ISBN : 978-602-0860-10-7

UISFS 2016 · SEAMEO SEARCA · I.S.F.A. Indonesian SEARCA Fellow Association

CONFERENCE PROCEEDINGS 2016

August 23-24, 2016
Bandar Lampung, Lampung, Indonesia

UISFS
THE USR INTERNATIONAL SEMINAR ON FOOD SECURITY

"Improving Food Security : The Challenges for Enhancing Resilience to Climate Change"

Volume II

The University of Lampung

Indonesian SEARCA Fellow Association

Southeast Asian Regional Center for Graduate Study and Research in Agriculture

ISBN : 978-602-0860-10-7

USR INTERNATIONAL SEMINAR ON FOOD SECURITY

Improving Food Security : The Challenges for Enhancing Resilience to Climate Change

Emersia Hotel and Resort, Bandar Lampung, Lampung, Indonesia

23 – 24 August 2016
Volume II

Organized by

Research and Community Service Institution
The University of Lampung – Republic of Indonesia,
Indonesian SEARCA Fellow Association,
SEARCA

2016

EDITORS

Christine Wulandari, Ph.D
Dr. Maria Viva Rini
Hari Kaskoyo, Ph.D
Hidayat Saputra, S.P.,M.Si
Windi Mardiqa Riani, S.Hut.,M.Si
Aristoteles, S.Si.,M.Si
Ade Pamungkas

REVIEWERS

Prof. Dr. Neti Yuliana
Prof. Dr. Bustanul Arifin
Prof. Dr. Kukuh Setiawan
Prof. Dr. Udin Hasanudin
Prof. Dr. Yusnita Said
Dr. Dwi Hapsoro
Endang Linirin Widiastuti,Ph.D
Dr. Siti Nurjanah
Wamiliana,Ph.D
Dr. Yaktiworo Indriani

LIST OF CONTENTS

OXYGEN SATURATION OF LAMBS DURING ESTROUS CYCLE WITHIN DIETS WITH DIFFERENT CATION AND ANION RATIO

FARIDA FATHUL[1)] AND ENDANG LINIRIN WIDIASTUTI[2)]

[1)]Animal husbandry Dept., Faculty of Agriculture – The University of Lampung –
Jl. Prof Dr. Sumantri Brojonegoro 1, Bandar Lampung 35145, Indonesia,
[2)] Biology Dept., Faculty Math and Sciences - The University of Lampung –
Jl. Prof Dr. Sumantri Brojonegoro 1, Bandar Lampung 35145, Indonesia, elwidi@yahoo.com

ABSTRACT

Estrous cycle is known consumed much energy than normal state of many rumens. The oxygen consumption for generating this energy could be accounted by determining the oxygen saturation, in which diets affected for improving effectiveness of oxygen saturation. Different diets with different ratio of cation and anion was assigned for this study. Five different cation and anion ratio diets were given to the lambs which already experienced with pregnancies, they were -28, -18, 0, + 14 and +32 mEq (of dietary cation and anion different/DCAD), each was replicated by 3. Group A (-28 mEq) were given normal diet with 0.230 g S + 0.446 g Cl, group B (-18 mEq) were given normal diet with 0.230 g S + 0.286 g Cl, group C (0 mEq) were given normal diet with 14.259 g S, group D (+14 mEq) were given normal diet only, group E (+32 mEq) were given normal diet with 0.235 g Na + 0.523 g K. Randomized groups were assigned for this study and ANOVA was used to analyze the collecting data such as blood pH, pCO_2, pO_2 and percentage of Hb O_2. Data was collected before and during estrous states. The result indicated that in most of groups, the pH as well as pCO_2 increased significantly during estrous, while the pO_2 and percent of Hb-O_2 decreased. Different ratio of cation and anion did not show any significant different among groups.

Key words: DCAD, blood, pH, oxygen,

INTRODUCTION

Modern livestock likely depend on the development of biotechnical and biotechnological methods which are playing the mayor roles in order to get more meat and more milk production. In the term of getting more meat, many livestock are depended in the female offspring. It is believed that vaginal fluid might affect the sex ratio of offspring (Pratt, *et al*, 1987), therefore manipulating the vaginal fluid may produced more female or male depend on what they need for. If the vaginal fluid close to basic more male offspring would be delivered, unlike with acidic fluid more female offspring would be delivered.

Cation-Anion in diets plays important roles in osmotic pressure, nerve function, metabolism etc. Even some of activities/animal performance needs more cation-anion intake, such as during parturition and lactation, beside their need on energy supply through metabolism. During that period of activities, for sure, the need of oxygen to bind to hemoglobin is high enough and plays a major role in succeed of their performances. In addition to it, different cation-anion on dietary (DCAD) affected the acid base of blood (Stewart, 1983). Related to major issues above, the study was conducted to determine the effect of differences in cation anion in diets on energy metabolism through hemoglobin-oxygen binding and pH of blood which is important for further possibility to change the sex ratio of newly born lambs of Domba Garut var. Therefore, we would like to evaluate **how the differences in cation-anion on diets affect the oxygen concentration in blood?**

MATERIALS AND METHODS

The study was conducted in Nutrition Lab of Animal Husbandry Faculty of Bogor Agriculture Institute (IPB) and Laboratory of Rehabilitation Unit (URR) – Dept. Veterinary, Bogor Agriculture Institutes (IPB). Animal diet consisted of 65 days-Haway corn leaves, padi peels, cassava, corn meals, coconut and soy beans remnants, fish oil, minerals: Zn SO_4, Na_2CO_3, K_2CO_3, $CaCL_2$, and $CaSO_4$. For worm preventive, the lambs/animals were given some medicinal substances provided by Nova Laboratories Sdn. Bhd. Sungai Pelek Sepang, Malaysia: *Vita vet* injectable solution and Alben 10% as oral suspension. Hormone was also delivered which was 0.3 g of progesterone EAZI-BREED™ (CIDR®). Other materials used were cotton, alcohol, jelly (mix of 30.0 g carboxymetilcelulosenatrium, 100.0 g glicerol 85.0%, and 1000 ml renset vand metilparahydroxybenzoat 0.1%), glicerol, milique water, aquades. 15 ewes (*Ovis aries*) from Garut-West Java were used as sample animals with their average body weight of 22 – 36 kg.

Equipments used for this study such as food and drinking plates, buckets, O-Haus analytic balances with accuracy of 0.001 g, capacity of 2 kg, 10 kg, 100 kg. Tools for mixing the feed, syrink, venoject, vacuum tube lithium heparin 7 ml, micropipet ependorf (1.5 and 2.0 ml), plastic material, apron, speculum, CIDR setting aplicator, cortex, centrifuge (with 2500 rpm), Radiometer ABL 700 Series.

Methods: As already mentioned in other paper, this research used basic animal dietary with 15.0% crude protein based on Wodzicka-Tomaszewska *et al*. (1991). In order to determine the diet content, Proximate Analysis was applied to all animal diet and done in Laboratorium Pusat Antar Universitas (PAU) IPB. While, mineral analysis of Na, K, Ca, Mg, P was conducted in Nutrition Lab of Animal Husbandry Faculty of Bogor Agriculture Institute (IPB) and for Cl and S was done in Bogor – Center of Soil Research (Puslitan – Bogor). *Dietary cation-anion different* (DCAD) was calculated based on Na, K, Cl, and S content of the total animal basic dietary. DCAD formula was generated by Tucker *et al*. 1992 and as follow:

DCAD (mEq)= (Na+K) – (Cl+S) (mEq/100 g BK diet)

Therefore, the DCAD number was +14 mEq/100 g of dry diet.

The treatment groups based on the cation-anion balance from basic dietary then was modified with addition of cation or anion to modified diet become 28, -18, 0, dan +32 mEq. The diet composition, amount of mineral added, and the nutrition content of treatment diets could be seen in Tabel 1.

Acclamation was performed for the sample animals by giving mix dietary for approximately 2 months. Each animal was randomly placed in metabolic cages and was fed and drink *ad libitum* twice a day at 07.00 am and 14.00 pm. To prevent sample animals from infecting worms, they were given 10% suspension of Alben as much as 2 ml/anima, a week prior acclamation time.

Data Collection:

1. First data collected when the animals found nonpregnant was for their body weights. Then, they were fed-drink *ad libitum* and the amount of diets was determined and given for the next day.
2. At the 7th day, sample animals were syncronized for their estrous cycle using EAZI-BREED™ CIDR® (implanted in vagina and was made for 13 day).

3. At the 13th day prior feeding period, blood was collected from Vena Jugularis, to determine blood parameters before estrous.
4. At the 13th day after implantation of CIDR, the CIDR was taken out from vagina of each animal.
5. At the 1st and 2nd day after CIDR was taken out, estrous condition of animals was observed and blood was collected from Vena Jugularis, for 2 – 3 ml, heparinized, centrifuged and analyzed for blood pH, gassous partial pressures and Hb-O_2 (oxygen saturation) - before and during estrus using Radiometer ABL 700 series.

Tabel 1. Dietary composition: mineral and nutrient content of treatment diets*

Criteria	DCAD treated diets (mEq/100 g dry diet)				
	-28	-18	0	+14	+32
Dietary composition (% dry weight of basic diet)					
Corn leaves	35.000	35.000	35.000	35.000	35.000
Padi peels	6.000	6.000	6.000	6.000	6.000
Cassava	9.500	9.500	9.500	9.500	9.500
Corn meals	18.500	18.500	18.500	18.500	18.500
Coconut remnant	7.000	7.000	7.000	7.000	7.000
Soy beans remnant	22.000	22.000	22.000	22.000	22.000
Fish oil	2.000	2.000	2.000	2.000	2.000
Minerals (g/kg dry weight of basic diet)					
Zn SO_4	0.124	0.124	0.124	0.124	0.124
$CaSO_4$	9.881	9.881	9.700	-	-
$CaCl_2$	6.974	4.965	-	-	-
Na_2CO_3	-	-	-	-	4.015
K_2CO_3	-	-	-	-	5.202
Nutrient Content (% dry weight)*					
Dry weight**	89.300	89.300	89.300	89.300	89.300
Ash**	8.118	8.118	8.118	8.118	8.118
Crude Protein**	15.003	15.003	15.003	15.003	15.003
Crude Lipid/fat**	5.118	5.118	5.118	5.118	5.118
Crude Fiber**	14.733	14.733	14.733	14.733	14.733
Nitrogenless extraction **	57.028	57.028	57.028	57.028	57.028

note:
* This table is also used by another article (Fathul and Widiastuti, 2016)
** = Analyzed by Laboratorium Pusat Antar Universitas (PAU) IPB

Treatment dietary of the research as follow:
1. A (-28 mEq) = basic diet added with 14.375 mEq (0.2300 g S) and 27.884 mEq (0.4461 g Cl)
2. B (-18 mEq) = basic diet added with 14.375 mEq (0.2300 g S) and 17.884 mEq (0.286 g Cl)
3. C (0 mEq) = basic diet added with 14.259 mEq (0.2281 g S)

4. D (+14 mEq)– basic diet only
5. E (+32 mEq)– basic diet added with h 10.21 mEq (0.235 g Na) and 7.531 mEq (0.5232 g K)

Data Analysis

All the collected data were analyzed by using ANOVA followed by LSD at 5% level in SPSS -17 program.

RESULTS AND DISCUSSIONS

Different cation-anion dietary (DCAD) on the blood parameters could be seen in Table 2. Basically, DCAD did not show any differences in blood gaseous parameters.

Tabel 2. The effect of different cation-anion dietary on oxygen saturation

Groups / Blood Gases Variables		**pH** X + SEM	**pCO_2** X + SEM (mmHg)	**pO_2** X + SEM (mmHg)	**$Hb\text{-}O_2$** X + SEM (%)
Estrous	**A**	7.37 ± 0.01	38.00 ± 6.22	37.47 + 5.82	68.10 ± 9.32
	B	7.37 ± 0.03	40.47 ± 7.42	37.10 + 2.11	68.70 ± 4.33
	C	7.40 ± 0.01	40.89 ± 3.41	34.44 + 7.23	63.67 ± 14.58
	D	7.36 ± 0.03	44.93 ± 5.98	36.07 + 4.56	65.37 ± 9,85
	E	7.40 ± 0.00	39.63 ± 1.61	42.37 + 4.03	77.10 ± 4.26
	X_{ABCDE}	**7.38 ± 0.02**	**40.77 ± 5.11**	**37.47 ± 5.09**	**68.59 ± 9.21**
Non-estrous	**A**	7.41 ± 0.00^{b}	34.53 ± 4.98	43.67 ± 5.30	78.83 ± 5.45
	B	7.42 ± 0.01^{b}	36.37 ± 2.70	40.60 ± 3.62	76.13 ± 4.12
	C	7.48 ± 0.03^{a}	35.0 ± 6.09	43.87 ± 8.52	80.47 ± 8.17
	D	7.37 ± 0.05^{b}	43.20 ± 4.86	40.27 ± 6.65	71.93 ± 9.97
	E	7.38 ± 0.05^{b}	40.83 ± 6.12	47.38 ± 9.34	79.6 ± 8.53
	X_{ABCDE}	**7.41 ± 0.05**	**38.17 ± 5.49**	**43.15 ± 6.49**	**77.39 ± 7.14**

^{a,b} Superscript at the means in the same column indicated significantly different LSD at 5%

However, DCAD affected the blood pH from non-estrous groups, increasing in cation or anion did change the blood pH, but not during estrous groups. The blood pH of all groups were still in normal range which was 7.35 – 7.45 (Anstey, 2005; Story *et al*, 2004). This acid-base of the blood was very crucial during animal performance, like those in parturition or lactation or even during determining the sex of offspring (Pratt *et al*, 1987). DCAD during lactating in cattle like cows affected the acid-base of the blood (Hu and Murphy, 2004).

Oxygen pressure in blood was greater in non estrous period as well as the percentage of hemoglobin-oxygen binding, reaching above 77%. This indicated that prior estrous, physiologically, the animals need to serve and provide more energy. Estrus or known as heat is energy consumable. However, reproductive efficiency in most ruminant, like sheep, depended on food resource accessibility as well as status of energy of each animal (Sejian *et al*, 2010). Naqvi *et al* (2013) indicated also that enhanced nutrition (by concentrating supplementation prior to breeding) used as a tool to increase ovulation rate and overall reproductive efficiency.

From the data we can see that DCAD which was in more basic, (diet with + 14 mEq) seemed increase in oxygen pressure in the blood, both in period of estrous and non estrous reached 42.37 – 47.38 (mmHg). Increasing the blood oxygen pressure could be accounted for the use of cation on diet, such as sodium and potassium to enhance the ability of blood to absorb more oxygen, in which then increase the percent of hemoglobin binding, above 77%. It is well known that these two cations were playing in major role in nerve function and other muscle contraction, beside their function in acid-base of body fluids.

We can conclude that different cation – anion ratio on diets did not give any significant different in blood gaseous, pCO_2, pO_2 and HB-O_2. However, the oxygen saturation reached up to 77% prior estrous period. The DCAD affected only those in phase before estrous (non estrous), the pH was affected either by increase/decrease in cation-anion ratios on diets.

REFERENCES

Anstey, C.M. 2005. Comparation of three strong ion models used for quantifying the acid-base status of human plasma with special emphasis on the plasma weak acids. *J Appl Physiol* 98:2119–2125.

Hu, W., M. R. Murphy. 2004. Dietary Cation-Anion Difference Effects on performance and Acid-Base Status of Lactating Dairy Cows: A Meta-Analysis. J. Dairy Sc. 87:2222-2229.

Naqvi, S. M. K., V. Sejian, and S.A. Karim. 2013. Effect of feed flushing during summer season on growth, reproductive performance and blood metabolites in Malpura ewes under semiarid tropical environment. Trop. Anim. Health Prod 45:143–148 DOI 10.1007/s11250-012-0185-2.

Pratt, N.C., U.W. Huck, R.D. Lisk. 1987. Offspring sex ratio in hamsters is correlated with vaginal pH at certain times of mating. *Behav Neural Biol* 48:310−316.

Sejian, V., V.P. Maurya, S.M.K. Naqvi, D. Kumar, and A. Joshi. 2010. Effect of induced body condition score differences on physiological response, productive and reproductive performance of Malpura ewes kept in a hot, semi-arid environment. Journal of Animal Physiology and Animal Nutrition, 94(2), 154-161.

Stewart PA. 1983. Modern quntitative acid-base chemistry. *Can J Physiol Pharmacol* 61:1444−1461.

Story, D.A., H. Morimatsu, R. Bellomo. 2004. Strong ions, weak acids and base excess: a simplified Fencl-Stewart approach to clinical acid-base disorders. *J. Anaesthesia* 92(1):54−60.

Tucker, W.B., Hogue, J.F., Waterman, D.F., Swenson, T.S., Xin, Z., Hemken, R.W., Jackson, J.A., Adams, G.D., Spicer, L.J. Sulfur should be included when calculating the dietary cation-anion balance of diets for lactating dairy cows. Animal Science Res. Rep., Oklahoma State Univ., Stillwater; 1992 (Pages 141–150).

Wodzicka-Tomaszewska M, I.K. Sutama, I.G. Putu, T.D. Chaniago. 1991. *Reproduksi, Tingkah laku, dan Produksi Ternak di Indonesia.* Diterbitkan atas kerjasama Direktorat Jenderal pendidikan Tinggi dan International Development Program of Australian Universities and Colleges. Jakarta: Gramedia Pustaka Utama.