G.J.A.S.R

GLOBAL JOURNAL OF
ANIMAL SCIENTIFIC RESEARCH

Print ISSN:2345-4377 Online ISSN:2345-4385

Original Article

Effect of Rumen-Protected Niacin and Vitamin C Additives on Productive Performance of Suckling Friesian Calves Under Heat Stress Condition

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ABSTRACT

This study aimed to evaluate the effect of rumen-protected niacin and vitamin C on suckling Friesian calves' productive performance under heat stress during the summer season. Twenty-four newly born Friesian calves with an average live body weight of 31±0.21 kg is assigned into four comparable groups. Calves were unsupplemented in G1 and served as control, or supplemented with rumen-protected niacin at 2g/head/day in G2, vitamin C at 2 g/head/day in G3, or rumen-protected niacin at 1 g/head/day plus vitamin C at 1 g/head/day in G4 during suckling period (105 days). Results confirmed that G4 recorded appreciably (P<0.05) the very best digestibility coefficients of all nutrients, feeding values, TVFA's attention and decrease notably

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Cite this Article: Eweedah, N.M., Salem, A.Y., Gaafar, H.M., Shams, A.S., Albary Mesbah, R.A., Aljadba, I.F. (2022). Effect of Rumen-Protected Niacin and Vitamin C Additives on Productive Performance of Suckling Friesian Calves Under Heat Stress Condition. *Global Journal of Animal Scientific Research,* 10(2), 91-105.
Retrieved from http://www.gjasr.com/index.php/GJASR/article/view/138

Article History: Received: 2022.09.21 Accepted: 2022.11.06

(P<0.05) Ph price and NH3-N awareness accompanied with the aid of G2 and G3, whereas G1 had the different trend. Blood biochemical and hematological values had been substantially (P<0.05) the highest, however, the exercise of liver enzymes (AST & ALT) was appreciably (P<0.05) the lowest in G4 accompanied by using G2 and G3, however, the lowest counts performed in G1. Group four recorded considerably (P<0.05) the very best TDN and DCP intake, weaning weight, whole, and daily weight gain, feed conversion ratio, and financial affectivity accompanied by G2 and G3, alternatively G1 had the lowest values. In conclusion, either rumen-protected niacin or vitamin C and its mixture had an effective role in improving the growth performance of suckling Friesian calves under heat stress.
Keywords: Suckling calves, heat stress, additives, growth performance.

INTRODUCTION

One of the largest challenges dealing with dairy farmers in most components of tropical nations is warmth stress. The heat (or hot) season in most components of Egypt is distinctly lengthy and there is normally the presence of excessive relative humidity. Heat stress has a direct impact on the feed consumption of the cow, which in flip reduces milk manufacturing (Ghosh *et al.,* 2017). Gaafar *et al.,* (2011) referred to that animals in Egypt expose to warmth stress in the course of the length from June to October and administration and diet techniques are wished to reduce warmness stress and acquire superior animal performance. Animals are experiencing warmness stress at a temperature humidity index (THI) of seventy-two and greater. The tiers of stress have been separated into, Mild (72 to seventy-nine THI), Moderate (80 to 89 THI), and Severe (90 THI or greater) (Smith *et al.,* 2006).

Mostafa *et al.,* (2015) indicated that using niacin as a feed additive in ration formulation of growing and fattening Friesian calves tended to improve product performance and economic efficiency. Flachowsky (1993) indicated that niacin supplementation was beneficial when body weight of bulls is lower than 300 kg and the diet are poor in protein. Kumar and Dass (2006) showed that the average daily gain of male buffalo calves was not significantly (p>0.05) affected by the level of niacin additive. Luo *et al.,* (2019) concluded that supplementation with niacin in a high-concentrate diet of male Chinese Jinjiang cattle may be beneficial for growth.

The goal of this finds out used to be to consider the impact of rumen-blanketed niacin and nutrition C on the productive overall performance of suckling Friesian calves beneath warmness stress at some point in the summertime season.

MATERIALS AND METHODS

Index Of Temperature and Humidity

Throughout the experiment, the temperature humidity index (THI) was determined using the components created with the help of Kibler (1964), as follows:

THI = (0.8×T) + H/100×(T-14.4)+46.4

where T stands for ambient temperature and H stands for relative humidity.

Experimental Animals and Groups

Twenty-four Friesian calves, newly born, with an average live body weight of 31±0.21 kg, are assigned into four comparable groups. Calves were unsupplemented in G1 and served as control, or supplemented with 2 g/head/day rumen-protected niacin (RPN) in G2, 2 g/head/day vitamin C (VC) in G3, or 1 g/head/day RPN plus 1 g/head/day VC in G4. Rumen-protected niacin is 70±2% niacin, ANEVIS, produced by QualiTech Inc., USA. Vitamin C is 35% active material produced by AVITASA,

Management Procedures

Calves have suckled their dam's colostrum for the duration of the first three days of life, then housed in separate pins at night time and free outside during day. Calves had been fed their allowance of entire milk, calf starter, and berseem hay all through the suckling duration (105 days) to meet their nutritional requirements, as shown in Table 1 by NRC (2001). Compositions of extraordinary feedstuffs and experimental rations are proven in Table (2).

Table (1): Allowances of milk, calf starter, and berseem hay per day for suckling calves.

Age	Milk*	Calf starter**	Berseem hay
1-3 days	Suckling their dam's colostrum		
	Kg/day		
4-7 days	3.5	-	-
Week 2	4.0	0.10	-
Week 3	4.5	0.25	0.1
Week 4	5.0	0.25	0.1
Week 5	5.0	0.50	0.2
Week 6	4.5	0.50	0.2
Week 7	4.0	0.75	0.3
Week 8	3.5	0.75	0.3
Week 9	3.0	1.00	0.4
Week 10	2.5	1.00	0.4
Week 11	2.0	1.25	0.5
Week 12	1.75	1.25	0.5
Week 13	1.5	1.50	0.6
Week 14	1.25	1.50	0.6
Week 15	1.0	1.75	0.7
Total	**318.50**	**86.45**	**34.30**
Average	**3.03**	**0.82**	**0.33**

* Composition of milk used to be 3.80% fat, 3.20% protein, 4.93% lactose, 8.85% solids not fats (NFS), 12.65% total solids (TS), and 0.72% ash.

** Calf starter: 15% soya bean meal, 10% linseed cake, 34% ground corn grain, 20% wheat bran, 15% rice bran, 3% molasses, 2% limestone, and 1% common salt.

Table (2): Chemical analysis of ingredients and basal ratio

Items	DM %	Composition of DM %					
		OM	CP	CF	EE	NFE	Ash
Milk	12.65	94.31	25.30	00.00	30.04	38.97	5.69
Calf starter	91.70	91.60	17.75	5.80	3.45	64.60	8.40
Berseem hay	89.45	86.35	12.80	28.70	2.65	42.20	13.65
Basal ration	34.22	91.24	18.75	8.97	10.41	53.11	8.76

Live Body Weight

Calves had been weighed weekly in the morning earlier than consuming and feeding to the nearest 0.1 kg for every animal and the common day-by-day physique weight attain has been calculated.

Digestibility Trials

Four digestibility trials have been carried out for the usage of three calves from every team to decide nutrient digestion and feeding values usage of acid insoluble ash (AIA) as a herbal marker (Van Keulen and Young, 1977). Samples of milk had been analyzed with the aid of Milko-Scan (model 133B), and ash through difference. While, samples of calf starter, berseem hay, and feces had been analyzed by the techniques of AOAC (1995). The digestibility coefficient of all nutrients used to be calculated from the equation given by way of Schneider and Flatt (1975). The fundamental components of McDonald *et al.,* (1995) were used to compute total digestible vitamins (TDN) and digestible crude protein (DCP).

Samples of Rumen Liquor

Rumen liquor samples were collected from calves using a belly tube three hours after morning feeding and filtered through two layers of cheesecloth. Ruminal pH was once calculated with the help of an Orian 680 digital pH meter. The detection of ammonia-N was previously determined by using a saturated solution following the AOAC's technique (1995). According to Warner, the awareness of TVFA's was originally determined in the rumen liquor using the steam distillation technique (1964).

Samples of Blood

Blood samples were obtained from each calf's jugular vein using a smooth sterile needle and placed in smooth dry glass tubes for hematological and biochemical examination. The Medonic Vet. The hematology Analyzer (Medonic CA 620, Sweden) was utilized to do the hematological analysis immediately after the samples were taken by the research laboratory and within 1–2 hours after the samples were collected. The amounts of blood serum biochemicals were determined calorimetrically using business kits provided by Randox (Randox Laboratories Ltd, Crumlin, Co. Antrim, UK).

Determination of Immunoglobulins

The amounts of immunoglobulins IgG, IgM, and IgA in blood serum samples were determined using a quantitative ELISA Bovine (IgG, IgM, and IgA), ELISA Quantitation Kit from Bethyl laboratories in the United Kingdom.

Feed Conversion Ratio

The amount of DM, TDN, and DCP required per kilogram of weight increase was originally known as the feed conversion ratio.

Economical Effectively

Economical effective parameters have been calculated under the expenditures of yr 2018. Prices per kg have been 6 LE for calf starter, 3.5 LE for berseem hay, 6.65 LE for total milk, 383 LE for rumen blanketed niacin, 118 LE for nutrition C, and 70 LE for stay physique weight.

Statistical Analysis

The facts had been statistically analyzed through the usage of widely widespread linear mannequin method adopted for user data, IBM SPSS Statistics (2020) with one-way ANOVA used. Also, Duncan takes a look at the inside application of SPSS used to be completed to decide the diploma of importance amongst the means.

RESULTS AND DISCUSSION

Environmental Conditions:

Mean month-to-month most and minimal ambient temperature (AT), relative humidity (RH), and calculated temperature humidity index (THI) all through the experimental length are proven in Table 3. Average values of THI ranged from 86.10 to 91.59 during day and from 70.88 to 75.82 at night, suggesting that animals done at day under severe stress during August and September and under moderate stress during July and October and under mild stress at night during July, August, and September, but not experiencing heat stress at night during October. The mean THI values revealed that animals experienced moderate heat stress during July, August, and September and mild heat stress during October. The top temperature for lactating cows was once 25°C and the relative humidity higher than 80% in a roundabout way influences the higher quintessential temperature (Kume *et al.,* 1998). The temperature humidity index (THI) is commonly used in dairy cows to determine their level of heat stress. Warmth stress is occurring in animals with a THI of 72 and higher. The tiers of stress had been separated into, Mild (72 to seventy-nine THI), Moderate (80 to 89 THI), and Severe (90 THI or greater) (Smith *et al*., 2006).

Table 3: Maximum and minimum ambient temperature, relative humidity, and temperature humidity index during experimental period

Items	July	August	September	October
Max. AT	33.7	34.6	34.6	31.5
Min. AT	27.3	28.2	27.1	24.6
Mean	**30.45**	31.4	30.85	28.05
Max. RH	84.2	85.3	86.7	84.8
Min. RH	51.1	49.7	47.7	47.1
Mean	**67.65**	67.50	67.20	65.95
Max. THI	89.61	91.31	91.59	86.10
Min. THI	74.83	75.82	74.14	70.88
Mean	**82.22**	83.57	82.87	78.49

Nutrients Digestion and Feeding Values:

Nutrient digestion and feeding values are shown in Table (4). Claves in G4 received the combination of RPN and VC recorded significantly (P<0.05) nutrients' digestibility coefficients (DM, OM, CP, CF, EE, and NFE) should be as high as feasible, as well as feeding values (TDN and DCP) followed by those received RPN in G2 and VC in G3, whereas those in control group (G1) had the lowest values. Improved digestibility may be due to the effect of the additives on reducing the heat stress burden. Luo *et al.,* (2019) indicated that supplementation with niacin increased the apparent digestibility of all nutrients (p<0.05) in male Chinese Jinjiang cattle. Mostafa *et al.,* (2015) indicated that digestion coefficients of most nutrients and feeding values (TDN, DCP, and DE) were markedly improved by two levels of thiamin or niacin on the productive performance of growing – fattening calves. Sallam *et al.,* (2005) indicated that ascorbic acid supplementation resulted in an insignificant increase in digestibility coefficients by rabbits. Digestibility was significantly (P<0.05) higher in the vitamin C and/or folic acid groups than in the control group (Tag El-Din *et al.,* 2008).

Table 4: Nutrient digestibility and feeding values by suckling calves in different groups.

Item	Experimental groups				SEM
	G1	G2	G3	G4	
Digestibility coefficients %					
DM	67.76^{c}	70.47^{b}	69.79^{b}	71.83^{a}	0.47
OM	69.11^{c}	71.87^{b}	71.18^{b}	73.26^{a}	0.48
CP	69.26^{c}	72.03^{b}	71.34^{b}	73.42^{a}	0.48
CF	62.47^{c}	64.97^{b}	64.34^{b}	66.22^{a}	0.42
EE	73.14^{c}	76.07^{b}	75.33^{b}	77.53^{a}	0.51
NFE	71.85^{c}	74.72^{b}	74.01^{b}	76.16^{a}	0.50
Feeding values %					
TDN	73.88^{c}	76.84^{b}	76.10^{b}	78.31^{a}	0.52
DCP	12.99^{c}	13.51^{b}	13.38^{b}	13.77^{a}	0.09

a, b, c: Values in the identical row with extraordinary superscripts range appreciably at 0.05.

Rumen Fermentation Activity

Rumen fermentation activity is shown in Table (5). Ruminal pH value, as well as the concentration of NH3-N, were significantly ($P<0.05$) lower, whereas TVFA's concentration, was significantly ($P<0.05$) higher in G4 in contrast to G1, whilst in G2 and G3 had been no longer considerably ($P>0.05$) distinctive with each G1 and G4. Enchantment of rumen fermentation may be due to that rumen-covered niacin and nutrition C components stimulate ruminal microorganisms using ammonia nitrogen and fermented carbohydrates and fibers producing risky fatty acids. Ruminal pH values have been most advantageous for ordinary rumen fermentation, microorganisms, and microbial synthesis of VFA and protein (Anantasook *et al.,* 2013). Van Soest (1994) counseled that the pH varies for most desirable microbial recreation was once 6.2 to 7.2. Ruminal VFA is nonetheless typically used to make statistical inferences concerning the impact of remedies on in vivo ruminal fermentation (Hall *et al.,* 2010).

Table 5: Rumen fermentation activity of suckling calves in different groups

Item	Experimental groups				SEM
	G1	G2	G3	G4	
pH value	6.44^{a}	6.32^{ab}	6.35^{ab}	6.25^{b}	0.03
Total VFA (meq/100 ml)	9.45^{b}	9.78^{ab}	9.70^{ab}	9.95^{a}	0.07
Ammonia-N (mg/100 ml)	8.76^{a}	8.48^{ab}	8.55^{ab}	8.32^{b}	0.06

a, b: Values in the identical row with extraordinary superscripts range appreciably at 0.05.

Blood Serum Biochemical

Blood serum biochemical introduced in Table (6) published that greater concentrations of whole protein and globulin and decrease albumin to globulin ratio considerably ($P<0.05$) in serum of G4 in assessment with G1, whereas G2 and G3 did not show massive variations with each G1 and G4. The concentrations of albumin, glucose, creatinine, and urea in blood serum no longer drastically effect on through additives. However, the endeavor of liver enzymes AST and ALT lowered notably ($P<0.05$) with additives. There have been no enormous variations in serum biochemical when male Chinese Jinjiang cattle-fed diets include unique tiers of niacin (Luo *et al.,* 2019). Mostafa *et al.,* (2015) located that blood serum complete protein and albumin concentrations have been widely greater for supplemental niacin than this manipulated one. Sayed-Ahmed *et al.,* (2018) indicated that ascorbic acid supplementation prompted a huge extent in some blood parameters of developing rabbits.

Table 6: Blood serum biochemical of suckling calves in different groups

Item	Experimental groups				SEM
	G1	G2	G3	G4	
Total protein (g/dl)	6.40[b]	6.50[ab]	6.52[ab]	6.70[a]	0.05
Albumin (g/dl)	3.10	3.03	3.07	3.05	0.03
Globulin (g/dl)	3.30[b]	3.47[ab]	3.45[ab]	3.65[a]	0.05
Albumin: globulin ratio	0.94[a]	0.88[ab]	0.89[ab]	0.83[b]	0.02
Glucose (mg/dl)	73.50	76.50	76.50	77.00	0.64
Creatinine (mg/dl)	0.75	0.72	0.73	0.71	0.01
Urea (mg/dl)	20.00	19.50	18.50	19.00	0.33
AST (U/l)	60.00[a]	54.48[b]	54.91[b]	49.50[c]	1.25
ALT (U/l)	26.33[a]	23.75[b]	23.51[b]	20.97[c]	0.47

a, b, c: Values in the identical row with extraordinary superscripts range appreciably at 0.05.

Serum Immunity Response

Blood serum immunity response shown in Table (7), indicated that RPN and VC additives improved significantly (P<0.05) immunity response of suckling calves. Calves in G4 recorded considerably (P<0.05) the easiest concentrations of IgA, IgM, and IgG in serum accompanied by using G2 and G3, on the other hand, G1 had the lowest concentrations. Ascorbic acid is necessary if the effectiveness of the immune device is to be optimized (Bendich, 1989; 1992). Ascorbic acid may additionally modulate the immune device with the aid of its position in the legislation of hormones related to stress (Scott, 1981). Aragona *et al.,* (20116) located that nicotinic acid supplementation prepartum notably extended IgG concentration.

Table 7: Blood serum immunity response of suckling calves in different groups.

Item	Experimental groups				SEM
	G1	G2	G3	G4	
IgA (mg/dl)	40.79[c]	47.59[b]	46.35[b]	52.53[a]	1.28
IgM (mg/dl)	18.84[c]	21.29[b]	20.88[b]	23.34[a]	0.49
IgG (mg/dl)	113.07[c]	127.00[b]	125.33[b]	140.36[a]	2.98

a, b, c: Values in the identical row with extraordinary superscripts range appreciably at 0.05.

Blood Hematological Profile

Table 8 shows the haematological characteristics of blood (8), G4 had much higher numbers of white blood cells (WBCs) and their distinct leukocytes (lymphocytes, monocytes, and granulocytes) as well as red blood cells (RBCs) in blood than G2 and G3, although G1 had lower levels. On the other hand, differential leukocyte percentages were nearly the same in different groups. Also, calves in G4 had significantly (P<0.05) higher hemoglobin concentration (HGB), hematocrit percentage (HCT), erythrocyte indices expressed as mean cellular volume (MCV), mean cellular hemoglobin (MCH), mean cellular hemoglobin concentration (MCHC) and red cell distribution width (RDW) and platelet indices expressed as platelet count (PLT), procalcitonin (PCT), mean platelet volume (MPV) and Platelet Distribution Width (PDW) in blood followed by those in G2 and G3, whereas the lowest value was detected with calves in G1. The counts of WBCs, lymphocytes, monocytes, granulocytes, and RBCs in the blood in this study are within the normal ranges reported by Jezek *et al.,* (2011). White blood cells (WBC) perform a critical role in the body's defense against disease-causing bacteria, viruses, and fungi. Lymphocytes, monocytes, and granulocytes are the three main types, each of which serves a specific purpose. Immune responsiveness, as measured by leukocyte numbers and, more commonly, lymphocytes, improved dramatically when blood pressure levels rose (El-Neney and El-Kholy, 2014). Ascorbic acid and other antioxidant vitamins, such as vitamin E, have been shown to improve neutrophil function and reduce free radical damage (Politis *et al.,* 1995).

Table 8: Blood hematology profile of suckling calves in different groups

Item	Experimental groups				SEM
	G1	G2	G3	G4	
WBC's (x10^3/µl)	9.48^c	10.23^b	10.02^b	10.84^a	0.16
Lymphocytes (x10^3/µl)	7.58^c	8.15^b	7.99^b	8.60^a	0.12
Lymphocytes (%)	79.97	79.63	79.74	79.35	0.12
Monocytes (x10^3/µl)	0.89^c	0.98^b	0.95^b	1.04^a	0.02
Monocytes (%)	9.39	9.56	9.48	9.63	0.04
Granulocytes (x10^3/µl)	1.01^c	1.10^b	1.08^b	1.19^a	0.02
Granulocytes (%)	10.64	10.80	10.78	11.02	0.12
RBC's (x10^6/µl)	5.94^c	6.40^b	6.25^b	7.30^a	0.16
HGB (g/dl)	8.95^c	9.84^b	9.80^b	11.02^a	0.23
HCT (%)	23.75^c	26.54^b	26.06^b	29.90^a	0.68
MCV (fl)	32.12^c	34.68^b	33.35^c	36.79^a	0.55
MCH (pg)	12.52^c	13.59^{ab}	13.26^b	14.04^a	0.18
MCHC (g/dl)	28.04^c	31.11^b	29.82^{bc}	33.65^a	0.67
RDW (%)	14.37^c	16.10^b	15.55^b	17.33^a	0.33
PLT (x10^3/µl)	276.84^c	317.34^{ab}	300.58^{bc}	339.68^a	8.00
PCT (µg/l)	0.156^c	0.172^b	0.167^b	0.185^a	0.003
MPV (fl)	4.52^c	5.02^b	4.85^b	5.40^a	0.10
PDW (fl)	51.11^c	56.16^b	54.62^b	61.65^a	1.18

a, b, c: Values in the identical row with extraordinary superscripts range appreciably at 0.05.

Blood hematological results in cattle received using are within normal ranges of UCDAVIS (2001). Variations in several erythrocytic parameters can also be explained by RBC size, oxygen-carrying capacity about age, and physiologic kingdom (Farooq *et al.,* 2011). Many hematological parameters are affected by a variety of factors such as breed, age, sex, seasonal fluctuations, lactation, pregnancy, fitness, and vitamin status (Aengwanich, 2002; Mohammed *et al.,* 2007). Platelets, also known as thrombocytes, are little disc-shaped cells that form clots to stop unusual or excessive bleeding. Platelet insufficiency can result in bleeding of the mucous membranes or other tissues, such as the skin. They are much smaller than other blood cells in terms of size. They work together to build clumps, or plugs, in a vessel's gap to stop the bleeding (Sarker *et al.,* 2010). Platelets play a crucial role in hemostasis (Despopouols and Silbernagl, 2003).

Feed Intake

Daily feed consumption in Table (9) confirmed that consumption of DM and CP had been identical for the exceptional groups. Whereas, TDN and DCP consumption have been extensively (P<0.05) greater in G4 than these of G1, whilst have been almost comparable in G2 and G3 barring any massive variations with each G1 and G4. Similar consumption of DM and CP may want to be attributed to calves fed identical quantities of milk, starter, and berseem hay. The make bigger TDN and DCP consumption with additives may be attributed to extent of TDN and DCP values. Kumar and Dass (2006) determined that DM, CP, DCP, and TDN consumption (g/d/kg) using buffalo calves had been greater in niacin supplemented group. Abd El-Monem and Kandeil (2011) located that developing youngsters confirmed that the day-by-day feed consumption improved drastically (P<0.05) at some point in the experimental durations for children fed diets supplemented with ascorbic acid.

Table 9: Feed intake by suckling calves in different groups

Item	Experimental groups				SEM
	G1	G2	G3	G4	
Feed intake as fed (kg/day)					
Whole milk	3.03	3.03	3.03	3.03	
Calf starter	0.82	0.82	0.82	0.82	
Berseem hay	0.33	0.33	0.33	0.33	
Total intake	4.18	4.18	4.18	4.18	
Feed intake as DM (kg/day)					
Total DM	1.43	1.43	1.43	1.43	0.002
TDN	1.06^{b}	1.10^{ab}	1.09^{ab}	1.12^{a}	0.008
CP	0.268	0.268	0.268	0.268	0.001
DCP	0.186^{b}	0.193^{ab}	0.191^{ab}	0.197^{a}	0.001

a, b, c: Values in the identical row with extraordinary superscripts range appreciably at 0.05.

Live Body Weight and Weight Gain

Data in Table (10) published that start weight used to be almost comparable for the exclusive groups. Whereas weaning weight, complete weight attains, and common every day reap have been extensively (P<0.05) greater in G4 accompanied by way of G2 and G3, then again G1 had the decrease values. Average each day acquire of G2, G3, and G4 elevated by way of 8.06, 4.84, and 12.90% in contrast to G1, respectively. Concerning growth performance, Mostafa *et al.,* (2015) determined that whole stay physique reap and everyday reap have been extensively multiplied due to each thiamin and niacin supplement. Luo *et al.,* (2019) indicated a great expansion in the common day-by-day weight good points ($p<0.05$) for the niacin companies than for the management group. Abd El-Monem and Kandeil (2011) printed that the remaining stay physique weight and everyday physique reap have been extend substantially ($P<0.05$ or 0.01) for Kids fed diets supplemented with ascorbic acid. Sayed-Ahmed *et al.,* (2018) indicated that ascorbic acid supplementation brought about an enormous amplify in increasing overall performance indices of developing rabbits.

Table 10: Live body weight and body weight gain of suckling calves in different groups

Item	Experimental groups				SEM
	G1	G2	G3	G4	
Suckling period (day)	105	105	105	105	
Birth weight (kg)	30.50	31.25	30.75	31.50	0.22
Weaning weight (kg)	95.60^{c}	101.60^{b}	99.00^{b}	105.00^{a}	0.84
Total weight gain (kg)	65.10^{c}	70.35^{b}	68.25^{b}	73.50^{a}	0.78
Average daily gain (kg)	0.62^{c}	0.67^{b}	0.65^{b}	0.70^{a}	0.01
Average daily gain %	100.00^{c}	108,06^{b}	104.84^{b}	112.90^{a}	1.27

a, b, c: Values in the identical row with extraordinary superscripts range appreciably at 0.05.

Feed Conversion Ratio

The feed conversion ratio is introduced in Table (11). Additives led to big ($P<0.05$) enhancements in feed conversion ratio. Calves in G4 published considerably ($P<0.05$) the lowest quantities of DM, TDN, CP, and DCP required per one kg weight obtained accompanied with the aid of G2 and G3, however, G1 had the very best amounts. Although feed consumption was once almost comparable for the exceptional groups, the upgrades in feed conversion would possibly be attributed to the amplify common day-by-day acquisition with additives.

Table 11: Feed conversion ratio of suckling calves in different groups

Item	Experimental groups				SEM
	G1	G2	G3	G4	
DM (kg/kg gain)	2.31^{a}	2.13^{b}	2.20^{b}	2.04^{c}	0.03
TDN (kg/kg gain)	1.70^{a}	1.64^{bc}	1.67^{ab}	1.60^{c}	0.02
CP (kg/kg gain)	0.432^{a}	0.400^{c}	0.413^{b}	0.383^{d}	0.005
DCP (kg/kg gain)	0.300^{a}	0.288^{bc}	0.294^{ab}	0.281^{c}	0.002

a, b, c: Values in the identical row with extraordinary superscripts range appreciably at 0.05.

Mostafa *et al.,* (2015) located that feed conversion expanded substantially due to each thiamin and niacin supplement. Luo *et al.,* (2019) indicated a decreased feed-to-obtain ratio ($p<0.05$) for the niacin organizations than for the management group. Abd El-Monem and Kandeil (2011) determined that developing youngsters confirmed that feed conversion accelerated appreciably ($P<0.05$) throughout the experimental durations for children fed diets supplemented with ascorbic acid. Sayed-Ahmed et al., (2018) indicated that the usage of ascorbic acid in the summer season in the developing rabbit diets used to be extra feed effectivity than the different cure groups.

Economic Efficiency

Economic effective parameters are proven in Table (12). Average day-by-day feed price tended to enlarge with additives. Whereas, G4 recorded extensively ($P<0.05$) the lowest feed value per one kg weight obtained and the very best rate of weight gain, internet income, and financial effectively observed by way of G2 and G3, however, G1 detected a different trend. Results of monetary effectiveness mirror the enhancements with feed additives. Mostafa *et al.,* (2015) observed that financial effectivity increased considerably due to each thiamin and niacin supplement. Sayed-Ahmed *et al*., (2018) indicated that the usage of ascorbic acid in the summer season in the developing rabbit diets used to be extra cost-efficient than the different therapy groups.

Table 12: Economic efficiency of suckling Friesian calves in different groups

Item	Experimental groups				SEM
	G1	G2	G3	G4	
Feed cost (LE/day)	26.22	26.99	26.45	26.73	0.16
Feed cost (LE/kg weight gain)	42.30^{a}	40.29^{b}	40.71^{b}	38.19^{c}	0.49
Price of weight gain (LE/day)	43.40^{c}	46.90^{b}	45.50^{b}	49.00^{a}	0.66
Net revenue (LE/day)	17.18^{c}	19.91^{b}	19.04^{b}	22.27^{a}	0.56
Economic efficiency[1]	1.65^{c}	1.74^{b}	1.72^{b}	1.83^{a}	0.02
Economic efficiency[2] %	65.49^{c}	73.76^{b}	71.95^{b}	83.32^{a}	1.96

a, b, c: Values in the identical row with extraordinary superscripts range appreciably at 0.05.

CONCLUSION

Finally, the results showed that both niacin and nutrition C, as well as their combination, were efficient in increasing feed intake, digestibility, rumen fermentation, blood parameters, growth rate, feed conversion, and financial efficiency in suckling Friesian calves.

CONFLICT OF INTEREST

The author(s) declare no conflicts of interest regarding the publication of this paper.

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