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Effect of substituting potato plant residues instead of straw on performance, blood and rumen parameters in Sanan she goats

Mostafa Hosseinabadi, Mehdi Piyadehkouhsar, Kosar Ghezelsefli, Taghi Ghoorchi, Abdolhakim Toghdory*

Department of Animal and Poultry Nutrition, Animal Science Faculty, Gorgan University of Agricultural Science and Natural Resources, Gorgan 49138-15739, Iran

*Corresponding author,
E-mail address:
mostafa_hosseinabadi@yahoo.com

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ORCID
Mostafa Hosseinabadi
0000-0002-3287-0735
Mehdi Piyadehkouhsar
0009-0004-8937-9666
Kosar Ghezelsefli
0009-0005-9523-0101
Taghi Ghoorchi
0000-0002-6869-2932
Abdolhakim Toghdory
0000-0002-5198-1940

Abstract This experiment was conducted to investigate the effects of two levels of potato plant residues on performance, digestibility, rumination behavior, blood, and rumen parameters in dairy goats. For this purpose, eighteen 3-year old Saanen she goats with an average weight of 38.19±0.84 kg were used. This experiment was conducted in a completely randomized design with 3 treatments, including 0, 50, and 100% replacement of potato plant instead of straw, and 6 replications. The goats were housed in a group pen with free access to water. To evaluate the growth performance, the goats were weighed at the beginning and end of the period, and feed intake was recorded daily. Additionally, blood and ruminal fluid samples were collected on the final day of the experiment. There were no significant differences in eating, chewing, and resting behavior between the treatments, but, rumination behavior increased with consumption of potato plant residues ($P<0.05$). There were no significant changes ($P>0.05$) in blood total cholesterol, triglycerides, glucose, total protein, albumin, globulin, creatinine, and the albumin/globulin ratio with increasing the dietary potato plant content. Only blood urea levels showed a significant increase ($P<0.05$) with higher dietary potato plant content. Using different levels of potato plant residues increased the average daily weight gain, final body weight, feed intake, and improved feed conversion ratio ($P=0.0001$). Blood concentration of ammonia nitrogen increased significantly with increased consumption of potato plants. Based on the results of this experiment, potato plants can replace up to 100% of straw in goat feed.

Keywords: blood parameters, digestibility, dairy goat, health index, potato plant

Introduction

As the global demand for high-value food rises, enhancing goat productivity through advanced management and genetic improvement is essential (Darezershkipoor, 2020). Since livestock feeding constitutes over 60% of the production costs, the valorization of local agro-industrial by-products offers a sustainable strategy to optimize feed efficiency, reduce operational costs, and mitigate greenhouse gas emissions (Russomano et al., 2012; Van Zanten et al., 2014).

Agricultural residues and by-products are materials remaining after the harvest or processing of crops, forestry, and food industries (Mehrani, 2019). According to Lau et al. (2021), the global agricultural industry produces approximately 998 million tons of these materials annually. Improper disposal, such as burning or composting without management, often leads to significant environmental pollution (Bhatia et al., 2023). However, processing these wastes into livestock feed not only contributes to effective waste management and soil fertility but also generates additional income for farmers while improving animal productivity (Kurniawan et al., 2024; Wislim et al., 2025).

Among these resources, potato plants are increasingly recognized for their potential as a high-quality feed for livestock. Potato tubers are a significant energy source, providing approximately 3,500 kcal/kg of starch, while the haulms and stems contain essential proteins and minerals (Rogan et al., 2000; Friedman, 2006). Potato plant residues are particularly suitable for ruminants due to their unique ability to digest high-moisture feeds, although starch digestibility may vary (Novak et al., 2001; Radu-Andrei et al., 2021). Furthermore, these residues can be processed into various forms, such as silage or dried chips, to enhance their nutritional stability and utility in year-round feeding programs (Radu-Andrei et al., 2021).

Given the current reality of increasing food waste and rising feed costs, this study aimed to evaluate the effects of replacing straw with potato plant on the performance, digestibility, rumination behavior, and blood and ruminal parameters in dairy goats.

Materials and methods

Ethical considerations

All experimental procedures were approved (No: 02-489-3) by the Animal Welfare and Ethics Committee of the Faculty of Animal Science at the Gorgan University of Agricultural Sciences and Natural Resources (Gorgan, Iran).

Animal management and experimental design

This study was conducted in the summer of 2024 at the sheep unit of the animal husbandry farm, Faculty of Animal Sciences, Gorgan University of Agricultural Sciences and Natural Resources. The study lasted for a total of 49 days, including a 7-day adaptation period. In this study, 18 Sanan she goats with a mean weight of 38.19 ± 0.84 kg and 3 years of age were used. The experiment was conducted in a completely randomized design with 3 diets and 6 replicates in each tretamnet group. Diet 1(control) contained 30% (DM basis) wheat straw. In diets 2 and 3, the straw content of the diet 1 was replaced with potato plant residues at 50, and 100%, respectively (Table 1). Potato plant residues were collected after harvest and air-dried. Diets were formulated based on NRC (2007); the only difference between the diets was the amount of potato plant in their composition (Table 1). All goats were subjected to identical management and nutritional conditions. Weighed amounts of the diets were provided twice daily, at 8:00 AM and 4:00 PM. The animals were housed in groups in the livestock facility and had free access to water.

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

Dietary ingredients	Diet 1	Diet 2	Diet 3
Potato plant	0.00	15.00	30.00
Straw	30.00	15.00	0.00
Barley, grain	15.00	15.00	15.00
Soybean meal	10.00	9.50	9.00
Cottonseed meal	12.50	12.50	12.50
Wheat bran	10.00	10.00	10.00
Corn, grain	15.00	15.00	15.00
Sugar beet pulp	5.00	5.50	6.00
Vitamin-mineral supplement[1]	1.00	1.00	1.00
Salt	0.50	0.50	0.50
Sodium bicarbonate	1.00	1.00	1.00
Nutrient composition (%)			
Crude protein	13.84	13.85	13.86
Acid detergent fiber	22.09	20.91	19.73
Neutral detergent fiber	39.73	38.80	37.86
Ash	7.29	7.04	6.80
Calcium	0.67	0.66	0.65
Phosphorus	0.38	0.40	0.42
Metabolizable energy (Mcal/kg)	2.59	2.60	2.61

[1]Provided (per kg of the mixed diet):1000000 IU Vitamin A; 75000 IU Vitamin D3; 3000 mg antioxidants; 150000 mg Ca; 60000 mg P; 300009 mg Mg; 2000 mg Mn; 3000 mg Fe; 500 mg Cu; 2500 mg Zn; 10 mg Co; 20 mg iodine.

Diet 1: Control diet (no potato plant), Diet 2: replacing 50% of straw content in the control diet, Diet 3: replacing 100% of straw content in the control diet.

The nutrient composition of the potato plant (DM, OM. EE, NDF, CP) used in the present experiment was also measured.

Growth performance

The diets used were provided daily at 8:00 and 16:00. Daily feed intake (FI) was calculated from the average difference between the feed provided for each group and the remaining feed in the trough of the same group the next day. The average dry matter intake of each goat was calculated from the average feed intake of each treatment during the period. If the orts were less than 200 g for three consecutive days, the allocated feed was increased. Animal weighing was performed at the beginning and end of the period after 16 hours of feed deprivation, using a digital scale. Daily weight gain (DWG) was calculated by dividing the weight difference over a time period by the number of days in that period. The dry matter intake (DMI), DWG, end-of-period weight, and feed conversion ratio (FCR) were also measured and calculated.

Nutrient digestibility

Apparent digestibility of dry matter (DM) and organic matter (OM) was measured using acid-insoluble ash

(AIA) as an internal marker (Van Keulen and Young, 1977). During the final 3 days of the experiment,fecal samples collected from each treatment were mixed, and a 100g fecal sample was placed into a sealed plastic bag and frozen at -20°C for chemical analysis. Subsequently, the percentage of DM, OM, and neutral detergent fiber (NDF) in the samples was determined in the laboratory based on the methods of AOAC (2005) and Van Soest et al. (1999).

$$AD\ (\%) = 100 - 100 \times (MD/MF) \times (NF/ND)$$

where, AD is the apparent digestibility (%), MD is the marker in the diet (%), MF is the marker in the faeces (%), NF is the nutrient in the faeces (%) and ND is the nutrient in the diet (%).

Measured attributes

The measured traits included the growth performance, apparent nutrient digestibility, daily feed intake (FI), body weight (BW), several blood and ruminal parameters, and feeding behavior.

Feeding behavior

On the last day of the experiment, feeding behavior was assessed over 24 h by monitoring the eating, rumination, chewing, and resting for all animals every five minutes, assuming that the activity had continued in the previous five minutes as well (Araujo et al., 2008).

Measurement of blood parameters

Blood samples were collected on the final day of the experiment, before feeding and under fasting conditions. About 10 mL of blood were drawn from the jugular vein without anticoagulant and rapidly transported to the laboratory in an ice-filled flask. The tubes were centrifuged at 3000 × g for 10 minutes to separate the serum. The levels of glucose, triglycerides, cholesterol, blood urea nitrogen, total protein, albumin, globulin, albumin/globulin ratio, creatinine, white blood cells, red blood cells, platelets, lymphocytes, monocytes, and neutrophils were measured using commercial Pars Azmoon kits and an autoanalyzer (Model BT 1500).

Ruminal fluid analysis

Ruminal fluid was collected using a vacuum pump 3 days before the end of the experiment for pH measurement. Ruminal fluid pH of each sample was immediately measured and recorded using a digital portable pH meter (AZ, model 8689). Ammoniacal nitrogen (NH_3-N) concentration was determined using the phenol–hypochlorite colorimetric method as described by AOAC (1990). Briefly, ammonia reacts with phenol and hypochlorite under alkaline conditions to form indophenol blue. The absorbance was measured spectrophotometrically at 630 nm.

Statistical analysis

Statistical analyses were conducted using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA). The experimental data were analyzed using PROC GLM, assuming a completely randomized design with 3 treatments, each with 6 replicates. The relationships between dietary levels of potato plant and various experimental parameters were evaluated using the PROC REG procedure. Data are presented as least-squares means, and Tukey's multiple range tests were performed to identify significant differences amongst means. Differences were considered significant at $P<0.05$. The statistical model used was:

$$Y_{ij} = \mu + T_i + e_{ij}$$

where, Y_{ij}: observed value μ: mean, T_i: treatment effect, e_{ij}: experimental error.

Results and discussion

Chemical composition and nutrients of the potato plant

Table 2 presents the DM, OM, CP, ether extract (crude fat), and neutral detergent fiber in potato plants. Fazaeli et al. (2009), using both *in vitro* and *in vivo* methods, measured the composition of different levels of potato plant mixed with alfalfa hay; the crude ash (CA), CP, and crude fat (CF) levels were reported as 11.55%, 8.13%, and 0.68%, respectively. Faraji Nafchi (2004) reported the chemical composition of the potato plant as follows: DM 89.73%, gross energy 3230, crude protein 14.75%, crude fiber 15.5%, crude fat 5%, and ash 19.92%. In another study, Hosseinabadi et al. (2023) reported the following chemical composition for potato plants: DM 89.17%, OM 13.13%, fat 5.33%, neutral detergent fiber 63.33%, protein 6.84%.

Table 2. Nutrient composition of potato plants

Composition	(%DM)
Dry matter	88.42
Ash	15.11
Ether extract	5.20
Neutral detergent fiber	64.47
Crude protein	6.50

Growth performance

Compared with wheat straw, inclusion of 30% potato plant (DM basis) in the diet resulted in higher daily weight gain, final weight gain, and dry matter intake but, at the same time, improved the FCR ($P<0.05$). Hosseinabadi et al. (2023) also reporetd that feeding of potato plant to Dalagh ewes caused an increase in feed intake. On the other hand, Salehi et al. (2014) indicated that the inclusion of potato aerial parts in the diet of fattening lambs had no significant effect on feed intake, weight gain, or feed conversion ratio. That study revealed that feeding male lambs with potato foliage instead of alfalfa, up to 35% of the total diet not only had no adverse effects on animals but was highly cost-effective. Therefore, in regions where potato cultivation is common, this agricultural waste can serve as a suitable replacement for alfalfa. Malechy et al. (2017), investigated the effect of replacing alfalfa with potato plant in fattening lambs found no significant difference in feedlot performance (BW, FI, ADG, and FCR) between the lambs fed potato plant and those fed alfalfa.

The increased feed intake of the diet containing potato plant can be attributed to the palatability of potato plant compared to wheat straw. It has also been shown that forages with high neutral detergent insoluble fiber digestibility lead to increased feed intake, milk production, and body weight gain (Ghoorchi and Seyed al-Mousavi, 2018). The mechanism of improved performance is also likely to be due to the more favorable nutrient composition of potato plantlets compared to wheat straw. Higher crude protein and mineral contents and more digestible cellulose fractions (due to the observed increased NDF digestibility) could create a more favorable ruminal environment, increasing microbial fermentation and volatile fatty acid production. This would lead to higher energy supply, stimulating feed intake, and consequently improving daily weight gain and feed conversion efficiency (Hosseinabadi et al., 2023; Narimani Karajeh et al., 2024).

Table 3. Effect of different levels of potato plant on dry matter intake and growth performance in Saanen dairy goats

Items	Diets[1]			SEM	P-value
	1	2	3		
Initial weight (kg)	37.75	38.23	38.59	2.138	0.7611
Final weight (kg)	42.89[b]	44.73[ab]	45.72[a]	2.672	0.0001
Average daily gain (g/day)	122.55[c]	154.99[b]	169.88[a]	23.169	0.0001
Total weight gain (kg)	5.14[c]	6.50[b]	7.13[a]	0.673	0.0001
Dry matter intake (g/day)	967.33[b]	1078.52[ab]	1165.13[a]	64.517	0.0317
Total feed intake (kg)	40.628[b]	45.298[a]	46.894[a]	1.19	0.009
Feed conversion ratio	7.90[a]	6.95[b]	6.85[b]	0.118	0.0001

[a,b] Within row, means with common superscript (s) are not different (P>0.05).

[1]Diet 1: Control diet (no potato plant), Diet 2: replacing 50% of straw content in the control diet, Diet 3: replacing 100% of straw content in the control diet.

Nutrient digestibility

No significant differences were observed among treatments in DM, NDF, and crude fat digestibility (Table 4). However, OM digestibility was highest at the highest level of potato plant residues in the diet (P<0.05). Faraji Nafchi et al. (2004) reported feeding of potato aerial parts did not affect nutrient digestibility in Lori-Bakhtiari sheep but Hosseinabadi et al. (2023), found that inclusion of 40% potato plant in the Dalagh ewe diets increased organic matter digestibility. Contrary to the present results, Malechy et al. (2017), in a study on the replacement of alfalfa with potato plant in fattening lambs, reported no significant difference between lambs in DM, OM, and NDF digestibility. Straw is the most important lignocellulosic compound categorized as an unconventional feed resource in ruminant diets. Digestibility of fibrous agricultural byproducts is limited due to the presence of cellulose crystals, the bonding between structural carbohydrates and lignin, as well as acetyl groups in hemicellulose (Al-Masri, 2005). Due to their low nitrogen content and high fiber content, straw and crop residues have poor nutritional value for ruminant feeding. This leads to a reduction in dry matter intake and palatability (Prasad et al., 1998).

Despite simple drying, the improved digestibility of organic matter by replacing wheat straw with potato husks is largely due to its superior structural and chemical composition. The tissue of young potato leaves and stems (even in the dried state) has higher levels of soluble protein, hemicellulose, and nonstructural carbohydrates. This composition provides a better substrate for the activity of the rumen microbial population. The additional protein provides the ammonia nitrogen needed by rumen microorganisms and increases the efficiency of fiber degradation (Shi et al., 2024). As a result, the overall fermentability of the organic matter is improved and a greater proportion of the dry matter consumed is converted into volatile fatty acids and other absorbable nutrients. It should be noted, however, that this benefit can only be realized under conditions of careful management and controlled replacement levels, as high levels of glycoalkaloids in the dried plant can negatively affect rumen function in the long term by causing subclinical toxicity (Shi et al., 2024).

Table 4. Effect of different levels of potato plant on nutrient digestibility (%) in Saanen dairy goats

Nutrient	Diets[1]			SEM	P-value
	1	2	3		
Dry matter	68.12	74.69	78.57	4.175	0.4131
Organic matter	49.13[b]	58.12[ab]	66.98[a]	3.114	0.0001
Neutral detergent fiber	56.12	58.17	62.69	2.987	0.4968
Crude protein	74.12	76.52	79.18	1.812	0.5672

[a,b] Within row, means with common superscript (s) are not different (P>0.05).

[1]Diet 1: Control diet (no potato plant), Diet 2: replacing 50% of straw content in the control diet, Diet 3: replacing 100% of straw content in the control diet.

Eating behavior

Parametrs of the eating behavior (measured as minutes per day) are presented in Table 5. An increase in potato plant level in the diet led to a decrease ($P<0.05$) in eating behavior and the occurrence of abnormal behaviors, although this reduction was not statistically significant ($P>0.05$). These findings contradict those reported by Ghoorchi et al. (2024), who stated that group and individual feeding did not affect FI behavior in Dalagh fattening lambs. McDonald et al. (2011), revealed that in ruminant animals, the energy expended for the act of eating accounts for approximately 3-6% of the animal's total metabolized energy. However, the energy required for rumination is significantly lower than that of eating, estimated to be about 0.3% of the total metabolized energy. The energy expenditure associated with food consumption is dependent not only on the quantity of food ingested but also on factors such as the duration of eating, food type, fiber content, and the physical form of the food (Lachica et al., 1977). Complete elimination of wheat straw from the diet resulted in an increase in energy expenditure during eating, rumination, and chewing behaviors. Chewing time decreases with a reduction in particle size and neutral detergent insoluble fiber content (Grant et al., 1990). The reduction in rumination and chewing activity is likely attributed to the lower amount of neutral detergent insoluble fiber and its chemical and physical nature (Van Soest et al., 1999). The energy expenditure associated with eating is not solely determined by the quantity of food consumed. Factors such as the duration of the eating process, the type of food, the fiber content, and the physical form of the food significantly influence the energy required for ingestion.

The improvement in rumination behavior in goats fed dried potato straw compared to wheat straw is mainly due to the different quality of fiber and its effect on the physiology of the foregut. Wheat straw, due to its high lignin content and rigid cell wall structure, has ineffective fiber that passes through the rumen quickly and provides insufficient mechanical stimulation to form a healthy foam layer. In contrast, dried potato straw has significant amounts of hemicellulose and fiber with greater rumen accumulative potential. This type of fiber provides a better effective physical content (eNDF) that increases the stimulation necessary for rumen contractions and the ruminative process (Kilama et al., 2024). As a result, rumination time and the number of chewing cycles are increased, which leads to more saliva production, better stabilization of rumen pH and ultimately optimization of the microbial fermentation environment. This improvement in rumen health directly affects the efficiency of digestion and nutrient utilization)Cassida and Stokes, 1986).

Table 5. Effect of different levels of potato plant on eating behaviors of Saanen dairy goats (min/day)

Items	Diets[1]			SEM	P-value
	1	2	3		
Eating	213.25	217.50	224.50	11.520	0.0721
Ruminating	320.50[b]	324.50[ab]	345.50[a]	17.251	0.0001
Chewing	411.75	395.25	407.00	16.280	0.2378
Resting	198.25	221.50	230.50	12.115	0.6114
Water consumption	108.75	116.25	123.75	22.672	0.8975
Non-nutritional behavior	187.50	165.00	108.75	27.357	0.1670
Laying	468.70	382.50	742.50	98.640	0.0698
Standing	971.30	1057.50	697.50	98.640	0.0698

[a,b] Within row, means with common superscript (s) are not different ($P>0.05$).
[1]*Diet 1: Control diet (no potato plant), Diet 2: replacing 50% of straw content in the control diet, Diet 3: replacing 100% of straw content in the control diet.*

Blood parameters

Tables 6 and 7 present the blood biochemical, hematological, and blood leukocyte parameters in different experimental groups. There were no significant changes ($P>0.05$) in total cholesterol, triglycerides, glucose, total protein, albumin, globulin, creatinine, and the albumin/globulin ratio in blood serum with increasing potato plant level. Only blood urea levels showed a significant increase ($P<0.05$) at higher potato plant level. Furthermore, no significant changes were observed in hematological parameters among the treatments in this study. Urea is the primary product of protein breakdown in the body. Therefore, blood urea nitrogen (BUN) can be used to assess protein nutritional status in ruminants (Ndlovu et al., 2009). The BUN concentration in ruminants is influenced by various factors, including feed chemical composition, dietary crude protein percentage, the ratio of crude protein to rumen fermentable organic matter, post-ruminal protein metabolism, endogenous urea nitrogen secretion, and liver and kidney function (Rosler et al., 1993). Consistent with the present findings, a study by Deng et al. (2023) on Angus steers fed potato plant silage demonstrated significant changes in blood parameters. Blood urea nitrogen was higher in steers fed this silage compared to those fed whole corn silage. This could be attributed to a nitrogen deficiency in the diet, leading to a decrease in BUN concentrations (NRC, 2007). The average total cholesterol concentration in clinically healthy goats was approximately 55.9 mg/dL (El Nasri and El Nasri, 2015). Malechy et al. (2017) reported replacement of alfalfa with potato plant in fattening lambs had no significant effect on glucose, cholesterol, triglyceride, and albumin levels. Serum glucose levels are a useful indicator of energy utilization in ruminants and are associated with quantitative and qualitative changes in the diet. Blood glucose levels within the normal range are reported to be approximately 40-100 mg/dL. It is expected that animals grazing on low-quality, woody forages will have blood glucose levels below the normal range (Ndlovu et al., 2009).

The glucose levels in the present study were within the normal range. The dietary potato plant levels used in the present experiment had no significant effect on white blood cells, red blood cells, lymphocytes, monocytes, neutrophils, and blood platelets (P>0.05). Consistent with the present findings, Hosseinabadi et al. (2023) reported that blood parameters in fattening Dalagh lambs did not significantly differ with increasing levels of potato plant.

Table 6. Effect of different levels of potato plant on serum biochemistry in Saanen dairy goats

	Diets[1]			SEM	P-value
	1	2	3		
Cholesterol (mg/dL)	55.17	58.93	60.65	1.913	0.4851
TG (mg/dL)	20.18	21.55	22.06	2.501	0.5851
Glucose (mg/dL)	67.17	70.12	71.44	2.111	0.6006
Urea (mg/dL)	10.57[b]	12.12[a]	13.57[a]	0.817	0.0124
TP (g/dL)	7.26	7.41	7.39	0.311	0.7218
Albumin (g/dL)	4.38	4.51	4.53	0.284	0.6517
Globulins (g/dL)	2.88	2.90	2.86	0.111	0.7185
Albumin/Globulins	1.52	1.55	1.60	0.083	0.8185
Creatinine (mg/dL)	0.83	0.82	0.89	0.019	0.1159

[a,b] Within row, means with common superscript (s) are not different (P>0.05).
TG: Triglyceride, TP: Total protein.
[1]Diet 1: Control diet (no potato plant), Diet 2: replacing 50% of straw content in the control diet, Diet 3: replacing 100% of straw content in the control diet.

Table 7. Effect of different levels of potato plant on blood cell counts in Saanen dairy goats

	Diets[1]			SEM	P-value
	1	2	3		
WBC (10^3/μL)	9.11	9.47	9.33	0.512	0.6763
RBC (10^6/μL)	8.18	8.86	8.77	0.313	0.4931
Lymphocytes (10^3/μL)	2.87	2.91	3.04	0.0123	0.6123
Neutrophils (10^3/μL)	3.66	3.43	3.59	0.0149	0.5593
Monocytes (10^3/μL)	3.01	2.87	2.69	0.0446	0.2496
Platelet (10^3/μL)	537.12	555.17	542.93	43.170	0.1257

[a,b] Within row, means with common superscript (s) are not different (P>0.05). WBC: White blood cells, RBC: Red blood cells.
[1]Diet 1: Control diet (no potato plant), Diet 2: replacing 50% of straw content in the control diet, Diet 3: replacing 100% of straw content in the control diet.

Ruminal parameters

Ruminal fluid pH values were not significantly affected by the experimental treatments (Table 8; P>0.05). Ammoniacal nitrogen concentration significantly increased with increasing potato plant levels (P<0.05). Sebastian Mlay et al. (2005) reported that the use of low-quality forage, compared to processed and high-quality forage, did not create a significant difference in rumen pH. Generally, the use of coarse roughage as the primary source of livestock feed contributes to rumen pH stability, thereby promoting balanced fermentation and volatile fatty acid production (Kleinschmit et al., 2007).

Replacing wheat straw with dried potato stalks increases rumen ammonia nitrogen through two concurrent mechanisms: first, potato stalks have a much higher crude protein content, which increases the total amount of nitrogen entering the rumen environment; second, the protein in young potato leaves and stems is mainly soluble and rapidly degradable proteins that are hydrolyzed more rapidly into peptides and amino acids by microbial proteolytic enzymes in the rumen compared to the protein bound to the lignin cell wall of wheat straw. These amino acids then release their amine group as ammonia in the microbial deamination process, and as a result, the simultaneous increase in the amount and degradability of the incoming protein leads to a surge in ammonia production and an increase in rumen ammonia nitrogen concentration (Shi et al., 2024; Smithyman et al., 2024).

Table 8. Effect of different levels of potato plant on rumen parameters of Saanen dairy goats

	Diets[1]			SEM	P-value
	1	2	3		
Ammonia nitrogen concentration	11.43[b]	12.45[ab]	13.37[a]	0.237	0.0172
pH	7.37	7.44	7.58	0.513	0.2149

[a,b] Within row, means with common superscript (s) are not different (P>0.05).
[1]Diet 1: Control diet (no potato plant), Diet 2: replacing 50% of straw content in the control diet, Diet 3: replacing 100% of straw content in the control diet.

Conclusions

Based on the findings of this study, it is possible to completely replace wheat straw with dried potato plants in the diet of dairy goats. Although this replacement resulted in significant improvements in growth performance (daily weight gain, feed intake and conversion ratio) and positive changes in ruminant behavior, it did not have a significant effect on hematological parameters except for increased blood urea and rumen ammonia. Overall, the findings indicate that the use of this by-product in the diet is acceptable when available and can be used as an alternative feed source without causing negative health effects.

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Conflict of Interest

There are no conflicts of interest by the authors.

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