	10.00	20.00	30.00
Soy bean meal	11.50	6.00	5.00	2.20
Barley grain	31.95	20.00	27.00	26.75
Wheat bran	11.60	20.8	10.50	5.00
Molasses	5.00	5.00	5.00	5.00
Calcium carbonate	0.450	0.440	0.450	0.450
Premix†	0.50	0.50	0.50	0.50
Nutrient content		**(% based DM)**		
DM	78.0	78.3	78.1	79.4
CP	16.00	16.00	16.00	16.00
NDF	35.4	35.2	35.1	36.3
ADF	21.4	23.1	24.3	24.00
Calcium	0.6	0.61	0.58	0.57
Phosphorus	0.4	0.39	0.43	0.42

‡Diets; control = (0% DTP); 1= (10% DTP); 2= (20% DTP); 3=(30%DTP); DTP, dried tomato pomace; DM, dry matter; CP, crude protein; NDF, neutral detergent fiber; ADF, acid detergent fiber. †Premix supplied (on a concentrate DM basis): Each 3 kg contain: vitamin A, 12.000.000 IU; vitamin D, 2.500.000 IU; vitamin E, 10.000 mg; vitamin K3, 1000 mg; vitamin B1, 1000 mg; vitamin B2, 5000 mg; vitamin B6, 1500 mg; niacin, 30.000 mg; biotin, 50 mg; folic acid, 1000 mg; pantothenic acid, 10.000 mg; Mn, 60.000 mg; Zn, 50.000 mg; Fe, 30.000 mg; Cu, 5.000 mg; Se, 100 mg; Co, 100 mg; Mn, 250.000 mg; CaCo3, up to 3kg.

Table 2. Mean values for Markhoz kids blood metabolites fed different levels of DTP

	Diets (DTP Levels) ‡					
	Control 0%	**1** 10%	**2** 20%	**3** 30%		
Items					**S.E.M**	**P value**
Glucose, mg/dL	62.2	62.1	63.3	62.1	4.34	NS
Urea, mg/dL	23.20	23.36	25.12	26.8	1.25	NS
Cholesterol, mg/dL	87.5	88.1	86.8	91.1	6.52	NS
Triglycerides,mg/dL	15.3	16.5	14.0	16.9	0.67	NS
Total protein, g/dL	5.83	5.61	6.21	6.95	0.23	NS

‡Diets; control = (0% DTP); 1= (10% DTP); 2= (20% DTP); 3=(30%DTP) S.E.M = standard error of means; NS= not significant

Table 3. Mean values carcass characteristic of goats fed diets differing in ratio of DTP.

	Diets (DTP Levels) ‡					
	Control 0%	**1** 10%	**2** 20%	**3** 30%		
Items					**S.E.M**	**P value**
Empty BW, (kg)	17.24	17.59	18.04	17.4	0.46	NS
Hot carcass, (kg)	8.30	7.86	8.7	7.7	0.25	NS
Dressing percentage	40.19	40.2	40.4	40.2	0.84	NS
Carcass	47. 2	47.01	48.50	46.4	0.67	NS
Chemical compositions of carcass						
Crude	30.43^{b}	30.42^{ab}	33.2^{ab}	33.34^{a}	0.14	✳
Crude fat,	31.6^{b}	32.1^{ab}	32.8^{ab}	34.9^{a}	0.23	✳

‡Diets; control = (0% DTP); 1= (10% DTP); 2= (20% DTP); 3=(30%DTP) S.E.M = standard error of means; NS= not significant- ✳p<0.05

Table 4. Mean values of fleece characteristics of goat fed different levels of DTP.

	Diets (DTP Levels) ‡					
	Control 0%	**1** 10%	**2** 20%	**3** 30%		
Items					**S.E.M**	**P value**
Greasy fibers (g)	453^{ab}	451^{b}	493^{a}	470^{ab}	0.34	✳
Clean fiber, %	77.30	76.8	79.68	80.14	0.5	NS
Fiber diameter (µm)	87.7^{b}	105.1^{ab}	116.8^{a}	81.1^{b}	0.14	✳
Staple length, cm	4.32	5.03	5.86	5.64	0.27	NS
B Length	31.77^{b}	35.61^{ab}	45.01^{ab}	45.95^{a}	0.23	✳
H Length	34.60	34.43	36.87	36.76	0.45	NS
Med fiber,%	2.17	3.6	3.67	2.87	0.16	NS
Kemp fiber,%	1.70	3.22	4.41	4.67	0.33	NS
True fiber, %	96.13	93.18	91.92	92.45	0.24	NS

‡Diets; control = (0% DTP); 1= (10% DTP); 2= (20% DTP); 3=(30%DTP) S.E.M = standard error of means; NS= not significant- ✳p<0.05.

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