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Potential role of dietary pomegranate seed powder (PSP) (Punica granatum L) and / or saccharomyces cerevisiae (SC) in some productive aspects of Local male lambs

By

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Abstract

This study was conducted to find out the effect of adding pomegranate seeds pomace (PSP) and Saccharomyces cerevisiae (SC) to the diet of local lambs on some productive traits. (body weight, ,final weight, ,weight gain, feed intake, feed conversion coefficient, and economic feasibility) It inducted in animal field of veterinary medicine college Baghdad university and lasted for the period between 12/1/2022 and 12/6/2022, used 20 lambs at 2–3 months of age grouped in four groups G1 as control group fed concentration diets 2.5% of body weight with wheat straw and alfalfa ,G2 fed same ration and 3% dried pomegranate seed pomace powder (PSP),G3 fed same ration and 4% PSP with 3g of Saccharomyces cerevisiae (SC), water supply at libdum. Lambs are weighed monthly to measure some productive traits (live body weight, total and monthly weight gain, total and monthly feed intake, feed conversion coefficient (FCC), and economic feasibility). The administration of PSP and SC with diets revealed statistically significant differences ($P < 0.05$) and a remarkable effect between treated and untreated groups for all productive aspects in some periods of the experiment compared to the control group, implying that using PSP and/or SC to treat groups could contribute to improving some productive traits in male lambs

Keywords: dietary pomegranate seed powder (PSP); saccharomyces cerevisiae (SC); live body weight; feed conversion coefficient (FCC) economic feasibility.

Introduction

Ruminants, in particular, have a remarkable ability to consume fiber due to their rumen microbes. This means that these by-products can essentially replace grains,.(Mirzaei-Aghsaghali et al., 2008), As a result, nutritionists and microbiologists have focused their efforts on improving feed consumption and ruminant production efficiency by manipulating the rumen microbial community, Dietary addition and probiotic (bacterial and yeast cultures) are primarily employed to increase rumen activity, and feed efficiency.. (Dawson, 2002).

Sheep farming is near the top of the animal production food chain. It is a vital component of national wealth because it is used to prepare a variety of foods, including red meat, milk, and wool production (Wiedemann et al., 2019). The rise in the population necessitates a sufficient supply of food. As a result, it is generally established that any endeavor to boost production must first improve the feeding system. Today, Nutritionists classify feeds based on their chemical make-up and the makeup of their various parts when

balancing meals that provide nutrients required for the growth and maintenance of microflora in the rumen (Rachid et al. 2019).

Feed additives are very important because they contribute to overall nutrition optimization and the welfare of animals, as well as providing a certain standard of quality of product. also Various research groups are investigating the efficacy of various vitamins, vitamin-like compounds, essential fatty acids, probiotics, and nutraceuticals in enhancing animal production effectiveness, metabolic balance, and nutritional status.Ameen and Rabea (2006)

The growth in the production of animal feed and the use of diverse feed materials has led to the discovery of new materials that may be used in feed components of animal feed to increase animal productivity and optimize feed nutrient consumption. (Jadoh, 2020).

To lower animal production feed costs, it may be advantageous to replace imported feedstuffs with locally produced feedstuffs, as long as the nutritive value of the alternative feedstuff is understood, Like fruit by- products and some yeast (Alhomidy et al., 2011).

One of the fruit by-products used in animal feed is pomegranate (Punica granatum L.) has gained popularity in recent years due to its nutritional and medical benefits, as well as its attractive appearance. It is also used for pharmaceutical applications due to medicinal benefits (Bellini et al., 2010) Reducing the effects of oxidative stress in particular **(Aljebori et al., 2017)**. Pomegranate and Derivatives have a wide range of therapeutic and pharmacological properties, including prebiotic benefits. (Tomás-Barberan and Espin ,2019) and antioxidation effect (**AL-Okaily et al ,2015**) this reason, pomegranates are used to improve body weight (Jandel, 2021).

Because it has many medical and antioxidation effects (Mahdi and Yousif, 2019), recent research on the effects of Saccharomyces cerevisiae (SC) as feed additives has piqued interest (Potter, 2019), but previous and recent studies have yielded mixed results.These discrepancies can be attributed to a variety of factors, including feeding levels (Hassan and Salim, 2009), protein degradation and levels (Hassan and Saeed, 2013), and the ratio of concentrate to forage (Ali and Göksu, 2013). The nutrient composition of the food and the quality of the forage, the quantity of yeast added, and the kind and amount of viable yeast (El-Saady et al., 2009).al so Adding Saccharomyces cerevisiae to lambs' feed improves reproductive performance despite little changes in production traits and blood parameters. (Ismaeel, et al 2019).

The goal of this study was to tind out how dietary pomegranate seed pomace(PSP) mixed with Saccharomyces cerevisiae SC affected several productive features in local male lambs.

Materials and Methods

This experiment was carried out in the animal farm of the University of Baghdad's College of Veterinary Medicine. The experiment lasted from January 12, 2022, through June 12, 2022. A reputable and well-known source provided twenty local-bred male lambs weighing 17.50 kg and aged 2 to 3 months. Lambs were placed into four groups, taking into account the live weight of lambs each with a single pen measure 2.5 x 4 m. All pens were furnished with cans to use for concentrate and forage diets at the same farm. Before the experiment began, clean, fresh water was always available.

Animal feeding

1- The first group (G1), which served as the control group, received concentrated feed at a ratio of 2.5 percent of body weight together with fresh alfalfa and wheat straw.
2- The second group (G2) was fed on the same ration as the first group, and 3% of the dried and crushed pomegranate seeds powder (PSP) were added to it with the concentrated ration.
3- The third group (G3) was fed on the same diet as the control group with the addition of 4% of the dried and crushed pomegranate seeds powder and 3 gm of bread saccharomyces cerevisiae (SC) per head daily with the concentrated diet.
4- The fourth group (G4) fed on the ration of the control group, in addition to 6% of dried and crushed pomegranate seeds powder (PSP), and 3 gm of saccharomyces cerevisiae (SC) bread yeast for each head daily added to it with the concentrated ration, With the concentrated ration.

The PSP were obtained at a local market as aby-product, and SC as Baker's yeast powder are used.

Body weight (kg/month) on a monthly basis.

To evaluate the change in body, weight the total growth and the final weight, during the trial period, all animals were weighed monthly using an animal balance.

Feed intake and feed conversion ratio and economic Feasibility

The concentrated diet was given twice daily, with wheat straw added about an hour before the following day's offering. Before the offering the following day, refusal diets were gathered and reweighed.

The quantity of concentrated diets supplied to each lamb was modified monthly based on body weight gain to ensure that the consumption was around 2.5 percent of the reported live weight (LBW), though the given wheat straw was balanced by the previous day's intake. (Abed, 2019).

An animal balance was used to weight lambs on a monthly basis. Feed intake was monitored on a daily basis, and the feed conversion coefficient (FCC) was calculated as follows:

FCC = total feed intake (kg) / total LWG (kg) (Ensmingar, 1980)

The economic feasibility

Economic feasibility of raising newly weaned lambs in two periods, namely, rearing for a period of three or five months, was compared by calculating the costs of purchasing lambs, fodder costs, and other administrative matters in the field, and then according to the selling price of lambs on the basis of live weight. The economic feasibility of all groups was calculated and compared between them, according to the following equation.

Economic feasibility= Net revenue/ total cost (El-Elaime ,2021)

Statistical analysis

Statistical analysis of data was performed using SAS (Statistical Analysis System - version 9.1). One-way ANOVA, two-way ANOVA (SAS, 2010.) and Least significant differences (LSD) post hoc test were performed to assess significant differences among means. $P < 0.05$ is considered statistically significant. (Sorli,D. 1995)

Results

Body weight (BW) Kg/ month:

The weights of the lambs have increased significant (P<0.05) in all groups of the experiment with the progress of experiment period and The weights of the lambs of the 2nd , 3rd and 4th groups were significantly (P<0.05) superior to the control group in the 4th and 5th month of the experiment. Table 1

Monthly weight gain Kg:

The lambs of the G2 ,G3and G 4 group were recorded highly significantly (P<0.05) superior in the total weight gain and monthly weight gain compared with control group (G1) from the 4th month until the end of the experiment period as shown in Table 2.

Feed intake kg

The amount of feed intake increased significantly (P<0.05) in the collection of the totals with the progression of the experiment period. while there was no significant (P>0.05) difference in the amount of feed consumed per month and the total feed consumed among the experimental animals. Table 3

Food conversion coefficient (FCC) Kg

The feed conversion coefficient (FCC) in lambs of the G2, G3, and G4 groups improved significantly (P<0.05) in total FCC compared with lambs of the control group(G1) also in monthly FCC of the G2, G3, and G4 groups groups improved significantly (P<0.05) compared with lambs of the control group from 2nd month to the end of the experiment periods) as we see in the table 4.

The final body weight kg:

The lambs of the 2^{nd} , 3^{rd} and 4^{th} groups were significantly (P<0.05) recorded higher final weight than lambs of the control group (G1). Table5

6. Economic feasibility /ratio

There are significant(P<0.05) superiority of the G2, G3 and G4 groups over the control group G1 in the percentage of economic feasibility in the fattening period of 3rd and 5th months, while the economic feasibility of total fattening lambs for five months was significantly(P<0.05) superior to fattening lambs for three months in all experimental groups. Table 6

Discussion

Body weight (BW) Kg/ month

The superiority of the weights of the (G2) , (G3) and (G4) groups compared with control group may be due to the effect of Pomegranate seed powder, according to chemical analysis, includes a wealth of nutrients relative to its value as a waste material, including fibres, carbohydrates, protein, fat, and minerals, (El-Hamamsy and El-Khamisi,2020) as well as thiamine , riboflavin, ascorbic acid, retinal, and tocopherol (Rowayshed et al., 2013), that were thought to be the ideal feed component for the digestion of ruminants. It agrees with Yulistiani et al., (2015), So pomegranate seeds contain a moderate percentage of tannin compounds (Sadq et al. 2016), as tannin acts as a protective substance for protein, delaying its decomposition in the rumen and increasing its flow to the abomasum and small intestine where it is digested by enzymes, distinguishing it from absorbing amino acids and

leading to an increase in animal weight (Saeed, et al 2017). the weight gain may be the result of improving the nitrogen balance in the rumen, which leads to a decrease in the loss of nitrogen in the form of ammonia gas (Hussein, 2012), or due to the improvement of the rumen environment and the increase in the formation of microbial protein, which is an important source of protein in ruminants and ultimately leads to an increase in protein synthesis and an increase in body weight (Abarghuei et al., 2013) and increase the blood protein **(Ali, and Al-Okaily,2016**) finally increase in body weight. Our results are consistent with the results of Jandal, (2021); El-Elamie, (2021) and Jadoh, (2020)

Adding saccharomyces cerevisiae to the diet of newly weaned lambs, which still have a primitive rumen, helps the development of the rumen structurally through the development of villi and the growth of the natural flora in the rumen, thus stimulating feed consumption and activating the processes of fermentation and absorption of nutrients. This ultimately leads to increased growth and development of lambs, and, as a result, weight gain (Chaucheyras et al. 2005).

The positive effects of adding saccharomyces cerevisiae (SC) on young ruminants through weight gain, increase in feed consumption, increase in animal length and width, and improvement of the rumen functionally and structurally, , which leads to an increase in the weight of the animal. Chaucheyras-Durand et al. (2008)

The properties of Saccharomyces cerevisiae (SC), which act as a probiotic by improving metabolic processes in the rumen and thus increasing weight, weight gain and growth, in lambs (Milewski et al., 2013).

As such, SC has a positive effect on muscle development and weight gain without the occurrence of excessive fat in the carcass, (Milewaki ,2009) this interpretation agrees with (Dobicki et al. 2005), Kewan et al. (2021) and Mahdi, (2020)

Monthly weight gain Kg:

The superiority of the lambs of the (G2) ,3 (G3) and (G4) groups in the rate of monthly weight gain at the expense of the control group may be attributed to the components of pomegranate seeds from effective nutrient component that preserving cells from harmful oxidation, as well as the presence of good amounts of fatty acids that have a positive effect on the processes of digestion and absorption of nutrients from carbohydrates, proteins, and free amino acids, and all of these can lead to an increase in muscle building and an increase in body weight, and this results come agree with (Jadoh , 2020).

or to the positive effect of tannin found in pomegranate seeds pomace powder(PSPP), which is beneficial in low concentrations and harmful in high concentrations (Al-Haris, 2021)., which leads to improvement of animal health in general (Yadollahi et al ,2020). In addition to the fact that pomegranates contain vitamins such as vitamin E and C, in addition to other necessary nutrients (Moradi et al ,2020), which act as natural antioxidants protects liver cells from being destroyed and promotes liver health and function **(Al-Okaily and Ali ,2019)**, as well as improve rumen conditions and improve animal health accordingly. The results of the current study agreed with El-Elaime (2021. and Kazemi and Valizadeh (2021).The reason for the significant increase in the rate of weight gain in may be attributed to the action of SC in improving the animal's health condition and increasing its weight (Ahmed and Ibrahim, 2007), because SC increases the coefficient of digestion of feed materials, as it was noticed by (Payandeh and Kafilzadeh, 2007) that there was an increase in the weight of lambs without a change in rates of feed

consumption, Or, the reason may be attributed to the increase in microbial protein synthesis in the rumen by SC, which leads to increased muscle building and an increase in animal weight as a result.(Direkvandi et al. 2020). The results of our current study are in agreement with the results of Al-Shadeedi, et al (2009), mohammed, (2016) and Hassan and Mohammed, (2014).

Feed intake kg

increase the amount of feed intake with the progression of the experiment period as a result of the increase in the weight of the lambs and their age, which leads to an increase in the needs of sustainability and growth (Eligy et al.,2014). These conclusions are consistent with Sultana et al. (2010),, which tannins present in the food of ruminants in general, and its effects may be adverse with regard to the intake of feed and toxic to sheep if it is in high concentrations (Hervás et al., 2003), because its compound passes unchanged to the true stomach and the small intestine later. Also it gives a Negative neural nutrition signals to hunger centers in the brain, so feed consumption decreases and this underscoring with (Min et al., 2003). The results of the current study agreed with Al-Haris ,(2021),and Yaowapaksophon, (2021).

The addition of Saccharomyces cerevisiae(SC) to the diets improves the animal's health condition and that the products of SC fermentation help in good average growth, but the secondary metabolites that are released during the rumen fermentation process, such as phenolic compounds, alkaloids, isoprenoids, and others, (Siddiqui et al., 2012),, As the time increases by feeding on rations to which Saccharomyces cerevisiae(SC) is added, because its produce secondary metabolites , the concentration of secondary metabolites increases and they have effects on the feeding process (Das and Das, 2015), as it can have a negative effect on eating the ration (Forbey et al., 2009), , The results of the study agreed with Abed, (2019), Kewan et al., (2017) and Gloria-Trujillo et al., (2020),

Food conversion coefficient (FCC) Kg

The value of the feed conversion coefficient(FCC) increased significantly in all groups with the progression of the experiment period, and this is consistent with what was mentioned (Sultana et al., 2010), which indicated an increase in the amount of feed intake from lambs to produce meat with the increase in the age of the lambs, and (Devendra, and McLeroy, 1982).

The improvement in the feed conversion coefficient in the treatment groups to which pomegranate seeds powder (PSP) and Saccharomyces cerevisiae (SC to the tannins effect , which work to reduce the fluctuations of the rumen environment by prolonging the stay of the food and water in the digestive system and increasing its digestion coefficient, thus reducing the quantities of feed intake because the absorption of protein in the small intestine (Yadollahi et al., 2020),and (Sadq et al., 2016).

Or it may be attributed to the direct role of SC on the pomegranate seeds by increasing the rates of carbohydrates, protein, fats, and fibers and thus the maximum benefit from the rough forage, which leads to weight gain with the stability of the amount of feed intake. The SC acts as a probiotic (Sánchez-Guerra et al.,2021). SC increases the number of cellulose bacteria that digest fibers (Direkvandi et al.,2020), as SC stimulates the growth and reproduction of cellulose as well as lactic acid bacteria, which leads to an increase in the number of microorganisms in the rumen, which in turn leads to an increase in ammonia and nitrogen absorbed in the rumen (Ghorbani et al.,2002The results of the study agree with Gloria-Trujillo et al. (2020) and Abed, (2019),

The final body weight kg:

The lambs of the 2nd , 3rd and 4th groups, were significantly higher recorded than the control groupG1 in the final live body weight, This could be explained by the favorable impact on body weight of pomegranate seeds pomace powder (PSPP) because they contain nutrients necessary for growth such as carbohydrates, proteins, fats, and mineral elements such as iron, zinc, and others (Rowayshed et al., 2013) or to existing phenols such as tannin, (Makkar , 2003) The results of the current study agree with Sadq et al. (2016) and Moradi et al. (2020),

We can explain the increase in the weight of the living animals as a direct effect of SC in increasing the digestion of fibers by increasing the numbers of cellulose-degrading bacteria and lacto-degrading bacteria, thus increasing the efficiency of feed digestion and, ultimately, increasing the weight of lambs (Al-Abedi et al.,2020), This allows SC to grow flora that consumes lactic acid, thus preventing the concentration of this acid in the rumen and thus preventing cases of rumen acidity (Maamouri et al., 2014), SC affects the increase in the secretion of digestive enzymes in the abomasum and small intestine, converting digested food into microbial protein and increasing the ability of the intestine to absorb (Al- Taie and Altayeb, 2020) The results of the current study agree with (Dávila-Ramrez et al., 2020) and Maamouri and Ben Salem, (2022),.

Economic feasibility /ratio

The G2, G3, and G4 groups achieved a significant ($P<0.05$) superiority in the the G2, G3, and G4 groups achieved a significant ($P<0.05$) superiority in the economic feasibility ratio compared with the control group for the fattening periods of three and five months. The reason it could be attributed to the fact that the weight gain in the three treatment groups was significantly superior to the control group, the reason is due to the effect of adding pomegranate seed (Moradi et al., 2020 and Jadoh, 2020) and saccharomyces cerevisiae (Kewan et al. 2021; Mahdi ,2020), which leads to improved growth and weight gain of the animal

A significant ($P<0.05$) increase in the economic feasibility of fattening newly weaned lambs for a period of 5 months compared with fattening lambs for a period of 3 months and within the same environmental conditions and ring management, as the Economic feasibility of fattened lambs for the period of 5 months was (1.19 ± 0.04) compared with the of Economic feasibility of obese lambs for the period of 3 months (0.97 ± 0.03). and this may be attributed to the weight gain of the lambs in the last two months, which was much greater than the weight gains in the first 3 months due to the physiological development of the lambs at the age of 5 months being better (Žitnan et al., 1998) and thus the mass increase in the last two months. The animal's muscles increase in weight, and eventually the value of the financial profit resulting from it increases because the price depends on the weight of the live body weight of animal. This result agreement with what was reached (Sultana et al., 2010). who indicated that the best age for marketing sheep from fattening projects is 8 months old.

Table (1) *Effect of dietary (PSP) with or without (SC) on monthly bodyweight (kg) of local male lambs (M±SE)*

months animal/group	zero time	1st month	2nd month	3rd month	4thmonth	5thmonth
G1 (control)	17.50±0.38 D a	19.86±0.09 D a	22.36±0.29 C a	24.60±0.18 BC a	26.86±0.39 B b	29.28±0.45 A b
G2 (3% PSP)	17.56±0.43 F a	20.18±0.45 E a	23.12±0.25 D a	25.70±0.49 C a	29.34±0.99 B a	32.10±0.86 A a
G3 (3g SC+4%PSP)	17.64±0.51 F a	20.44±0.65 F a	23.58±0.36 D a	26.30±0.79 C a	29.44±0.76 B a	32.38±1.02 A a
G4 (6%PSP + 3g sc)	17.52±0.69 F a	22.20±1.06 E a	23.50±1.47 D a	26.98±1.50 C a	30.30±1.70 B a	34.00±1.51 A a
LSD`	2.44					

Means with a different small letter in the same column are significantly different (P<0.05
Means with a different capital letter in the same row are significantly different (P<0.05)

Table (2) *Effect of dietary (PSP) with or without (SC)on monthly weight gain (kg) of local male lambs (M±SE) .*

months animal/group	**1st month**	**2nd month**	**3rd month**	**4th month**	**5th month**	**Total gain**
G1 (control)	2.36±0.42 A a	2.50±0.35 A a	2.24±0.14 A a	2.32±0.51 A b	2.42±0.19 A b	11.84±0.90 b
G2 (3%PSP)	2.62±0.72 A a	2.94±0.59 A a	2.78±0.14 A a	3.64±0.57 A a	2.76±0.05 A b	15.14±1.07 a
G3 (3g SC+4%PSP)	3.00±0.45 A a	3.14±0.82 A a	2.92±0.38 A a	3.14±0.46 A a	2.94±0.43 A a	15.58±0.85 a
G4 (3g sc+6%PSP)	2.70±0.43 A a	3.28±0.73 A a	3.48±0.64 A a	3.32±0.52 A a	3.70±0.26 A a	16.54±1.05 a
LSD`	1.41					

Means with a different small letter in the same column are significantly different (P<0.05
Means with a different capital letter in the same row are significantly different (P<0.05)

Table (3) *Effect of dietary (PSP) with or without (SC) on feed intake (kg) of local male lambs (M±SE)*

months animals / group	**1st month**	**2nd month**	**3rd month**	**4thmonth**	**5th month**	**Total**
G1 (control)	9.40±0.22 D a	13.40±0.28 C a	13.04±0.31 C a	15.90±0.30 B a	17.23±0.33 A a	69.61±3.16
G2 (3%PSP)	9.39±0.24 D a	13.39±0.21 C a	13.62±0.20 C a	15.50±0.16 B a	17.44±0.20 A a	69.32±3.17
G3 (3g SC+4% PSp)	9.43±0.12 D a	13.83±0.15 C a	13.00±0.17 C a	15.65±0.34 B a	17.50±0.38 A a	69.48±3.11
G4 (+3g sc 6% DRGP)	9.11±0.07 E a	13.79±0.15 C a	12.98±0.46 D a	15.62±0.16 B a	17.68±0.26 A a	69.18±3.09
P (VALUE)	0.73					9.48 NS

Means with a different small letter in the same column are significantly different (P<0.05

Means with a different capital letter in the same row are significantly different (P<0.05)

Table (4) *Effect of dietary (PSP) with or without (SC)on food conversion rate (kg) of local male lambs (M±SE)*

months animals /group	1st month	2nd month	3rd month	4thmonth	5thmonth	Total
G1 (control)	3.81±0.03 E a	5.44±0.03 D a	5.87±0.31 C a	6.85±0.31 B a	7.23±0.04 A a	5.80±0.07 a
G2 (3%PSP)	3.71±0.03 D a	4.55±0.05 C b	4.89±0.04 B b	3.85±0.40 D b	6.31±0.04 A b	4.72±0.04 b
G3 (3g SC+4%PSP)	3.16±0.04 D a	4.40±0.01 C b	4.45±0.03 C c	4.98±0.01 B b	5.78±0.04 A c	4.63±0.07 b
G4 (+3g sc 6%DRGP)	3.37±0.07 D a	3.82±0.01 C b	4.18±0.04 B d	4.20±0.04 B c	4.75±0.04 A d	4.05±0.31 c
LSD	0.39					0.50

Means with a different small letter in the same column are significantly different (P<0.05)
Means with a different capital letter in the same row are significantly different (P<0.05)

Table (5) *Effect of dietary (PSP) with or without (SC) on final body weight (kg) of local male lambs (M±SE)*

animals / group	G1 (control)	G2 3% PSP	G34%PSP+3gsc	G46%PSP +3g SC	LSD
Initial weight	17.50±0.38 a	17.56±0.43 a	17.64±0.51 a	17.52±0.69 a	2.44
final weight	29.28±0.45 b	32.10±0.86 a	32.38±1.02 a	34.00±1.51 a	

Means with a different letter in the same row are significantly different (P<0.05)

Table (6). *The economic feasibility of fattening lambs in of the third and fifth month period ratio. (M±SE)*

period / animal groups	3rd month	5th month
(G1) Control	0.17±0.01 B c	0.24±0.005 A b
G2 (3%PSP)	0.24±0.02 B b	0.31±0.01 A a
G3 (3g SC+4%PSP)	0.27±0.005 B a	0.31±0.005 A a
G4 (+3g sc 6%DRGP)	0.29±0.01 B a	0.33±0.01 A a
LSD`	0.03	
Total	0.97 ± 0.03 b	1.19± 0.04 a
LSD	0.1031	

Means with a different small letter in the same column are significantly different (P<0.05)
Means with a different capital letter in the same row are significantly different (P<0.05)

Conclusion

The addition of pomegranate seeds and yeast led to an improvement in the growth of lambs in terms of increasing body weight and the rate of daily weight gain, improving the feed conversion cofficient and raising the economic feasibility..

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