

Dietary Effect of Ginger and Sodium bicarbonate on growth performance and ruminal fluid of Sheep



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Submitted By:

**Farjana Akter**

Roll No: 16/23;

Reg. No: 01634

Intern ID: 20

Session: 2015-2016

**Faculty of Veterinary Medicine**

**Chattogram Veterinary and Animal Sciences University Khulshi,  
Chattogram-4225, Bangladesh**

Dietary Effect of Ginger and Sodium bicarbonate on growth performance and ruminal fluid of Sheep



Approved by



DR. Priunka Bhowmik

Assistant Professor, Department of Animal Science and Nutrition,  
CVASU

**Faculty of Veterinary Medicine**

**Chattogram Veterinary and Animal Sciences University Khulshi,  
Chattogram-4225, Bangladesh**

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## LIST OF ABBREVIATIONS

Abbreviations	Elaborations
Na <sub>2</sub> CO <sub>3</sub>	Sodium bicarbonate
CVASU	Chattogram Veterinary and Animal Sciences University
FVM	Faculty of veterinary medicine
et al.	et alia (and others)
DVM	Doctor of Veterinary Medicine

## ABSTRACT

The study was conducted to compare the effect of ginger and sodium bi-carbonate on body weight and ruminal fluid condition of sheep. One year old twelve rams having average 12-15kg body weight were distributed into four treatments group with three replication and one ram per each replication in a completely randomized design. The sheep reared 2 months into research shed of Chattogram Veterinary and Animal Sciences University. They offered four different diets; Control (no sodium bicarbonate or ginger powder), T1(1.5 g ginger powder /kg diet), T2(1.5 g sodium bicarbonate powder /kg diet), and T3 (ginger powder 1.5 g + sodium bicarbonate powder 1.5 g/kg diet). Body weight was recorded every fifteen days interval through digital weigh scale. The rumen fluid collected through stomach tube after 1 hour of feeding at the morning after recording body weight of the sheep. Immediately after collection of rumen fluid, went to laboratory for measurement of pH, protozoa, protozoal motility, and other physical properties such as colour, odor, consistency of rumen fluid. Among three times collection of rumen fluid, the final pH was highest in T0 group (control group) which was 5.65 and lowest pH in T3 group (combined diet group) which was 5.23 found. In four treatment group, the odor and consistency of rumen fluid were same which were slightly pungent and viscous in three times. Final colour of rumen fluid was olive green in all treatment group. In final collection of fluid, protozoa is highest in T3 group (combined diet group) and lowest in T0 group (control group). In final weight, lowest body weight was 15.51 kg which found in T0 group and highest body weight was 19.69 kg which found in T1 group. After the analysis of result, we can clearly state that, the combination of sodium bicarbonate and ginger gives best result from other three treatments. The control group gives worst result in all parameters of ruminal fluid as well as growth performance. It was determined that feeding a mixture of 1.5 g/kg sodium bicarbonate and ginger diets will result in overall superior rumen function than providing 1.5 g/kg sodium bicarbonate or ginger diets separately.

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**Keywords:** Sodium bicarbonate, Ginger, Sheep, Rumen fluid, Protozoa.

## CHAPTER I

### INTRODUCTION

Sheep is one of the significant animal types among all small ruminant which is broadly conveyed all through the world (Ahmed et al., 2018). In 2008, the worldwide sheep population remains at 1078.2 million head among of them 19% found in Asia and Africa (FAO, 2008). World sheep population during the period 1961 is 980 million head and in 2000 is 1060 million head. World sheep population during the period 1961-2000 was expanded exclusively by 6.22%. In the meantime, this population during a similar period, in Asia was expanded by 78.3% (Skapetas B and Kalaitzidou M, 2017). Sheep rearing is increasing nowadays in Banglades. Bangladesh has 1.9 million sheep as of now in 2019 (M. Uddin et al., 2019). They are utilized principally for meat (Ahmed et al., 2018). Countries with a long tradition of consuming sheep and goat meat also consume many products, such as hams, sausages and pates, or other processed products. Many of these products correspond to ancient methods of preserving meat at a time when there was no other way of preserving than curing with salts, air drying or smoking (A. Teixeira et al., 2020). As sheep farming needn't bother with a lot space, the landless and peripheral ranchers are raising sheep for extra pay age (S.S. Islam et al., 2020). Moreover, the sheep are considered as tame creatures having capacity of half-yearly lambing and different births (Bhuiyan, 2006). In addition, sheep is milder than goat meat which effectively processes (Ahmed et al., 2018). Sheep don't need a ton of feed and the most significant thing is they don't have a specific feed propensity (S.S. Islam et al., 2020).

Gingers (*Zingiber officinale* Roscoe) are fresh or dried rhizomes of the family Gingeraceae (Yue Yin et.al., 2019). Ginger may be known to exhibit great antioxidant activity as demonstrated in cell culture (Chaiyakunapruk et al., 2006). Ginger is a good source of essential micronutrients, such as potassium, magnesium, copper, manganese and silicon. potassium and manganese help to strengthen the resistance to diseases and protect the heart, blood vessels and the inner wall of the urinary tract. Small amounts of vitamins A, E and some vitamins B and C were also found in ginger rhizomes (Adel and Prakash, 2010). Preliminary studies have shown that nine compounds found in ginger can bind to the serotonin receptor, which may affect the gastrointestinal function

(Botsoglou et al., 2002). In vitro experimental studies have shown that ginger extract can control the amount of free radicals and lipid peroxidation (Al-Amin et al., 2006). The unique smell and taste of ginger is caused by the mixture of gingerone, shagaols and gingerol. The volatile oil of accounts for 1% to 3% of the weight of fresh ginger (Rivlin, 2001). Spices and flavors are referred to have medical advantages like craving and processing energizers, anti-microbial activity, calming activity, hostile to oxidative activity and immunostimulant work on creatures when utilized as feed additive (Faniyi et al., 2016). Ginger can manipulate the rumen microbial fermentation (M. Soroor and M. Moeini, 2014). Rumen microbial population can be controlled by adding ginger as food additives to eliminate or reduce rumen ciliated protozoa (fauna loss), reduce protein degradation and methane production (T. Faniyi et al., 2016). Recently, many researchers have shifted their attention to the use of ginger extracts / dials due to their great potential as alternatives to antibiotics for to manipulate ruminant nutrition and growth. Many studies conducted by different researchers use extracts / flours of certain herbs and spices combined with various techniques to manipulate the microbial ecosystem of the rumen to increase the productivity of ruminants (Geraci et al., 2012, Patra and Saxena, 2010, Benchaar et al., 2008a, Calsamiglia et al., 2007, Jayasena and Jo, 2013).

The addition of ginger powder in sheep resulted in a decrease in total volatile fatty acid (VFA) concentration, but no change in fatty acid compositions, acetate-to-propionate ratio, pH, or ammonia-N concentration (Zhang et al., 2011). Suggested that after 20 days of feeding, the effect of ginger powder in sheep diet lowered overall VFA concentration and that ruminal microorganisms may have adapted and built up a resistance to it (T. Ikyume et al., 2020).

The significant increase in daily body weight gain and final body weight of broilers fed ginger and garlic supports the findings of Demir et al., 2003; Ademola et al., 2005; Javendel et al., 2008) who used herbal plants (ginger and garlic) as growth promoters in broiler diets and saw a significant increase in body weight gain and feed conversion ratio (V. Oleforuh-Okoleh et al., 2014). In comparison to the control group, those who consumed more ginger powder in their diets had lower percentages of abdominal fat, liver, and gizzard (S. Eltazi, 2014). The activity of ginger, which has been documented to have lipid lowering effects, may be responsible for the reduction in the proportion of belly fat in meals supplemented with ginger powder (Sharma et al., 1996).

The ruminal environment of sheep is a complicated, unique environment made out of basically anaerobic microscopic organisms, protozoa, anaerobic parasites, methanogenic archaea and phages. (Mizrahi, 2013). The ruminal microorganisms are created for the most part by three gatherings of anaerobes; by microbes, protozoa and organisms. The population of each gathering and their species are straight forwardly impacted by the kind of feed stuff gave to the ruminant host (Tiago valenty et al., 2016). These microorganisms connect with one another and have an advantageous connection with the host, giving energy from the breakdown of plant cell divider sugars that are generally unpalatable by people (Mizrahi, 2013). The rumen microbes are the most plentiful and assorted gathering of microorganisms in the rumen environment. Overall, they have a huge number of enzymatic exercises (i.e., amylases, cellulases, proteases, lipases) that complete absorption of starch, plant cell dividers, proteins and lipids in the rumen (Sharon A. Huws, 2018). Protozoa can contribute with the greater part of the rumen microbial mass (Van Soest, 1994). Nonetheless, the stream out of the rumen protozoa isn't relative to its number in the rumen. Protozoa are held on account of biomass specifically in the rumen (Williams et al., 2008). Protozoa utilize insoluble proteins as opposed to solvable proteins, while microscopic organisms didn't utilize alkali for amino acid combination (Dijkstra et al., 1998).

### **Objectives:**

1. To investigate the dietary effect of ginger and sodium bi-carbonate on growth performance of sheep.
2. To determine the influence of ginger and sodium bi-carbonate on ruminal environment.



## CHAPTER II

### MATERIALS AND METHODS

#### 2.1. Experimental site:

The experiment was carried out at Chattogram Veterinary and Animal Sciences University (CVASU) from May to September, 2021.

#### 2.2. Collection and preparation of ginger powder:

The ginger bulbs were obtained in good condition from a local store. Then the ginger bulbs were washed, sliced and sun dried. The bulbs were dried in the oven at a 105<sup>0</sup> C. The plant materials were ground after drying with the assistance of an electric grinding machine (Panasonic MX-AC555).

#### 2.3. Experimental animals and diet:

In this study, twelve (12) yearling rams of mixed breeds with an average weight of 12-15 kg were divided into four groups and assigned to four (4) treatment groups, with each animal serving as a replicate. The rams were purchased from a local farm. They had to stay in quarantine for two weeks. During the quarantine period, the animals were given Ivermectin which was used to treat them for ectoparasites and endoparasites. The four experimental diets (Table 1) were Control (basal diet), T1 (basal + ginger powder), and ginger was included in the diet at a rate of 1.5 g/kg; T2 (basal + Na bicarbonate is included in the diet at a rate of 1.5 g/kg diet); T3 (basal + 1.5g/kg ginger + 1.5g/kg Na bicarbonate).

#### 2.4. Table 1: Composition of experimental diets (Kg)

Ingredients	T0	T1	T2	T3
Maize	20	20	20	20
Rice polish	14	14	14	14
Wheat bran	40	40	40	40
Soybean meal	25	25	25	25
salt	0.25	0.25	0.25	0.25
Vit-mineral premix	0.25	0.25	0.25	0.25
DCP	0.5	0.5	0.5	0.5
Ginger Powder	-	0.15	-	0.15
Na <sub>2</sub> CO <sub>3</sub>	-	-	0.15	0.15
Total	100	100	100	100

#### 2.5. Data Collection:

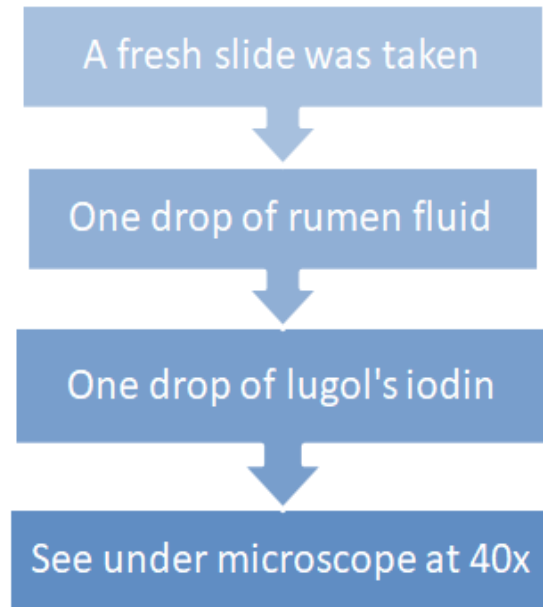
After 21 days later, the rumen fluid was collected by stomach tube insertion. The colour, consistency, odour, pH, protozoal motility, protozoal count were seen immediately after collection of rumen fluid. The rumen fluid was collected for three times and seen these parameters.

The colour, consistency were detected by eye and odour was detected by directly. The pH of rumen fluid was detected by portable pH machine.

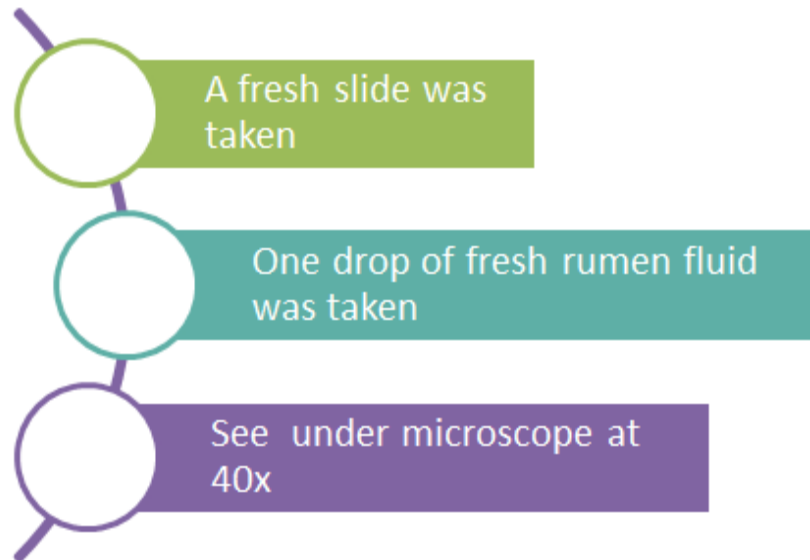
**2.6. Data analysis:** All the data were inserted and compiled using Microsoft excel 2013 and descriptive statistics were analyzed using STATA 13.

**2.7. Laboratory analysis:** In lab, we had done different laboratory test of ruminal fluid such as pH test, rumen protozoa motility test, rumen protozoal count by lugol's iodine.

**2.7.1. Enumeration of protozoa:**



**2.7.2. Determination of protozoal motility:**



## **2.8. Growth performance:**

The body weight was first taken at the day of purchase. The average body weight 12-15 kg. After that, frequently three times body weight is taken. The body weight was taken by a digital hanging weigh scale. The balance was hanging by a rope and the balance had to zero mode. Then the animal hung with the hook by a bag. Then gave time to fixed the balance ,at a time it shows the weight of the animal.

## CHAPTER III

### RESULTS

#### 3.1. Growth performance of sheep fed diet containing ginger

Table 2 shows the growth performance features of sheep supplemented concentrate diets containing Na bicarbonate and ginger powder, as well as their combination. When compared to the control group, the daily weight change in the herb combination increased. In final weight, lowest body weight was 15.51 which found in T0 group and highest body weight was 19.69 which found in T1 group.

**3.1.1 Table 2: Growth performance parameters of sheep**

Parameters	Treatment group			
	T0 group (Mean±SE)	T1 group (Mean±SE)	T2 group (Mean±SE)	T3 group (Mean±SE)
Initial weight	11.18 ±0.82	14.25± 0.42	13.49± 0.75	12.89± 0 .26
15 <sup>th</sup> day weight	12.41 ± 0.59	16.06 ± 0.32	15.36± 0.85	14.64 ± 0.29
30 <sup>th</sup> day weight	14.24±0.39	18.44± 0.39	17.53±0.79	16.87±0.33
45 <sup>th</sup> day weight	15.14±0.32	18.98±0.43	17.60±0.51	17.60±0.49
60 <sup>th</sup> day (final day) weight	15.51±0.30	19.69±0.48	18.26±0.19	18.07±0.74

T0= basal diet, T1= basal diet+1.5gm/kg diet, T2 = basal diet + Na bicarbonate 1.5 g/kg diet); T3= basal diet+ 1.5g/kg ginger + 1.5g/kg Na bicarbonate), SE= Standard Error

### 3.2. Physical examination of rumen liquor

#### 3.2.1. Colour:

Visualization revealed the type of rumen liquor in control group, T1, T2 and T3 group. When rumen liquor from sheep with T1 diet, T2 group and T3 group was compared to that of control group, it was same at first collection which is olive green. At second collection, the colour of rumen liquor was different from before. The colour was yellowish green which was normal. The colour was same in control group, T1 group, T2 group and T3 group. At the time of third collection, the colour was same as before that was olive green.

#### 3.2.2. Consistency:

The consistency of rumen liquor was viscous in control group, T1 group, T2 group and T3 group at first rumen liquor collection. After 15 days later, 2<sup>nd</sup> time rumen liquor collected and the consistency was same which is viscous. 3<sup>rd</sup> time collected liquor also same as before which was viscous and it was normal in sheep.

#### 3.2.3. Odour:

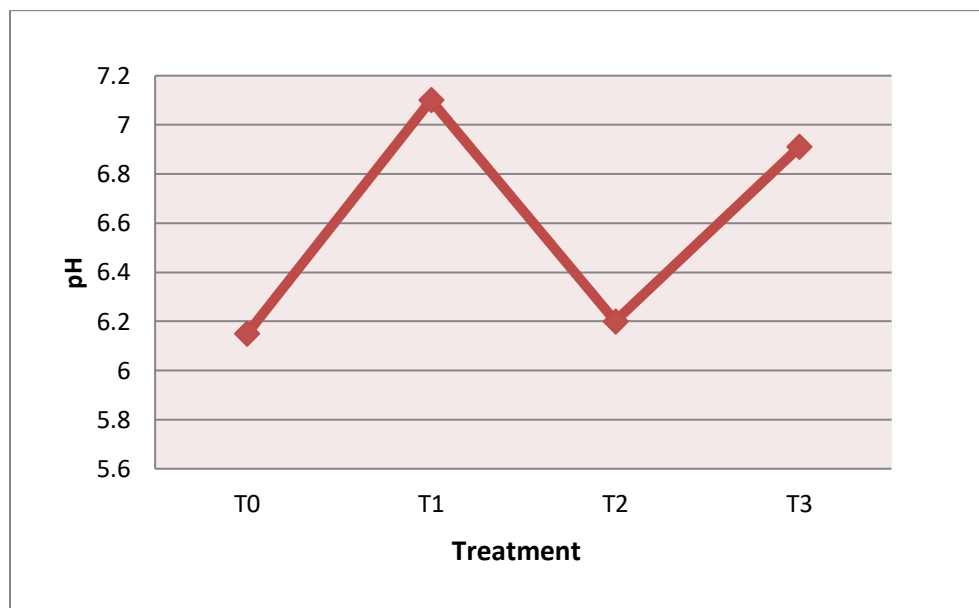
The odor of rumen liquor was slightly pungent of control group, T1 group, T2 group and T3 group. Three times collected the rumen liquor and all time the four treatments group were same as before which is slightly pungent.

#### 3.2.4. Table 3: Rumen fluid parameters

Variables	Treatments	1 <sup>st</sup> collection	2 <sup>nd</sup> collection	3 <sup>rd</sup> collection
Colour	Control	Olive green	Yellowish green	Olive green
	T1	Olive green	Yellowish green	Olive green
	T2	Olive green	Yellowish green	Olive green
	T3	Olive green	Yellowish green	Olive green
	Control	Viscous	Viscous	Viscous

Consistency	T1	Viscous	Viscous	Viscous
	T2	Viscous	Viscous	Viscous
	T3	Viscous	Viscous	Viscous
Odour	Control	Slightly pungent	Slightly pungent	Slightly pungent
	T1	Slightly pungent	Slightly pungent	Slightly pungent
	T2	Slightly pungent	Slightly pungent	Slightly pungent
	T3	Slightly pungent	Slightly pungent	Slightly pungent

### 3.3. Ruminal Fluid pH:

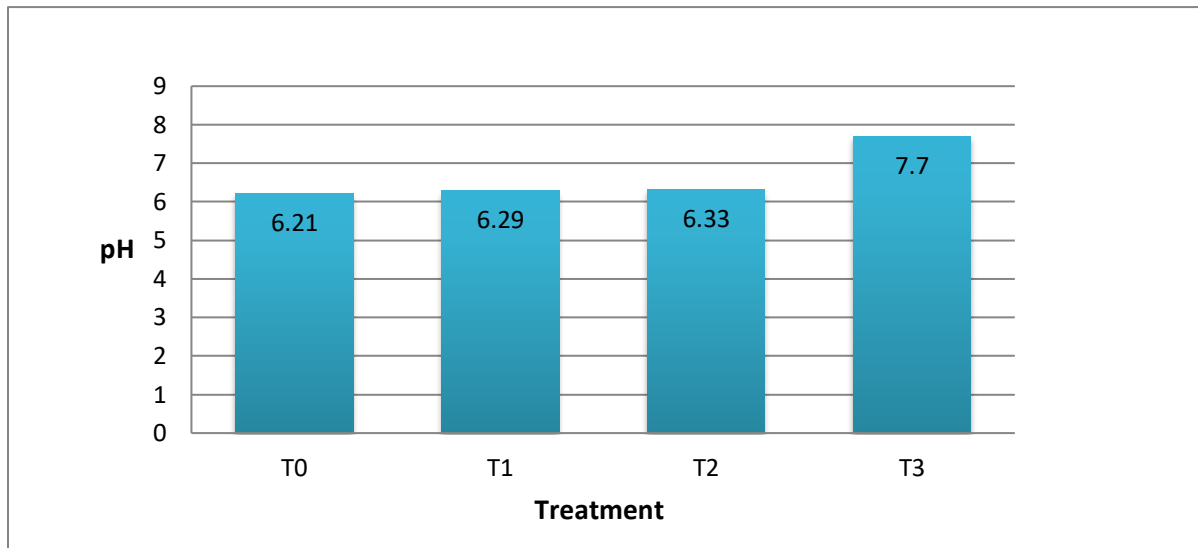


**Fig.3.3.1. Ruminal fluid pH at 3rd week**

T0= basal diet, T1= basal diet+1.5gm/kg diet, T2 = basal diet + Na bicarbonate 1.5 g/kg diet); T3= basal diet+ 1.5g/kg ginger + 1.5g/kg Na bicarbonate).

Here the diagram shows the pH of 1<sup>st</sup> collection of rumen fluid after 15 days of diet. Here, the pH of control group is 6.15, ginger group is 7.1, sodium bicarbonate group is 6.2, combined diet

group is 6.91. At first collection, pH high in T1 group which is alkaline in nature compare then other group. In control group, pH is lower then other group which is acidic in nature.

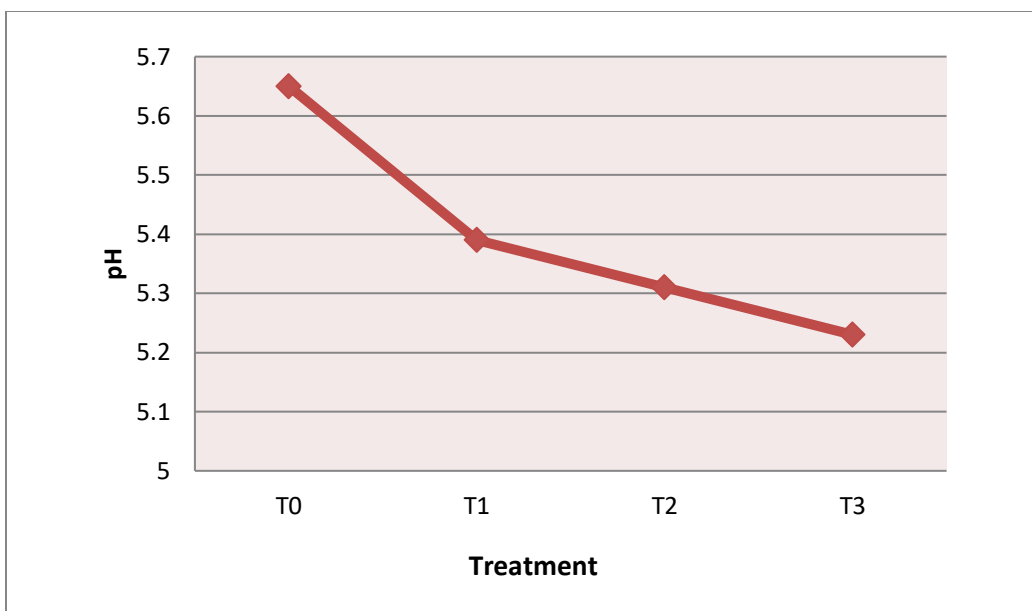


**Fig. 3.3.2. Ruminal fluid pH at 5th week**

T0= basal diet, T1= basal diet+1.5gm/kg diet, T2 = basal diet + Na bicarbonate 1.5 g/kg diet); T3= basal diet+ 1.5g/kg ginger + 1.5g/kg Na bicarbonate).

In 2<sup>nd</sup> collection, control group=6.21, ginger group =6.29, sodium bicarbonate group=6.33, combined diet group=7.7. Here, Higher pH seen in combined diet group (T3) which is alkaline in nature compare then other group. Lower pH seen in control group compare then others. Wanapat et al. (2013) found that beef cattle treated with a combination of garlic, lemon, and peppermint had a higher ph. A modest increase in pH in sheep was also found by Zhang et al. (2011).





**Fig.3.3.3. Ruminant fluid pH at 9th week**

T0= basal diet, T1= basal diet+1.5gm/kg diet, T2 = basal diet + Na bicarbonate 1.5 g/kg diet); T3= basal diet+ 1.5g/kg ginger + 1.5g/kg Na bicarbonate)

In 3<sup>rd</sup> collection, control group=5.65, ginger group=5.39, sodium bicarbonate group=5.31, combined diet group=5.23. Here, the pH is acidic in nature in all group. But most lower pH is seen in combined diet group (T3) and higher pH is seen in control group compare then others which is acidic in nature.

### 3.4. Activity of rumen protozoa:

The motility of protozoa detect the ruminal environment of ruminant. The motility of protozoa detect by microscope from fresh rumen liquor. In first collection , the motility of protozoa is very rapid (++++) in all group except combined diet group (NaGP) which is moderately motile (+++). In 2<sup>nd</sup> collection, the motility of protozoa was same as before. In 3<sup>rd</sup> collection, the protozoal motility is very rapid (++++) in all group except control group which is moderately motile (+++) in nature.

#### 3.4.1. Table 4: Protozoal motility of rumen liquor in treatment groups

Parameter	Treatment	3 <sup>rd</sup> week of rearing	5th week of rearing	9th week of rearing
Protozoal motility	Control	Very motile (++++)	Very motile (++++)	Moderately motile (+++)
	T1	Very motile (++++)	Very motile (++++)	Very motile (++++)
	T2	Very motile (++++)	Very motile (++++)	Very motile (++++)
	T3	Moderately motile (+++)	Moderately motile (+++)	Very motile (++++)

### 3.5. Protozoal count of rumen liquor:

Protozoal count were seen in cells/ml under microscope for four focus. Fresh rumen liquor in slide then lugols iodine add one drop and see under microscope and count protozoa in four focus. The protozoa was lower in first and second collection then 3<sup>rd</sup> one. In first collection, protozoa was comparatively high in T2 group then others. In second collection, protozoa was higher in combined diet group (T3) then others and comparatively lower in control group. In 3<sup>rd</sup> collection, protozoa was high in combined group(T3) then others and lower in control group.

**3.5.1. Table 5: Protozoal count in rumen liquor**

<b>Parameter</b>	<b>Treatment</b>	<b>1<sup>st</sup> collection</b>	<b>2<sup>nd</sup> collection</b>	<b>3<sup>rd</sup> collection</b>
Protozoal count (X10 <sup>5</sup> cell ml-1)	Control	10	68	110
	T1	10	110	107
	T2	30	69	125
	T3	20	121	152

## CHAPTER IV

### DISCUSSION

Growth parameters such as daily weight changes, feed intake, and feed conversion ratio could be used to assess the animal's performance. Results discovered that there are significant variations in frame weight of rams between treatments (Table 2). The rams' weights ranged 11.74 to 20.66 kg on the give up of the experiment. The combined effect of the ginger and Na-bicarbonate when administered in feed it is visible in the improved daily changes in sheep in the combined group (T3). The weight of sheep increased seen in ginger powder group (T1). In control group, the weight of sheep not so increased as other treatments group. In T2 group, weight also increased then before but not as combined group(T3). Table (2) indicated that until the third week of the investigation, there were no significant variations in the initial weight of sheep, but that there was a significant increase in the weights of sheep in the sixth week of the study. These findings are consistent with those of Al- Jubouri (2012), who observed no significant variations in body weight when varying percentages of Ginger roots were introduced to the diet of dairy cows. When it came to the weight of the lambs from birth to weaning, the table revealed that the weight of the lambs who had ginger added to their diet began to increase the body weight gradually, especially with the treatment with sodium bicarbonate (R. Ammar and M. Al-Hafz, 2019). The non-significant increases in body weight in this study are similar with previous findings in sheep and goats exposed to ginger and Na-bicarbonate powder, respectively (Muhammad et al., 2016; Ikyume et al., 2017).

The rumen pH is an important element in rumen health, microbial stability, and shift, as well as a requirement for proper microbial proliferation. The pH can be used to anticipate the type of diet supplied to animals, as well as the rate of fermentation, depending on the degree of increase or reduction. The ideal pH for fiber digestion is between 5.8 and 6.0. (Kolver and De Veth, 2002). in the second therapy, as opposed to the third treatment, which is dependent on the first. The use of concentrated feed resulted in a higher concentration of acidity and a lower pH of the rumen, as evidenced by the fact that T1 had a lower pH value than the other treatments, while operating T2 had a much higher pH value. The change in output fermentation rumen as a result of improving the conditions of the rumen using this mixture to the ration, and a reflection positively in activity of microorganisms within the rumen, may be due to the change in pH in T3 despite

the addition of mixture sodium bicarbonates and ginger which could be due to the change in output fermentation rumen as a result of improving the conditions of the rumen using this mixture to the ration, and an increase in the activity of microorganisms in the rumen, which may lead to an increase in the concentration of organic acids, which are the principal cause of the rumen's low pH (M. Tayeb et. al, 2020). My result also agreed with this. Wanapat et al. (2013) found that beef cattle treated with a combination of garlic, lemon, and peppermint had a higher pH. A modest increase in pH in sheep was also found by Zhang et al. (2011). In goats and lambs treated with ginger products, however, pH was lowered (Hodjatpan et al.,2010; Ikyume et al.,2017). Lower pH causes fibrolytic activity to diminish, which is caused by microbes' inability to maintain pH inside their cells (Chiba, 2014). Herbs contain antibacterial characteristics and can be used to change the rumen's energy or protein utilization (Kamel, 2001).

Newbold et al. (1991) showed that adding sodium bicarbonate (25, 50, and 75 g/day) to corn silage diets increased the protozoa population relative to the control treatment. It was most likely owing to sodium bicarbonate's ability to keep the rumen pH in the right range for protozoa activity, as there is a strong link between daily minimum pH and rumen protozoa population. Philippeau et al. (2017) found that lowering the rumen pH to less than six caused a considerable reduction in the rumen protozoa population. Santra et al. (2003) also found that increasing the amount of sodium bicarbonate in the high concentrate diets had no significant effect on the rumen protozoa population of lambs, but that adding sodium bicarbonate and ginger to the diet increased the rumen protozoa population in general. In compared to our findings, I agreed with this. In contrast to our findings, Montao et al. (1999) found that adding sodium bicarbonate to the steer's diet resulted in an increase in rumen pH and a considerable drop in protozoa population.

## **LIMITATIONS**

No such facility found in lab to determine the bacteria of ruminal fluid. We could not grow the bacterial colony due to insufficient facility and poor storage system. As a result, we could not count the bacteria of ruminal fluid and could not see the load of bacteria in rumen.

## **CHAPTER V**

### **CONCLUSION**

The experiment confirmed that the impact of feeding sodium bicarbonate and ginger to sheep to govern rumen fermentation, microbial populations and overall performance may be higher if the two are blended at decrease amounts. The aggregate of 1.5 g/kg of sodium bicarbonate and 1.5 g/kg of ginger gave a higher rumen modifier impact than feeding sodium bicarbonate and ginger 1.5 gm/kg singly. Further studies can range the stages of aggregate.

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## **BIOGRAPHY**

I am Farjana Akter, daughter of Late Haji Ahamed Kabir and Khurshida Begum was born on February 25, 1998 at Jahanpur, Fatikchhari. I passed Secondary School Certificate examination from Jamal Khan Kusum Kumari Girls High School in 2013 (GPA-5.00) followed by Higher Secondary Certificate examination from Chattogram College in 2015 (G.PA-5.00). She is now enrolled in year-long internship programme for completion of Doctor of Veterinary Medicine (DVM) degree in CVASU, Chattogram, Bangladesh. She has immense interest to work as a veterinary practitioner.

## REFERENCE

- Afele, T., Ikyume, T. T., Allu, R. P., Aniche, O. S., Onuh, M. E., & Agbo, E. (n.d.). Effects of garlic (*Allium sativum*) and ginger (*Zingiber officinale*) powder and their combination on antioxidant and hematological response in sheep. *Malaysian Journal of Animal Science (MJAS)*, 23(2), 29-39.
- Ahmed, S., Rakib, M. R. H., Yesmin, M., Sultana, N., Jahan, N., & Ershaduzamman, M. (2018). Evaluation of lamb production potentiality of the Barind, Jamuna river basin and coastal region sheep of Bangladesh under intensive management. *Journal of Advanced Veterinary and Animal Research*, 5(1), 37–43.
- Al-dain, S., & Jarjeis, E. A. (2015). Vital impact of using ginger roots powder as feed additive to the rations of local Friesian dairy cows and its effect on production & economic efficiency of milk and physiological of blood. *Kufa Journal for Veterinary Medical Sciences*, 6(1), 154–165.
- Ammar, R. M., & Al-Hafz, M. A. K. (2019). Effect of Using Ginger Roots (*Zingiber officinale*) on Milk Yield and Some of Its Components, Body Weight of Ewes and Lambs, in Awassi Sheep. *Tikrit Journal for Agricultural Sciences Mağallaġ Tikrġt Li-l-‘ulŭm Al-Zirā‘at*, 19(3), 1–5.
- Baraka, T. A., Khalaf, A. M., & Tayeb, F. A. (2018). Effect of ginger powder (*Zingiber officinale*) on selected rumen and blood serum constituents in sheep. 8(4), 450-453.
- Faniyi, T. O., Prates, Ê. R., Adewumi, M. K., & Bankole, T. (2016). Assessment of herbs and spices extracts/meal on rumen fermentation. *PUBVET*, 10(5), 427–438.
- Huws, S. A., Creevey, C. J., Oyama, L. B., Mizrahi, I., Denman, S. E., Popova, M., Muñoz-Tamayo, R., Forano, E., Waters, S. M., & Hess, M. (2018). Addressing global ruminant agricultural challenges through understanding the rumen microbiome: past, present, and future. *Frontiers in Microbiology*, 9, 2161.
- Islam, S. S., Hasan, M. S., Ghosh, N., Islam, M. S., & Islam, M. M. (2021). Prospects and Problems of Indigenous Sheep Production in South-Western Coastal Regions of Bangladesh. *The Journal of Agricultural Sciences - Sri Lanka*, 16(1), 54-66.

- Mahdavirad, N., Chaji, M., Bojarpour, M., & Dehghanbanadaky, M. (2021). Comparison of the effect of sodium bicarbonate, sodium sesquicarbonate, and zeolite as rumen buffers on apparent digestibility, growth performance, and rumen fermentation parameters of Arabi lambs. *Tropical Animal Health and Production*, 53(5), 1–12.
- Mazinani, M., & Rude, B. (2020). Population, World Production and Quality of Sheep and Goat Products. *American Journal of Animal and Veterinary Sciences*, 15, 291–299.
- Mursheda, H. M., Sarkerb, M. A. H., Rahmana, S. M. E., & Hashema, M. A. (2014). Comparison of carcass and meat quality of Black Bengal goat and Indigenous sheep of Bangladesh. *Journal of Meat Science and Technology. July-September*, 2(3), 63–67.
- Oleforuh-Okoleh, V. U., Chukwu, G. C., & Adeolu, A. I. (2014). Effect of ground ginger and garlic on the growth performance, carcass quality and economics of production of broiler chickens. *Global Journal of Bio Sciences and Biotechnology (GJBB)*, 3(3), 225–229.
- Skapetas, B., & Kalaitzidou, M. (2013). Current status and perspectives of sheep sector in the world. *Change*, 2000(2013).
- Soroor, M. E. N., & Moeini, M. M. (2015). The influence of ginger (*Zingiber Officinale*) on in vitro rumen fermentation patterns. *Annual Research & Review in Biology*, 54–63.
- Tag El-Din, A. E., Moharam, M. S., Nour, A. A., & Nasser, M. E. A. (2012). Effect of Some Herbs on the Rumen Fermentation: 1-Effect Of Ginger (*Zingiber Officinale*) And Garlic (*Allium Sativum*) On Gas Production, Energy Values, Organic Matter Digestibility And Methane Emission, In Vitro. *Journal of Agriculture and Environmental Science*, 11(2), 33–53.
- Tayeb, M. A. M., Al-Zeadan, O. A. G., & Basher, N. M. (2020). Effect of using sodium bicarbonate and mixture of vitamin E and selenium in production performance of awassi ewes. *The Iraqi Journal of Agricultural Science*, 51(1), 311–316.
- Teixeira, A., Silva, S., Guedes, C., & Rodrigues, S. (2020). Sheep and Goat Meat Processed Products Quality: A Review. *Foods*, 9(7), 960.
- Tripathi, S., Maier, K., Bruch, D., & Kittur, D. (2006). Ginger and its active ingredient 6-gingerol

down regulate pro-inflammatory cytokine release by macrophages. *Journal of Surgical Research*, 130(2), 318.

Uddin, M. N., Taweekun, J., Techato, K., Rahman, M. A., Mofijur, M., & Rasul, M. G. (2019). Sustainable biomass as an alternative energy source: Bangladesh perspective. *Energy Procedia*, 160, 648–654.

Valente, T. N. P., da Silva Lima, E., dos Santos, W. B. R., Ces&ario, A. S., Tavares, C. J., & de Freitas, M. A. M. (2016). Ruminant microorganism consideration and protein used in the metabolism of the ruminants: A review. *African Journal of Microbiology Research*, 10(14), 456–464.