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Metabolizable protein determination and crude protein degradability of potato, tomato, melon and strawberry bush by in-situ method in Lori-Bakhatirai Ram lambs

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Abstract: This study was carried out to determine the metabolizable protein of potato bushes, tomato bushes, melon bushes and strawberry bushes using nylon bags method in Lori-Bakhatirai ram lambs. In this experiment, three fistulated castrated male sheep were used in a completely randomized design. Treatments included: A: potato bush, B: tomato bush, C: melon bush and D: strawberry bush, respectively. The degradability was measured using nylon bags at 0, 2, 4, 6, 8, 12, 16, 24, 36, 48, 72 and 96 hours. The crude protein degradability rates of treatments for A, B, C and D for soluble part were 19.59, 16.99, 14.91 and 10.59%, respectively, and for the fermentable protein were 33.58, 20.93, 38 and 24.24%, respectively. The metabolizable protein of A, B, C, and D treatments were 66.207, 79.49, 67.45 and 44.86 gr / kg, respectively. The results showed that using these lesions, livestock growers can use shrubs as a complementary supplement to feed livestock. In addition to this other farmer, they can replace these wastes and create environmental pollution as a side income, in which case a significant amount of unusable waste will be re-imported. In addition to this, other farmers can sell these wastes and create environmental pollution as a side income, in which case a significant amount of unusable waste will re-enter the product of production product.

Keywords: Melons, Metabolizable protein, Potatoes, Strawberries, Tomatoes. Lori Bakhtiari Ram lambs.

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Introduction

Food and nutrition is undoubtedly the most important topic of today's world. Increasing population growth and the efforts to meet the growing needs of the growing population necessarily lead to efforts in various agronomic and animal husbandry fields, technology and related sciences. In developing countries, the amount of protein and energy consumed by the population is lower than the global average and in some cases is lower. In addition, in many of these countries, the level of protein consumed from the animal source is very low. In terms of nutritional improvement, human need for animal protein consuming is more important than plant protein. Existing proteins in eggs, milk, meat and fish are preferable to the removal of essential amino acids on plant proteins. A low level of food production in developing countries with a high rate of population growth is one of the most complex issues in these countries. It seems that solving these problems is facilitated in the light of scientific, economic and cultural advances. Although the related issues of rapid population growth and hunger in the world are not fully solvable, this issue should not be a barrier against our efforts and efforts in these areas (9, 10).

With the increasing demand of human society's needs, including Iran, the need to increase animal production is inevitable. One of the most distinguished characteristics of ruminants is the ability to convert foods such as dry fodder, fiber materials and non-usable industrial food byproducts to humans into consumable foods such as meat and milk. This ability is the result of degradation of the oral food with the help of the germs of ruminants and their use of the final products for their physiological application, which ultimately leads to the production of human protein able materials (9).

In Iran, which is considered to be a semiarid region of the world, breeding ruminants, especially cattle and sheep, have been cultivated historically. Since the amount of available animal feeds that are available is limited in comparison with the number of livestock in the country, it is necessary and necessary to use the optimum and suitable use of all existing feed materials (13).

Feed materials used in animal nutrition are the most important factors in the development of livestock industry and in Iran, like in other world countries; the largest share of livestock farming costs is allocated to feeding. Achieving maximum profitability in livestock units is not feasible without proper nutrition. Also, raising biological and nutritional efficiency is one of the main goals of farm animal breeding, in the way that the consumption of food (especially those that are not directly used by humans) in animal nutrition, the maximum possible production is obtained. Therefore, with the recognition of feeds and the supply of animal food needs, this can be achieved.

Today, lack of food sources (energy and protein) is considered as the most important limiting factor in the development of animal husbandry in many countries, including Iran. Therefore, evaluation of feed materials used in livestock feeding, as a key factor, plays a very important role in the development of animal husbandry. Because, with such information, it is possible to prepare and adjust more suitable diets and also optimize the use of potential sources and agricultural sub products in the production of animal products (5, 8).

Forage is formed one of the important components of the diet of livestock. Forage crops are quantitatively a major part of the diet of livestock, so that 60-70% of the total dry matter is from the forage and the livestock for proper rumination, should receive enough fiber. In other words, the basis for the breeding of ruminants is the use of wood materials in order to meet their needs. Forage is important not only for the supply of energy required by ruminants but also provides significant amounts of protein for the animal. The available forage in the country does not meet 110 million heads of livestock in the country, and the shortage of forage will cause excessive pressure on livestock in rangelands and will destroy and destruction the rangeland (10, 12).

Therefore, in the vast country of Iran, considering the special climate conditions and agricultural policies for growing and growing foodstuffs for its growing population and the existing economic conditions, attention to ruminants should be highlighted in particular. In this regard, shrubs, shrubs and agricultural waste can be used as a food in feeding ruminants. Because is the inexpensive resource and high in nutritional value, which produces and mainly dies annually. Therefore, using it in diets, while reducing nutritional costs, prevents their accumulation in the environment and their loss. On the other hand, the limitation of natural resources, pastures and the inadequate use of animal feed clearly highlight the need for better use of unconventional and unusual sources of food that does not compete with human foods (1, 10).

Therefore, in addition to using the bushes, for grazing, they can be used as feed for daily feeding of sheep and goats on the farm, which it also makes, reduces costs and reduces the erosion of pastures. Iran is one of the main holders of large potato fields, tomatoes, melons and strawberries, and in this regard has a privileged position in the region.

Considering that these four products have been found abundantly in the region, they are considered as cheap resources. These four products have been found abundantly in the region, they are considered as cheap resources.

Therefore, the present study was carried out to identify the nutritional value of potato plants, tomatoes, melons and strawberries, and the possibility of increasing and optimizing their use in livestock feeding and preventing its loss and environmental pollution reduction.

Material and Methods

Preparation of samples from gardens in Chaharmahal and Bakhtiari province was prepared. Approximate analysis of food products including dry matter, ash and crude protein, insoluble fibers in neutral detergent and insoluble fiber in acid detergent was performed according to standard AOAC (2).

Lori Bakhtiari ram lambs that used in current experiment were fed at a slightly higher level than maintenance. The defined food was assigned to animals on a regular basis (two times a day) were given to them to provide the appropriate growth and density for the microbial population during the fermentation of the specimens in the rumen. In addition to feeding these animals, salt and as well as water was permanently supplied for nutritional balance (12). To estimate the degradability by nylon bags, feed samples were first grinding with a special grinding mill with a 2 mm sieve.

The amount of 5 g of each food item was poured into artificial nylon bags of 6 × 12 inches and pore diameter of 50 micrometers. The empty bag weight and bag weight were also measured and recorded. To determine the degradability at zero time, the sample bags were rinsed under running water for 15 minutes. Incubation times were 0, 2, 4, 6, 8, 12, 16, 24, 36, 48, 72 and 96 ^{h}. For each treatment, 4 replicates were prepared per hour (two bags per sheep per each hour incubation) (10, 11).

After each incubation hour, the bags were removed and rinsed with cold water until the water was completely clear. After washing, the bags were evaporated for 24 hours at 65 ^{oC} and evaporated in an oven for 24 hours at 105 ^{oC}. The degradability parameters (soluble part, insoluble part and constant decomposition rate) were calculated using Naway software. The P = a + b (1-e $^{-ct}$) equation was used to match the degradability data. In this equation, P = the decomposition rate at time t, a = the rate of decomposition of the soluble part, b = the insolubility of the partition, c = constant the degradability rate, t = the incubation time, and e = the neperian number (2.718). Effective degradation was calculated by the equation ED = a + (b × c) / (c + k). K = is the pass rate, which was considered in this study 02/0 (9, 10, 11, 12). The results of incubation in each hour were analyzed by SAS software in a completely randomized design with two treatments and four replications.

The mean of the studied effects was compared with the Duncan test at a significant level of 0.05. The statistical model of the design was as follows: Yij = μ + Ti + εij, in this model: Yij = the value of each observation, μ = total mean, Ti = treatment effect and εij = experimental error. Finally, the correlation between the nylon bags and the gas production data was calculated by SAS software (11, 12).

Result and Discussion

To overcome the problems caused by digestible protein, a metabolizable protein system is presented this system is based on the microbial protein and unbranched dietary protein in the rumen that is digestible and absorbed in the digestive tract after the rumen. In this system, the microbial protein introduced into the narrow intestine is based on the effective digestible protein in the rumen. An effective protein digestible protein in the rumen consists of two sections of protein with rapid decomposition (with 80% yield) and slow dissolution. Undifferentiated digestible food protein in the rumen, digestible and absorbed in the intestinal tract after its correction is calculated for the amount of insoluble nitrogen in acid detergent. Therefore, in order to ensure the integrity of the system, it is necessary to calculate the amount of insoluble nitrogen in acid detergent. The rumen-degradable protein represents the total amount of nitrogen in the rumen that consumes rumen microorganisms for growth. The higher the level of feed intake, the ERDP reduces due to increased feed passage from the rumen (10, 12).

As seen in Table 1, there is a significant difference between ERDP of experimental treatments (P <0.05). The reason for the difference in ERDP treatments is the difference in protein percentage of the samples, the amount of water soluble (a) and the amount of fermented material (b). This causes differences in the activity of ruminal microorganisms and the degradability of crude protein.

According to the results obtained in Table 1, the most metabolizable protein related to the tomato plant is 79.49 and the lowest is strawberry plant with 44.88 g / kg dry matter.

All of the three food items were statistically significant (P <0.05).

The difference in the metabolizable protein content of the treatments can be due to differences in the amount of crude protein and degradability and the differences in the cell wall sections of these materials, which has led to a reduction in the metabolizable protein in strawberry bush (10).

Table 1. The parameters estimated from the metabolizable protein (g/kg DM) of feeds.

Treatments	QDP	SDP	ERDP	UDP	DUP	MP
A	16.82a	27.92b	41.38b	41.22b	37.36b	66.21b
B	17.39a	21.02c	34.89c	63.99a	57.16a	79.49a
C	13.47b	33.48a	44.56a	43.38b	38.98b	67.45b
D	5.94c	13.31d	18.06d	37.05c	33.30c	44.86c
SEM	0.501	0.447	0.746	1.21	1.044	1.62

QDP=Quick degradable protein, SDP=Slow degradable protein, ERDP=Effective ruminal degradable protein, DUP=Digestible undegradable protein, MP=Metabolizable protein. A: potato bush, B: tomato bush, C: melon bush and D: strawberry bush, SEM= Standard error means.
a,b,c = Within a column, means without a common superscript letter differ (P< 0.05).

The metabolite protein values for vine leaves were 126. 626%, this is different from the results of this study for the tested treatments. The ruminant microorganisms in the ruminant animals are able to break down the protein and use nitrogen to make the microbial protein. Which, when fed with an easy digestible carbohydrate source in ruminants, leads to an increase in the production of microbial protein. Given that the ratio of ruminal ammonia nitrogen is negatively correlated with the rate of nitrogen transfer from the rumen to the rumen, the change in the ratio of urea or nitrogen levels in the rumen's digestion can change the rumen nitrogen in the rumen. This can increase the rumen stomach digestion and subsequently open the nitrogen ring of the urine into the rumen and degrade the nitrogen microbial. Urea entering the rumen is rapidly hydrolyzed by ammonia by bacterial urease, and therefore, the ruminal ammonia concentration can be significantly increased (9, 10).

The results showed that there was a significant difference between the metabolizable protein of the treatments ($P < 0.05$). The ruminants use a different kind of food from the protein single-digest animal, in which part of the feed protein in the rumen is decomposed by microorganisms and simply used to produce a microbial protein. The use of digestibility properties of edible protein is used as the main tool in new systems expressing the value of protein intake (9, 10). The mean of crude protein disappearance and crude protein degradability coefficients of the experimental treatments are listed in Table 2. According to the results, melon (38.13%) and tomato bush (20.93%) had the highest and lowest degree of degradability of the insoluble part (b) in the rumen, respectively. This could be due to high levels of crude protein, which has led to the growth of microorganisms and increased protein degradation. Moghaddam (9) reported that the soluble crude protein content at time zero (a), the fermentable crude protein (b), and the constant degradation coefficient in dry leaf grapes leaves were 34.5%, 32.8% and 0.008% per hour, respectively, which is similar to the values obtained in this study. Potato bush shows less protein degradation due to higher ADF values than strawberry bushes.

Table 2. Means of crude protein degradability coefficients of feeds by incubation at different times in the *in-situ* method (% DM).

Treatments	CP	Degradation coefficients			
		a	b	c	ED
A	8.6b	19.59a	33.58b	0.61c	56.52a
B	10.24a	16.99b	20.93d	1.02a	37.51c
C	9.06b	14.91c	38.13a	0.89b	52.19b
D	5.63c	10.59d	24.42c	0.6c	33.95d
SEM	0.354	0.427	0.458	0.039	1.82

a=Crude protein solution at zero time (%), b=Fermentable material (%), c=Constant degradability coefficients at time t (%/h), ED=Effective degradation (The passage of time r=0.02), SEM= Standard error means. A: potato bush, B: tomato bush, C: melon bush and D: strawberry bush, SEM= Standard error means.a,b,c = Within a column, means without a common superscript letter differ (P< 0.05).

According to the results of this study, potato plant (19.59%) and strawberry plant (10.59%) had the highest and lowest amount of crude protein solution at time zero (a), respectively. Also, the amount of potato plant part b was higher than strawberry plant, which was statistically significant (P <0.05).

This can have two reasons: firstly, the amount of ash in potato plants is higher and, conversely, less organic matter. Secondly, the total amount of phenolic compounds and tannins and the degree of decomposition of these anti-nutrients in potato plants are more than strawberry bush. This can prevent the activity of protein degrading microorganisms and inhibit protein degradation. Yanez Ruiz et al., (18) reported that the values of the degradability coefficients a, b, and c and the effective degradability of olive leaves in goats were 12.8%, 24.4% and 0.016, ratio/hours and 22.4%, and in sheep, respectively, 14.0%, 00 / 5% and 106/0 ratio/hours and 18/0% respectively .The test data in goat was similar to the values of this experiment, but the sheep test data was less than the values obtained in this study. In the study of Mansuri et al., (6), the values of the decomposability coefficients of alfalfa hay protein (b = 162.206 and a = 16.499), wheat straw (a = 60.550, a = 7.006) and herbaceous gland (489 / 38 = b and 122/33 = a) have been reported which does not match the data from this study. This difference can be due to differences in the variety of scorpions used in the experiment, the different climatic conditions, and also because the livestock used in the present study are male bovine sheep, this factor can also be the source of some differences (10).

In all periods of incubation, the degradability of the potato plant is more than the strawberry bush. The CP digestibility of the treatments decreases with increasing potato plants, tomatoes, melons and strawberries in the diet, which may be due to the effects of tannin in the protein content of feed and rumen microorganisms. Tannins are bonded to proteins and reduce the availability of proteins for rumen microorganisms (3). Hagerman et al., (4) reported that tannins reduce protein digestibility. In another study, McNeill et al., (7) showed that with increasing tannin content in the diet (from 6 to 65 g / kg dry matter), the nitrogen digestibility decreased from 0.805 to 0.378 and the nitrogen excreted in the sheep's stool rises from 4.3 to 7.9 grams per kilogram of dry matter.

The results show a significant reduction in the nitrogen digestibility by providing tannin, which is consistent with the reported results for cedar leaf-fed sheep (17) and the leaf of the cedar tree with Ray Grass (16) with and without polyethylene glycol. It is also assumed that the he reduction in nitrogen digestibility may be due to a decrease in protein digestion (15). The digestibility of NDF and ADF in the diet decreased with increasing percentage of dry strawberry plant ($P < 0.05$).

Stienezen et al., (14) showed that polyethylene glycol caused a significant increase in the relative concentration of ruminal ammonia in sheep receiving tannin (258 μmol / ml versus 155 μmol / L) and increased nitrogen digestion from 0.631 to 0.776 ($P < 0.001$).

They showed that the excretion of nitrogen concentrations in sheep receiving tannin was much higher than those that received polyethylene glycol. In summary, the results showed that tannin and phenolic compounds reduce the digestibility of CP. Available reports suggest that tannins and phenolic compounds are considered as nutritional agents due to the low nutritional value of these products (9, 10).

Conclusion

In conclusion we could demonstrate that the significant differences were observed in the crude protein degradability at different hours of incubation, between potato, tomatoes, melons and strawberries. The tomato bush had the highest metabolizable protein and the strawberry bush had the least metabolizable protein. According to the results of this study, it is clear that cultivated plants that are disposed of as agricultural wastes have high digestive potential and in the case of further information, they can be used as an alternative feed in the ruminant diet. In addition to reducing the costs of keeping livestock, it avoids environmental pollution, improves soil fertility and prevents the accumulation of agricultural waste in rural environments.

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