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Evaluation of Some Commercial Food Rations in Terms of Chemical Composition, Methane Production, Net Energy and Organic Substance Digestibility

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A B S T R A C T

The change in living standards in developing countries and the rapid increment in the world population increase the need for plant and animal food. Agriculture and animal husbandry practices become more common day by day to meet the need for food and obtain more products. This situation increases the amount of waste per unit of animal products. Increased animal excrement is associated with greenhouse gas emissions, it harms the environment and animal health. Methane, one of these greenhouse gases, increases poses significant threat to global warming. Today, studies that optimize rumen and animal productivity in order to reduce methane release caused by ruminant animals are among the subjects that attract the attention of researchers. This study is purpose to evaluate the beef rations in terms of chemical composition, methane production, net energy and organic matter digestibility by collecting roughage and concentrate feed mixtures (TMR) obtained from different livestock farms in Niğde province. Thus, for increase the productivity of livestock in small farms in Turkey, the ratios of feed raw materials at the farm scale were determined, and evaluations were made according to the results of the lower and upper limits obtained from the fattening rations. *In vitro* gas production technique was used for gas and methane production of TMR samples. Nutrient contents obtained from different livestock farms Crude Protein (9.58-14.72), Raw Oil (1.89- 2.30), CA (7.64-13.92), ADF (19.77-27.82) NDF (36.71-45.69) Dry Matter (90.48-91.79), methane (CH_4), OMS, NEL and ME values were also different. In the study, it was observed that the ration contents were not calculated according to the age, developmental stage, fattening period and needs of the animal. It was determined that different rations were used in farms even in animal groups with similar characteristics. It can be said that a more economical and profitable animal husbandry can be made by recording the fattening performances of animals such as live weight gain, weight gain at the beginning and end of fattening, feed consumption.

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Introduction

Livestock is an integral part of both our country's and the world's agriculture. In animal husbandry, the effective use of available feed resources is the most important issue in economic animal breeding. In livestock farms, feed covers 60-70 % of the expenses of the farm (Boğa and Çevik, 2012; Pinotti et al., 2021). However, this rate has increased to around 80-85% day by day due to the increase in feed costs. In the region where animal husbandry is made, easy-to-access feed raw materials are generally preferred in order to minimize feed expenses. This situation may cause the ration contents to vary from region to region.

Although the contents of the rations used in livestock farming in our country vary from region to region, it has been determined that there is also variability in the rations of livestock farms located in the same region. For example, there may be differences between the feed ration used by a livestock farm engaged in intensive production in Adana and the feed ration used in Niğde due to transportation to feed raw material. In the emergence of this situation, not only transportation, but also many factors have an effect. Variables such as the animal feed to be used in the ration being grown in that region, its widespread availability, and low prices due to its use as human food may cause the ration content to be different. To be given to the animal; Mixed feed, concentrated feed or coarse-concentrate feed mixtures should be prepared in the form of TMR (total mixed ration), which allows for balanced feeding, in a cost-effective manner and to meet the nutrient needs of the animal (Boğa and Çevik, 2012).

Using the TMR ensures the best possible utilization of the potential of animal feeds. By providing a quantitative mixture of ration raw materials with TMR, the separation and selection of feed are prevented. Thus, it is used as a single food source and is prepared to meet the nutritional requirements of the animal. TMR has a balanced condition rate, for this reason; it reduces eating and positively affects rumination time and therefore rest time (Beigh et al., 2017).

In addition, TMR contributes to more efficient use of ruminal non-protein nitrogen and nutrients as it spreads uniformly in the rumen. (Oelberg, 2015). Thanks to the use of TMR, an ancestral form of animal feeding will be eliminated with the feed raw materials available in the region and which will be easily accessible. In this situation, it can be used in rations due to the decrease in the prices of some products used as human food that are produced locally. The significant differences between the TMRs in terms of ration nutrient contents are due to the change in the use of some feed raw materials such as wheat straw, corn silage, sugar beet pulp, and alfalfa hay in the farms in Niğde. It is also seen that some products used as human food such as apples, potatoes, and cabbage are widely used in animal feeding in Niğde. These feed raw materials are frequently used on farms around Niğde to meet feed costs more cost-effectively and to reduce operating costs. There are significant differences between animal farms in Niğde in terms of feed ingredients, TMR levels, as well asconcentration level of TMRs between the livestock farms in Niğde province. The TMRs used in this study contain different feed ingredients with different nutrient contents.

The ration contents in Niğde are not in the nutritional range recommended by NRC (2000) (Boğa et al., 2020). However, the ADF (acid-insoluble fiber) and NDF (neutral insoluble fiber) contents of TMR samples taken from Niğde province were found to be between 22.79-32.32% and 42.5-52.98%, respectively. Therefore, the fact that the amount of ADF and NDF of TMRs in this region is higher than NRC (2000), causes metabolic disorders such as low milk fat, acidosis and foot ulcers in farms in Niğde. Likewise, due to the high content of ADF and NDF in TMRs, the nutrient intake required by the animals is not sufficient and it is estimated that a decrease in meat quality may be observed with the prolongation of the fattening performance and duration. Although the increase in ADF consumption decreases the digestibility of dry matter, it also affects rumen pH, acetate, propionate, butyrate ratio, and rumen ammonia level (Santini et al., 1992). NEL (net energy lactation) and OMS (organic matter digestibility) decrease with increasing NDF or ADF content in TMRs (Boğa et al., 2020).

Likewise, when the ratio exceeds 25% NDF, there is a decrease in dry matter intake (Allen and Grant, 200). Therefore, the NFC (starch content) of TMRs should be between 23.9% and 34.1%, as having a high NDF content of TMRs will lead to reduced feed consumption and thus a decrease in yield.

When we examine the different roughage used in TMR; Wheat straw, corn silage, sugar beet pulp, potato, bean straw, alfalfa straw, barley straw, corn straw are widely used, while barley wheat and oat grain are used as an easily digestible nutrient. It is estimated that each of the feed raw materials used in this ratio will have positive or negative effects on the nutrient content in terms of their rates and usability. The aim of this study is to give information about the nutrient composition, methane production, NEL and OMS content of some commercial fattening rations. There may be differences in methane release, *in vitro* gas production, NEL and OMS values of TMRs due to ration differences on the farm basis. This difference in rations generally varies depending on the farm location, the price of feed raw materials, the education level, and the experience of the farmer.

It is required that the ration content is prepared in the most economical way and in an amount sufficient for the nutritional needs of the animal. If the nutritional needs of the animal cannot be met, it causes many problems such as prolongation of the fattening period, decreased performance, metabolic diseases, and thus economic losses in beef cattle. In this study, the conditions of meeting the needs of the animals were examined by looking at the optimization of the rations taken from different farm environments in Niğde In the study, it was ensured that the mistakes made in livestock activities in Niğde were determined and this situation was eliminated by comparing it with the NRC. The ration ratios to be taken from different breeding farms were determined, the rations were ground in the laboratory environment, and the nutrient analysis of the TMR samples was made and compared with the NRC. The gas and methane production in TMRs will be evaluated in terms of NEL and OMS and will reveal the positive or negative situations between farms. According to the findings obtained from the research, in order to increase the productivity of livestock on small farms in Turkey, the ratios of feed raw materials were determined on a farm basis, and the lower and upper values obtained from the fattening rations were also determined.

Materials and Methods

Animals

The rations used in the study were obtained from cattle fattening farms located in different locations in Niğde. It is stated that these farms are at the beginning of the first 4 farms, and the 5th farm is at the end of the fattening, and the average live weights of these farms consist of animals with a live weight of 300-350 kg and 500-600 kg, respectively.In order to determine the in vitro gas and methane gas production amounts, metabolic energy (ME), net energy lactation (NEL) and *in vitro* organic matter digestion degree (IVOMSD) values of the ration samples, rumen fluid that was obtained from rams that were freshly slaughtered from at the slaughterhouse was used. Rumen fluid taken from 3 rams (2 years old) consuming dried alfalfa hay (60%) and concentrated fodder (40%) before the animals were slaughtered was brought to the laboratory without delay and analyzed on the same day. In the present study, rumen fluids obtained from the rumen of newly slaughtered animals were used.

Table 1. Feed raw material ratios used in the ration in different breeding farms

Different fattening farms	Feed intake /day (kg asfed)	Feed raw materials	Quantity kg	%	Rough/Low rate (%)
1. Farm	9.75	Wheat straw	1	10,26	
feed intake/day		Clover	4	41,03	
		Corn silage	0.84	8.62	
		Sugar Beet Pulp (SBP)	0.41	4.21	
		Concentrate feed	3.5	35.90	64.10
2. Farm	10.4	Concentrate feed	5.5	52.88	
feed intake/day		Cottonseed meal (CSM)	0.92	8.85	
		Peanut straw	0.36	3.46	
		Wheat Straw	3.22	30,96	
		SBP	0.4	3.85	38.27
3. Farm	9.75	Barley paste	0.4	4.10	
feed intake/day		Wheat bran	0.4	4.10	
		Wheat straw	0.5	5.13	
		Corn silage	0.25	2.56	
		Clover	3	30.77	
		Concentrate feed	5.2	53.33	38.46
4. Farm	8.97	Clover	0.58	6.47	
feed intake/day		Peanut straw	1.16	12.93	
		Wheat straw	1.55	17.28	
		SBP	0.84	9.36	
		Wheat bran	0.97	10.81	
		Concentrated feed-calf rearing	1.94	21.63	
		Concentrated feed-fattening starter	0.97	10.81	
		Barley paste	0.38	4.24	
		Oatmeal	0.58	6.47	39.58
5. Farm	14.5	Concentrate feed	5	34.48	
feed intake/day		CSM	1	6.90	
		Wheat bran	1.5	10.34	
		Wheat straw	3	20.69	
		Clover	1.5	10.34	
		Peanut straw	1.5	10.34	
		Wheat bran-sieve	1	6.90	41.38

Table 2. Nutrient content of the rations in different farms (%DM)

Beef Farms	DM	CA	ADF	NDF	CF	CP
1	91.79[a]	12.49[b]	24.63[b]	39.77[c]	2.02	13.85[b]
2	91.79[a]	13.92[a]	27.82[a]	45.69[a]	1.89	9.58[d]
3	90.48[d]	12.14[b]	19.77[d]	36.71[d]	2.25	14.72[a]
4	91.45[b]	7.64[d]	21.64[c]	41.70[bc]	2.28	11.42[c]
5	91.03[c]	9,92[c]	23.90[b]	43.30[ab]	2.30	11.40[c]
SEM	0.066	0.183	0.544	0.771	0.168	0.056
Shallow	0.000	0.000	0.000	0.000	0.386	0.000

DM: Dry matter; CA: Crude ash; CP: Crude protein; CF: Crude fat; ADF: Acid-insoluble

Table 3. Gas production parameters and methane value (%) of rations taken from different farms

Beef Farms	Methane %	TDS	PF	MY	EMP	OMS	ME	NEL
1	19.62[eu]	349.64[a]	3.96[a]	155.49[a]	44.43[a]	60.83[b]	7.22	5.18[a]
2	18.49[c]	298.18[c]	3.77[b]	123.83[c]	41.52[b]	58.09[d]	7.16	5.11[b]
3	20.09[a]	339.47[a]	4.04[a]	154.67[a]	45.55[a]	61.36[a]	7.23	5.22[a]
4	19.00[bc]	339.59[a]	3.69[b]	137.19[b]	40.39[b]	59.13[c]	7.21	5.17[ab]
5	19.93[a]	319.95[b]	3.76[b]	132.39[bc]	41.37[b]	59.32[c]	7.23	5.21[a]
SEM	0.292	4.527	0.052	3.950	0.748	0.091	0.018	0.019
Shallow	0.00	0.00	0.00	0.00	0.00	0.000	0.13	0.01

TDS: Truly digested substrate; PF: Partitioning factor (PF24); MY: Microbial protein (MP); EMP: Efficiency of microbial protein; OMS: Organic matter digestibility; ME: Metabolic energy; NEL: Net energy lactation; SEM: Standard error of mean; P: Probability; a–eu: The differences between the means indicated by different letters in the same column are statistically significant ($P<0.05$).

Diet Preparation and Animal Feeding

TMR samples were collected from five different breeding farms in Niğde. The ration contents used in the experiment are presented in Table 1. The selection of feed raw materials, usage rate, and roughage/concentrated feed ratio are different from each other on farms. This situation arises due to the lack of technical personnel on ration in the farms, the uniqueness of the feed raw materials to the region and the previous usage habits.

In Vitro Gas Production Technique and Feed Analysis

In the study, ration contents, rough concentrate feed rate, and nutrient samples were taken from five different breeding farms and brought to the laboratory. Then, in the laboratory, feed raw materials were mixed in light of the information obtained from the farms. The obtained TMR samples were dried under shade at room temperature. Dried TMR samples were ground to pass a 1 mm sieve, ration contents were prepared, and the samples were stored in airtight plastic bags for nutrient analysis and *in vitro* gas production. Dry matter (DM), crude ash (CA), crude protein (CP), and crude fat (CF) contents of TMR samples were determined according to AOAC (1990). Cell wall (NDF and ADF) contents of TMRs were determined respectively according to Van Soest and Wine (1967) and Van Soest (1963). All chemical analyzes were performed in triplicate. TMR samples were dried in an oven at 55°C for 48 hours and the nitrogen-free extract (NFE) values were determined by calculation, as reported by Van Soest et al. (1991). After the chemical composition was determined in the laboratory, the grinding process was carried out. For each prepared farm, DM (AOAC, 2000), CP (AOAC, 2000), and CA (AOAC, 2000) analyzes were performed in TMR. ADF (AOAC, 2000;), NDF (AOAC, 2000;), CC (AOAC, 2000) analyzes were performed by using the ANKOM 200 Fiber Analyzer (ANKOM Technology Corp. Fairport, NY, USA) as reported Van Soest et al. (1991). CF content (AOAC, 2000) was determined by using ANKOM XT15 (ANKOM Technology Corp. Fairport, NY, USA). OM, cellulose (CEL= NDF-(HC+ADL), hemicellulose (HC= NDF-ADF) and non-cellulose carbohydrate (LOK= 100-(CP+CA+ADF+CF), NFC (NFC= OM- (CF+CP+CC) contents were determined by calculation. Ammonia analysis was made with samples taken from the rumen fluid content obtained as a result of 96-hour incubations. *In vitro* gas production technique (IVGU) was applied to determine the total gas content of the feeds. (Menke et al., 1979; Menke and Steingass, 1988; Blümmel and Ørskov, 1993).

Application of in Vitro Gas Production Technique

In vitro methods, which can be done in laboratory conditions, can get results in a short time, can be applied easily and have lower analysis costs, have been used in recent years to determine the nutritional values of ruminant feed (Canbolat, 2006). Gas and methane production of TMR samples were determined using the *in vitro* technique. The rumen fluid obtained from the slaughterhouse was transferred to the thermo bottle and after washing with CO_2, it was passed through a four-layer cheesecloth and the buffer solution was combined at a ratio of 1:2 (V/V). 40 ml of buffered rumen fluid was transferred into syringes containing four units of TMR samples (0.5 grams). To obtain cavities, 40 ml of buffered rumen fluid was transferred to four syringes without TMR samples. All syringes were incubated in a water bath maintained at 39°C for 24 hours. Gas and methane production were determined from syringes containing TMR samples to determine net gas production at 24 hours of incubation.

The effects on animals were determined by *in vitro* digestibility. Gas production parameters and pH values were determined because of OMS, ME, and NEL values and 96 hours of incubation. The feed sample, which was ground to pass through a 1 mm sieve, was weighed at approximately 250 mg of dry feed in the air (200 mg of DM) and placed at the bottom of the injector. Just before the rumen fluid was taken, it was prepared by mixing 0.1 ml of micro mineral solution, 200 ml of rumen buffer solution, 200 ml macro mineral solution, 1.0 ml resazurin solution, and 40 ml reducing solution in 400 ml pure water and kept in a water bath at 39ºC with CO_2. Rumen fluid was taken from the animals just before feeding, filtered through two layers of cheesecloth into a 2-liter erlenmeyer, heated at 39ºC and fed with carbon dioxide. In addition, serial transport was carried out to the laboratory in a thermos to maintain the temperature. One part of the rumen fluid was mixed with two parts of the medium and carbon dioxide gas was continuously introduced into the mixture. 30 ml of the rumen fluid medium mixture was added to each syringe.

Incubations were started in the morning and readings were taken at the 3rd, 6th, 9th, 12th, 24th, 48th, 72nd and 96th hours. However, pH values were also determined in the liquid remaining in the syringes after 96th hours of incubation. Gas production parameters were calculated according to the model below with the help of the PC package program called NEWAY (Ørskov and McDonald, 1979).

$$Y = a + b\ (1\text{-}e\text{-}ct)$$

Where;

- a: Gas amount formed from an immediately soluble fraction (ml)
- b: Gas amount formed depending on time (ml), c: gas production rate
- a + b: Potential gas production (ml), t: incubation time (hour)
- y: “t” represents the gas production time**.**

The organic matter digestibility (OMS, %), gas production amount at 24 hours (GP), crude protein (CP, g/kg DM), and CA (g/kg DM) were determined by this formula (Menke et al., 1979). Calculated using this formula: GP = 24th hour net gas production (ml / 200 mg); CP = Crude protein (%), CF: Crude fat or ether extract (%), CA: Raw ash content (%), NEL multiplied by 0.239 to kcal. After 24 hours of incubation of the TMR samples, the methane contents of the produced gas were determined using an infrared methane analyzer by Sensor Europe GmbH, Erkrath. The net gas production of the TMR samples was obtained after correction. NEL (MJ/kg DM) and OMS of TMR samples were estimated using the equation as follows (Menke et al., 1979):

OMS, Concentrated Feeds % = 0.7602 GP + 0.6365 CP + 22.53

NEL, Concentrate feeds (MJ/kg DM) = 0.075GP + 0.087CP + 0.161CF+ 0.056 NFE-2.422

ME, Concentrate feeds (MJ/kg DM) = 1.06+0.157GP + 0.00884CP + 0.022 CF- 0.0081 Crude ash

Methane production (ml) = total gas production for 24 hours incubation (ml) × Methane (%)

Data Collection and Measurements

In order to determine the nutrient content, OMS, NEL, ME and methane values of the TMR samples, they were tested according to the randomized plot design and their importance levels were determined. The trial model is presented below. A comparison of means was applied in Duncan's multiple comparison test in the SPSS program. The mathematical model of the trial plan obtained from different farms is presented below;

$$Y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + e_{ijk}$$

Where;

Y_{ijk}: The investigated property of the kth group at the j'th ration level of i th farm level

μ : Overall average

α_i: Effect of i'th farm level

β_j: Effect of j'th ration level

$(\alpha\beta)_{ij}$: Effect of interaction

e_{ijk}: Error

Results

The rapid increase in the world population causes many environmental problems such as food shortage, climate change and global warming. Recently, sustainable agriculture and food security have attracted attention because they are closely related to this issue. The increase in the number of agricultural products, especially to balance the increasing supply-demand relationship causes unconscious practices. Since the emission of methane gas released by ruminant animals into the environment cannot be prevented, it is thought that feeding strategies to reduce this emission can prevent the negative effects of human, environmental, and animal health that threaten the atmosphere. Boğa et al. (2020) investigated the metabolizable energy, organic matter digestibility, and methane production of the rations to observe the effects of commercial rations on dairy cattle from 8 different farms in Niğde province. TMRs examined as a result of this study reported that they did not meet the requirements of dairy cattle.

Reducing methane emissions, which are commonly encountered as greenhouse gases, can be possible with proper care and nutrition of livestock. By ensuring this situation, other yield parameters such as animal feed consumption, daily live weight gains, and milk yields can also increase. Because there are harmful gases such as methane formed in the rumen. For the removal of these gases, energy loss occurs in the animal and the efficiency level is adversely affected. In our study, it was determined that the rations used in the breeding farms were different from each other. In the choice of these raw materials, the experience and cost of the breeders in the past years and the ease of availability in the market were considered. However, when the contents of these rations were examined, it was observed that the DMI (dry matter intake) and nutrient contents of the animals were not fully met. At the same time, it is seen that the methane release that the animal will create under rumen conditions tends to be more than under normal conditions. It has been observed that the factors that increase methane release are high, such as the low digestible nutrient content of the ration and the high roughage ratio. For all these reasons, the preparation of the rations and the amount of roughage should be kept in balance, considering the nutrient needs of the animal in animal feeding.

In this study, it is stated that by displaying the precautions to be taken with nutrition, the damage to the environment caused by the methane release in both the region and the country will be reduced, as well as increasing the productivity per unit animal by increasing the performance of the animals.

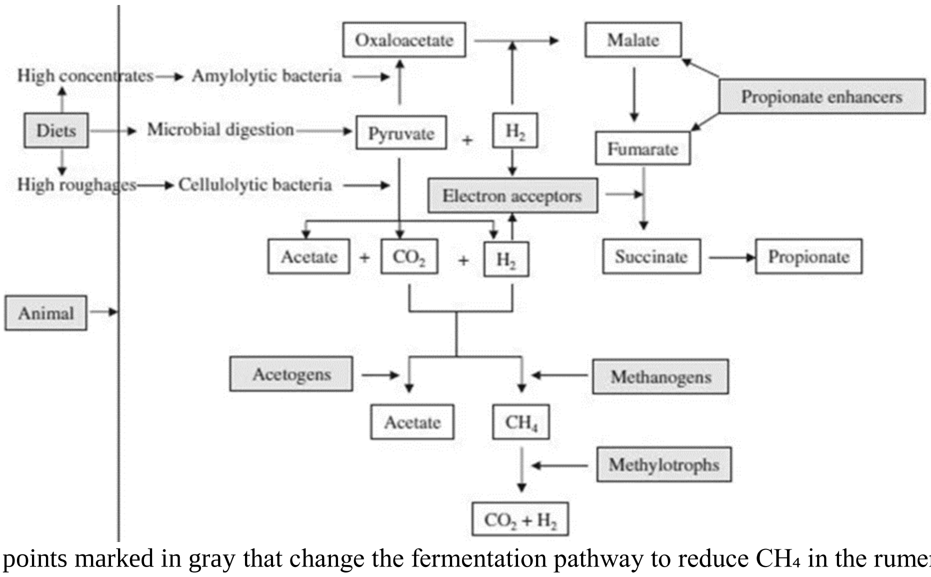

Figure 1. Key points marked in gray that change the fermentation pathway to reduce CH_4 in the rumen with feeding strategies (McGinn et al., 2004; Haque, 2018).

Discussion

Considering that each unit's decrease in feed costs will increase the profitability of the farm, the distance of the feed raw material to the region attracts attention. Therefore, feed raw materials grown in the region, where the farm is located, play an important role in reducing feed costs. Forage in farms in Niğde; wheat straw, corn silage, sugar beet pulp, potato, bean straw, alfalfa straw, barley straw, corn straws are widely used as concentrated feed; barley wheat, oat grain are used.

Fattening farms are common in Niğde Province. Therefore, the nutrient composition and in vitro digestibility of TMRs were evaluated to evaluate the chemical composition, methane production, net energy, and organic matter digestibility of some commercial diets in Niğde province. In Table 3, the nutrient analyses obtained from the feed raw materials given to the animals were made and the values for each different breeding farm are given in the table. Nutrient contents obtained from different breeding farms CP (9.58-14.72), CF (1.89-2.30), CA (7.64-13.92), ADF (19.77-27.82) NDF (36.71-45.69) DM (90.48-91.79) differed from each other ($P<0.05$).

fiber; NDF: Neutral insoluble fiber; SEM: Standard error of the mean; P: Probability; a–e: The differences between the means indicated by different letters in the same column are statistically significant ($P<0.05$).

For rumen microorganisms to function normally, at least 7-8% CP is needed in the diet (Van Soest, 1994). It is also known that the amount of protein needed to maximize microbial growth in the rumen can reach up to 14-15% of the ration DM under certain conditions (Hoover and Stokes, 1991). In the research, it was observed that the CP content was sufficient among the farms. The CP content of the animals not only meets the survival needs of ruminant animals but also contributes to meeting some of the yield share needs.

It is known that the increase in the world population in recent years has increased the industry and energy requirement, and agriculture and livestock applications have also increased depending on the consumption situation. In this case, it affects the change in the amount of methane, causing you to feel the effect of the amount of animal waste and greenhouse gases more. This furthers our problem of global warming.

Agricultural activities account for 50.63% of anthropogenic methane emissions, approximately 95% come from ruminant animals. Methane release mostly corresponds to 5.5-6.5% of the gross energy for cattle, sheep, and goats and is expressed as a loss (Johnson and Ward, 1996). In addition, 2-12% of the energy taken in the diet during ruminal fermentation is lost as methane, thus causing a loss of gross energy in the feed (Johnson and Johnson, 1995; Boğa et al., 2021). Ruminant animals contribute significantly to global warming with methane production. Thanks to the enzymes secreted by the microorganisms in the rumen, the nutrients are taken with the feed and fermented into animal foods such as meat and milk. In other words, consuming carbohydrate sources causes fermentation in the rumen and volatile fatty acids, hydrogen, and carbon dioxide are released (Opio et al., 2013). Various nutritional strategies are being researched to reduce enteric methane (CH_4) release. It has been stated that the use of starch-containing feeds or easily digestible carbohydrates instead of easily digestible fibrous material (ADF, NDF, and CEL) in the diet reduces the production of recesses, and methane (Yurtseven et al., 2009; Weiss and St-Pierre, 2010; Yurtseven, 2013). Strategies such as increasing the ratio grain level, adding fats to the ration, and ionophores (>24 ppm) are among these. It can also be predicted that improved rangeland management, replacing grass silage with corn silage, and using legumes can reduce the release of CH_4, sulfur hexafluoride (SF_6), hydrofluorocarbon (HFC), and perfluorocarbon (PFC) (Haque, 2018). Depending on the degree of feeding strategies and the implementation of these strategies, it can reduce CH 4 emissions by up to 40% (Patra, 2012; Haque, 2018; Kılıç and Boğa, 2021). Important places that change the fermentation pathway to reduce CH_4 in the rumen with feeding strategies are given in Figure 1.

The methane production potentials of some commercial diets and some feeds are evaluated using in vitro gas production technique (Gatechew et al., 2005; Prirondini et al., 2012). As a result, in practice, the rations of cattle holdings in Turkey are not balanced due to the formulation of well-balanced rations, the lack of nutrient analysis, and qualified nutrition consultants on most small farms. There are significant differences in the TMR used by farms, especially in terms of chemical composition. For this purpose, nutrient (CC, DM, CA, CP, NDF, ADF) analyses of rations taken from different fattening farms in Niğde province were carried out. Then the obtained OMS, ME, NEL, and CH_4 values were also compared. Methane (18.49-20.09%), OMS (58.09-61.36%), ME (7.16-7.23), NEL (5.11-5.21) obtained from different livestock farms were found to be different. The highest methane production was observed in breeding farm no.3. It can be said that this is due to an increase in the rumen microbial flora in favor of methane-producing bacteria. Table 3.

Informed Consent

The manuscript is an in vivo research paper experiment using normal density beef cattle in fattening conditions without any stressful treatment for the animals.

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