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NUTRIENT DIGESTIBILITY AND BLOOD CONSTITUENTS EVALUATION AFTER ORAL ADMINISTRATION OF PROPYLENE GLYCOL AND CALCIUM PROPIONATE IN BUFFALO CALVES

By

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ABSTRACT

Fifteen Egyptian buffalo calves with an average live body weight (LBW) 212.27 ± 8.84 kg and 13.0 ± 0.42 months old were used for 6 months experimental period and randomly divided into three treatments (5 calves per treatment) to study the effect of drenching propylene glycol and calcium propionate as glycogenic precursor's supplementation during growth period on nutrient digestibility and selected blood parameters. 1st group drenched three liters of saline solution (Nacl 0.9%) without addition was served as control, the 2nd group (PG) drenched 300mL of propylene glycol dissolved in three liters of (Nacl 0.9%) and the 3rd group (Ca-Pr) drenched with 335g of calcium propionate dissolved in 3 liters of (Nacl 0.9%). Results showed that daily dry matter intake decreased (P>0.05) in PG and Ca-Pr drenched buffalo calves than control group. Also,DM, OM,NDF and EE digestibility was not influenced by treatments during the metabolism trial. However, CP and CF digestibility tended to be higher in Ca-Pr treatment (P<0.05) and slightly improvement nutritive value as (TDN and DCP). The overall means of plasma total protein, globulin, ALT, AST/ALT ratio, plasma urea, creatinine, triglycerides and cholesterol concentration remained un-affected among treatments however, the albumin and albumin/globulin ratio of Ca-Pr and PG groups were significantly higher (P<0.05) than control group. AST plasma activity was significantly lower (P<0.05) in PG and Ca-Pr experimental groups. Moreover, red blood cells count (RBC) and packed cell volume was decreased in PG treatment. Hemoglobin content, WBC count and balance plasma phosphorous, sodium and potassium concentration showed no change in all treatments.While,plasma calcium increased (P>0.05) in Ca-Pr calves (10.70 mg/dL) compared to PG and control groups (9.73 and 10.08mg/dL) respectively. PG and Ca-Pr showed higher

significant difference than the control group on T3 (115.32, 123.07 and 100.71 ng/dI) and T4 (4.03, 3.81 and 3.44 ug/dl) respectively.

It is worthy to mention that previous findings suggested a potential influence of PG and Ca-Pr which had widely safe accepted as a new energy source and calcium additive in buffalo calf's growth diet**.**

Keywords:

Buffalo calves, oral administration, propylene glycol, calcium propionate,blood indices metabolites and digestibility.

INTRODUCTION

As consequence of rising corn costs, using glucose precursors partially in feed animals to replace grain may be have become a major focus attractive option, and alternative feed sources for livestock industry **(Ferraro *et al*., 2009**). Propylene glycol and calcium propionate used for correct metabolic problems in dairy cattle by increase short chain fatty acids as major end products of ruminal microbial fermentation but only propionate, valerate, and isobutyrate can serve in the rumen, which it is the main precursor required of glucose synthesis in liver **(Trabue *et al.,* 2007**). Propionate is glycogenic fatty acid (VFA) absorbed by rumen epithelial wall, then transported via the portal vein to liver and incorporated into tricarboxylic acid cycle through succinyl coenzyme and converted to glucose via pyruvate and oxaloacetate **(Allen *et al.* 2009)**. In adult ruminants, gluconeogenesis is an important accessory function to prevent negative consequences of systemic propionate accumulation,e.g.,depressed appetite or propionic acidemia **(Deodato *et al.,* 2006**). Oral administration of gluconeogenic precursors, such calcium salts of propionate force calcium into the blood by passive diffusion with increase blood calcium administration and ruminal propionate production that cause a positive energy balance and antiketogenic during growth period in the cattle **(Rigout *et al.,* 2003).**

Also, decreased pH values and acetate to propionate ratio in the rumen improved the digestibility's of dry matter (DM), organic matter (OM), neutral detergent fibre (NDF) and acid detergent fibre (ADF) (**Overton, and Waldron, 2004)**.Propylene glycol is rich glucoplastic substance in energy (4.7 McCall NE/L)**,** which reduce the negative energy balance with limiting risk of ketosis and fatty liver because it is rapid metabolized and absorbed in the rumen **(Miyoshi *et al.,*2001)**.Propylene glycol, roughly 50 % can be

metabolized in 1-2hr after feeding, with approximately 80-90% usually metabolized until 3hr after feeding. The portion of this substance metabolised to lactic and propionic acid in the rumen, and converted to glucose in liver throughout glyconeogenesis pathway **(Nielsen and Ingvartsen, 2004)**. After ingestion, remaining PG absorbed directly from the gastrointestinal tract without alteration and enters gluconeogenesis via pyruvate in the liver **(Trabue *et al.* (2007).** A few data showed the effect of fed PG and Ca-Pr as energy source on beef- cattle performance and blood characteristics.

Therefore, the main object of the present work was to evaluate the effect of propylene glycol and calcium propionate as feed additives on some blood biochemical constituents and digestibility nutrients during growth period in buffalo calves.

Material and methods:

Animals and experimental diets:

The study was conducted at Mehalt Mousa Buffalo Research Station, Animal Production Research Institute (APRI),Agricultural Research Center.Fifteen male buffalo calves (*Bubalus bubalis*) apparently healthy, at 13.0±0.42 months of age with 212.27±8.684 kg body weight were used in this experiment and were divided randomly into three equal groups (5, each) based on their live body weight; the first group was fed basal ration only without additives (control), the second was fed with supplemented 300 mL (310 g) of propylene glycol (PG) (Korea D2551U- Corporation 1589/3 Seocho, Dong, Seocho- Seoui Korea) and the last group was supplemented with 335g of Calcium propionate (Ca-Pr) (NutroCal®; Kemin Industries, Inc., Des Moines, IA). Each PG drenched (300 mL) produced 4.08 mol. glucose precursors, while each CP drenched (335 g) produced 81.6 g calcium and 4.08 mol. glucose precursors which gives (1.41Mcal NE/L) according **Gavana and Motorga, (2009)**. Calves administrated by drenching into the esophagus via an esophageal feeder tube after dilution with 3L of saline solution (Nacl 0.9%) twice/weekly, and adapted for 21 days to the experimental diet which extended to 6 months. Animals were weighed on two consecutive days and kept indoors semi-open wall-ventilated sheds yards in separated pens, each pen was provided with adequate individual feeding space facilities and watered free. Animals fed individually a conventional concentrate mixture based on LBW twice daily in two equal portions at 8 a.m. and 3 p.m. to meet the animal's protein requirements for maintenance and growth according to **NRC (2005)** recommendations. The concentrate feed mixture (CFM)

was composed of 35.5% wheat bran, 31.5% decorticated cotton seed cake, 15% yellow corn, 10 % sun flower seed cake, 3.5% vinas, 3%limestone and 1.5% common salt (Nacl) whereas, mineral blocks was available free choice also berseem hay and rice straw fed ad lib. CFM animals' daily requirements changed qualitatively gradually biweekly according to body weight increase.

Digestibility trial:

Actual amount of individual animal feed offered and refusal recorded withheld overnight before weighing and daily representative samples were collected monthly for chemical composition analysis. At the end of feeding trials three calves from each experimental group were assigned randomly and carried out individual digestibility cages to determine nutrients digestibility and nutritive values by using Acid Insoluble Ash (AlA) method according to **(Van Keulen and Young, 1977**). DM digestibility as well as all nutrients was determined with the following equations:

% Nutrient digestibility =100 - (% DM digestibility x %Nutrient in feces) / % Nutrient in feed). Fecal samples were collected individually from the rectum twice daily every 10 hr at 7:00 and17:00 hr for seven successive day's collection period after 15 days preliminary period involving daily collection of fecal samples. Feed and fecal samples dried and kept for later analysis.

Table (1): Chemical composition of the experimental feed stuffs (% 0n DM basis).

Feed stuff	As DM basis								As fed	
	DM	OM	CP	CF	EE	NFE	Ash	AIA*	TDN*	DP*
CFM	91.2	90.08	13.37	24.66	3.2	48.85	9.92	4.27	63.70	9.80
Berseem Hay	88.7	86.42	14.55	31.63	0.7	39.54	13.58	2.25	48.0	9.00
Rice straw	90.5	84.36	2.96	38.83	1.23	41.34	15.64	12.35	40.00	0.00

***AIA: Acid insoluble ash: TDN total digestible nutrients; DP: digestive protein.**

Analytical methods:

Chemical composition of different ingredients and fecal samples were analyzed according to **A.O.A.C. (1996)** method to determine, dry matter DM, crude protein CP, crude fiber CF and ether extract EE while nitrogen free extract NEF content was calculated by the difference. Concentrations of neutral detergent fiber NDF samples were determined using an Ankom 200

fiber extractor (Ankom Technologies, Fairport, NY) according to the method of **Van Soest *et al.* (1991).** Chemical compositions of feed stuffs are illustrated in (Table 1).

Blood sampling:

Blood samples were collected biweekly via the jugular vein from each buffalo calf throughout the experimental period. The count of red blood cell (RBC) and white blood cell (WBC) was determined using haemocytometer, packed cell volume (PCV%) estimated by using micro-hematocrit tube then centrifuge at 10000 rpm for 5min, while concentration of hemoglobin (Hb) was carried out using (Super+Ior®, Sahli's method) according to **Sahli, (1905).** Blood plasma was carefully separated after centrifugation at 4000 r.p.m. for 20 minutes, and then stored at -20^{o}C until analysis. Plasma used for determination total protein **(Armstrong and Carr 1964**), blood urea nitrogen **(Faweat and Scott, 1960**), creatinine **(Young 2001),** albumin **(Drupt, 1974)**, cholesterol **(Kostner *et al.,* 1979**) and triglycerides **(Schalm *et al.,* 1975**), liver function enzymes (aspartate aminotransferase (AST), alanine aminotransferase (ALT), were devised by kit method, purchased from Biosino Bio-technology and Science INC). Liver function and some minerals concentrations (Na, K, Ca and Pi) in plasma were carried out using commercial chemical reagent kits (Sigma kit 310-A, Sigma Diagnostics). Absorbance of Ca and P was read at Spectrophotometer (UV-double Beam) at 650 and 340 nm, respectively. Direct radioimmunoassay technique was performed for determination triiodothyronine (T3) and thyroxin (T4) hormones in representative plasma samples. Kits of ‘‘Diagnostic Products Corporation, Los Angles, USA’’ with ready antibody coated tubes according to the procedure outlined by the manufacturer.

Statistical analysis:

The obtained data were analyzed using GLM procedures of the SAS (**SAS, 1999**) and means calculated using Duncan's multiple range test **(Duncan, 1955**). Statistical significance was established at $P \leq 0.05$.

RESULTS AND DISCSSION

Impact of drenching PG and Ca-Pr administration on feed intake:

Average daily dry matter intake (DMI) for treatment groups are presented in (Table 2). Results showed non-significant difference in DMI in buffalo calves drenched PG and Ca-Pr compared to the control group. Similar results were recorded by **Miyosh *et al.* (2001)** and **Pickett *et al.* (2003).** The poor palatability of PG which might be negative affected feed

consumption and negative stimulate regulate feedback signals of feed intake with increase insulin triggered **(Ingvartsen and Andersen, 2000).**

Impact of drenching PG and Ca-Pr on nutrients digestibility and nutritive values:

Nutrient digestibility coefficients and feeding values of treatment groups are shown in (Table 2). CP and CF digestibility coefficient was higher ($P<0.05$) in Ca-Pr addition group and subsequently slight improvement on nutritive value as (TDN and DCP) than other treatments. However, PG and Ca-Pr add groups didn't influence of DM, OM, NDF and EE digestibility during the metabolism trial compared to control group. CP and CF digestibility improvement in drenched Ca-Pr group tented to increase Ca as intestinal pH buffers which bind ability with fatty acids and remove their inhibitory rumen microorganism's effect especially rumen proteolytic and cellulolytic bacteria resultantly increased rate of fibre breakdown and digestion in the gut **(Anjum *et al.,* 2014).** Results were in agreement with those obtained by **Avila-Stagno *et al.,* (2013)** who found no affect on nutrient digestibility among the sheep diet groups providing glycogenic precursor's supplementation. **Shin *et al.*, (2012)** showed NDF digestion reduction by 30% with low amounts of effective fibre when replacing concentrate with PG at 10% of DMI. Additionally, PG supplemented diet reduced cellulolytic microorganisms and cellulose digestibility due to increase molar percentage of ruminal propionic acid and lower ruminal pH value **(Christensen *et al.,*1997)**. Contrary to our results, **Wang e*t al.* (2009)** found that fed steer diet on 200 g/day PG enhanced ruminal degradation, total DM,NDF and ADF digestibility's with decrease crude protein degradability. Also,addpropyleneglycol improvement rumen protein utilization metabolism.**(Rukkwamsuk, 2010).**

Table (2): Nutrients digestibility and nutritive value in buffalo calves drenched PG and Ca-Pr supplementation of the experimental rations.

Items	Treatments (+MSE)		
	control	PG	Ca-Pr
Initial body weight (kg)	212.2 ± 7.19	213.6 ± 8.99	211.00 ± 9.67
Total Dry matter intake/day	11.1 ± 0.19	10.7 ± 0.24	10.20 ± 0.20
Soluble Ca, mg/L	9.90 ^{b} ± 1.10	9.70 ^{b} ± 0.92	18.50 ^{a} ± 1.21
pH	5.87 ^{a} ± 0.05	5.66 ^{b} ± 0.04	5.54 ^{b} ± 0.03
Digestibility of nutrients (%)			
Dry matter (DM)	62.89 ± 3.53	60.85 ± 4.86	65.46 ± 2.38
Organic Matter (OM)	65.36 ± 2.25	61.73 ± 5.04	67.64 ± 4.62
Crud Protein (CP)	60.23 ^{b} ± 1.70	58.21 ^{c} ± 2.66	63. 85 ^{a} ± 1.48
Crud Fiber (CF)	53.02 ^{b} ± 3.13	52.11 ^{c} ± 4.68	55.40 ^{a} ± 1.24
Ether Extract (EE)	63.37 ± 4.88	61.81 ± 6.59	63.61 ± 5.12
Nitrogen Free Extract (NFE)	65.51 ± 2.84	64.84 ± 3.32	67.81 ± 1.89
Neutral detergent fiber (NDF)	66.13 ± 2.45	63.90 ± 2.75	65.11 ± 3.22
Acid detergent fiber (ADF)	62.47 ± 2.78	61.64 ± 3.12	65.25 ± 2.05
Nutritive value (%)			
TDN	62.51 ± 0.45	65.58 ± 0.65	67.99 ± 0.95
DCP	8.16 ± 0.06	8.05 ± 0.15	8.35 ± 0.11

a,b,c: values in the same row with different superscripts differ significantly (P < 0.05).

PG = propylene glycol and Ca-pr= calcium propionate add groups; LS mean± standard errors.

Impact of drenching PG and Ca-Pr on blood parameters of buffalo calves:

Regarding date in (Table 3) shown the impact of drenched PG and Ca-Pr on blood plasma biochemical parameters. The overall mean of total protein and globulin tended to be low (P>0.05) in PG and Ca-Pr calve groups Moreover, albumin and Alb/Glo ratio were higher (P<0.05) than the control group during the investigation period. The present results are in accordance with those obtained by **Abd Elfadeel *et al.*, (2017) and Adamski *et al.*, (2011)** who found no significant difference in total protein and albumin when Simmental cows

supplemented PG**. Klebaniuk *et al.,* (2009)**, fed cows on calcium propionate and propylene glycol at two levels (300 and 450 g/head/day) at different periods found no exert any significant impact on level total protein concentration in blood plasma. **Piccione *et al.,* (2009**) found increased Albumin significantly as described to increase glomerular filtration and low protein intake responsible in PG treatment. Furthmore**,** blood total protein concentration decreased with PG supplementation may be indicated to malabsorption, malnutrition and a gamma globulinaemia or to maternal circulation amino acids utilization and muscles protein synthesis **(Antunovic *et al.,* 2002)**. In contrast, **Rukkwamsuk, (2010)** found that addition propylene glycol improved protein utilization in the rumen and plasma protein concentration.

Plasma AST activities in PG and Ca-Pr treatment groups were significantly lower ($P<0.05$) compared with the control. Whereas, blood ALT and AST/ALT ratio not affected by PG and Ca-Pr drenched groups. AST overall mean was (63.68, 61.31 and 60.65 µ/L) and ALT (32.36, 31.21 and 29.64 µ/L) for control, PG and Ca-Pr, respectively. The present results are in accordance with those obtained by **Adamski *et al.,* (2011) Klebaniuk *et al.* (2009).**

They revealed that calcium propionate and propylene glycol at two levels (300 and 450 g/head/day) decreased significantly AST activity with no significant impact on ALT level and total protein concentration in blood plasma. In contrast, **Hoedemaker *et al.,* (2004)** found no significant effect of PG treated Holstein on AST activity enzyme.

Moreover, blood plasma urea and creatinine as kidney function indicator showed insignificant differences between treatments. The obtained results were supported by **Kabu and Civelek (2012)**; **Klebaniuk *et al.,* (2009) and Abd-Elfadeel *et al.,* (2017).** They reported plasma urea nitrogen concentrations and creatinine didn't show any significant impact in PG and Ca-Pr treated buffalo cows as reflect to ruminal ammonia-N concentration lack response. Contrary to our results, **Rukkwamsuk, (2010)** found that added propylene glycol improve rumen protein utilization with increased plasma urea concentration significantly.**Ballard *et al.,* (2001)** recorded a significant difference blood creatinine concentration between animals provided with energy supplementation (beet pulp, sugar cane,calcium propionate and propylene glycol) and the control group. Also, **Caldeira *et al.,* (2007)** indicated that ewes fed PG improved negative energy balance and decreased plasma urea levels as a result to body protein degraded.

Table (3): Means concentrations of blood plasma buffalo calves drenched with PG and Ca-Pr.

Variable	Experimental groups (+MSE)		
	Control	PG	Ca-Pr
Protein fractions			
T. protein (g/dl)	7.46 ± 0.43	7.26 ± 0.39	7.27 ± 0.46
Albumin (A) (g/dl)	3.70 ^{b} ± 0.25	3.74 ^{ab} ± 0.38	3.83 ^{a} ± 0.31
Globulin (G) (g/dl)	3.76 ± 0.22	3.52 ± 0.25	3.41 ± 0.28
A / G ratio	0.98 ^{c} ± 0.11	1.06 ^{b} ± 0.11	1.113 ^{a} ± 0.08
Liver functions			
AST (u/L)	63.68 ^{a} ± 1.76	61.31 ^{b} ± 2.43	60.65 ^{c} ± 1.46
ALT (u/L)	32.36 ± 0.88	31.21 ± 2.89	29.64 ± 1.43
AST/ ALT ratio	1.97 ± 0.04	1.96 ± 0.03	2.19 ± 0.02
Kidney functions			
Urea-N (mg/dL)	37.26 ± 3.51	39.81 ± 4.36	41.23 ± 3.97
Creatinine (mg/dL)	0.70 ± 0.04	0.65 ± 0.05	0.67 ± 0.04
Triglycerides (mg/dl)	27.50 ± 0.26	23.53 ± 0.45	25.31 ± 0.52
Cholesterol (mg/dl)	77.00 ± 5.02	82.81 ± 2.14	81.43 ± 3.56

a, b, ab, and c: values in the same row with different superscripts differ significantly (P < 0.05). PG= propylene glycol and Ca-pr= calcium propionate add groups; AST= aspartate aminotransferase; ALT= alanine aminotransferase; LS mean± standard errors.

Also, a declining tendency was observed in plasma triglycerides concentration (TG) without significant distinctions among PG and Ca-Pr treated groups and control groups (Table 3). PG and Ca-Pr reducing liver TG accordance to subsequently cause's lower fat accumulation and decreased lipid mobilisation with reducing liver metabolic functions **(Drackley *et al.,* 2001**). Similar results denoted by **Rukkwamsuk *et al.,* (2005); Mikula *et al., (*2008) and Adamski *et al.,* (2011).** In contrary, **Nielsen and Ingvartsen, (2004**) observed that add PG increased energy balance with reducing hepatic effect on TG concentrations. Also, **Pickett *et al.,* (2003)** found that cows decreased liver TG-content by 44% compared to control when allocated orally 518 g PG per day. A significant decrease circulating blood triglycerides related to

contribute significantly fat synthesis as increased lipolysis of hormonally regulated, without expression of energy deficiency **(Nazifi *et al.,* 2002).**

Data in (Table 3) showed that blood cholesterol concentration was higher in PG and Ca-Pr treatments without significant differences among treatments; the overall mean of cholesterol concentration was 77.00, 82.81 and 81.43 mg/dl for control, PG and Ca-Pr respectively, the results in accordance by **Rukkwamsuk *et al.*,(2005);and Mikula *et al.*,(2008).**

Rukkwamsuk, (2010) reported that PG supplementation increase cholesterol level after the end of administration due to the diminished responsiveness of target tissues towards insulin with an increased mobilization of fatty acids from adipose tissue. The moderate variability glycogenic precursor reason of cholesterol was not clear but can be attributed to metabolic blood glucose or insufficient nutrient intake which can reduce circulatory cholesterol levels **(Kristensen and Raun, 2007).**

Impact of drenching PG and Ca-Pr on plasma hormone levels T3, T4 (Thyroid hormones) and minerals concentrations of buffalo calves.

Regarding values of triiodothyronine (T3) and thyroxin (T4) hormones as considered a good indicator of thyroid gland activity are shown in (Table 4)**,** buffalo calves drenching PG and Ca-Pr revealed higher significant differences ($P<0.05$) on T3 and T4 than the control group. The overall mean of T3 hormone concentration was (100.71, 115.32 and 123.07ng/dI) for control, PG and Ca-Pr groups respectively. Also, PG treated group was the highest values of T4 hormone concentration (4.03 ug/dI) than Ca-Pr and control (3.81 and 3.44 ug/dl) respectively, the similar result was obtained by **Iriadam, (2007)** drenching glycogenic precursors increased T3 and T4 these finding evidenced to increase blood glucose when compared with the control group **(Abd Elfadeel *et al.,* 2017).**

There was no significant distinction among PG, Ca-Pr treated buffalo calves and the control group without blood balance interferes for the all estimated plasma minerals concentration (Table 4). The higher overall mean estimates to phosphorous and potassium concentration in blood plasma recorded in the control group when compared with PG and Ca-Pr groups while, Ca-Pr treatment increased plasma calcium (10.70mg/dL) than PG and control groups (9.73 and 10.08mg/dL) respectively. Similar result was obtained by **Abd Elfadeel *et al.*,(2017)** who found that, the drenching glycogenic precursors of buffalos not affected than control for all estimated plasma minerals**.**

Table (4): Means concentrations of blood plasma of buffalo calves groups drenched with PG and Ca-Pr.

Variable	Experimental groups (+MSE)		
	Control	PG	Ca-Pr
Thyroid hormone			
T3 (ng/dl)	100.71 ^{c} ± 5.12	115.32 ^{b} ± 3.66	123.07 ^{a} ± 4.45
T4 (ug/dl)	3.44 ^{c} ± 0.16	4.03 ^{a} ± 0.09	3.81 ^{b} ± 0.11
Minerals concentrations			
Calcium, mg/dL	10.08 ± 0.72	9.73 ± 0.67	10.70 ± 0.58
Phosphorus, mg/dL	6.56 ± 0.35	6.21 ± 0.41	6.34 ± 0.37
Sodium, mmoL/L	147.15 ± 7.17	143.24 ± 9.38	151.42 ± 8.60
Potassium, mmoL/L	3.96 ± 0.22	3.63 ± 0.24	3.69 ± 0.21

a,b,c: values in the same row with different superscripts differ significantly (P < 0.05).LS mean± standard errors. PG= propylene glycol and Ca-pr= calcium propionate add groups;

Table (5): Means concentrations of blood plasma buffalo calves groups drenched with PG and Ca-Pr.

Variable	Experimental groups (+MSE)		
	Control	PG	Ca-Pr
RBC count x106/mm3	6.77 ± 0.10	7.15 ± 0.08	8.28 ± 0.06
WBC count x103/mm3	6.53 ± 0.09	6.92 ± 0.05	7.59 ± 0.07
Hemoglobin (Hb) g/dl	8.40 ± 0.11	8.36 ± 0.09	10.01 ± 0.06
PCV (%)	31.72 ± 0.66	32.81 ± 0.53	34.03 ± 0.45

PG= propylene glycol and Ca-pr= calcium propionate add groups; LS mean± standard errors.

Date in (Table 5) showed a slight decreased of red blood cell (RBC) and packed cell volume (PCV) count (P>0.05) for PG treatment compared to the other groups, also non-significant differences were observed in hemoglobin percent and WBC count among treatments this could be due to low hormone functions with decrease blood total protein and globulin in PG treated animals. These results are in accordance with those obtained of **Saini, (1996)** who

reported that the total erythrocyte count, hemoglobin% and packed cell volume on PG treated group decreased related to formulation on hemopoiesis glucogenic precursor effects**,** also a reversible decline in red blood cell count was probably due to either cells destruction, or their removal from circulation. Likewise, 60 to 120 g/kg DM add PG in diet decreased the lifespan of RBC, but it was induced feedback mechanism increase the production of new RBC, so there was a slight change occurred in the hematocrit value **(Bauer *et al.,* 1992). Mikula *et al.,* (2008)** reported that add propylene glycol had no changed in hemoglobin content and differential leucocyte cell count. Also, **Mordak and Nicpoń (2006)** showed that propylene glycol addition decreased packed cell volume (PCV),mainly due to hyper-osmolality (increased concentration of a solution expressed as osmoles of solute per kilogram of serum water). Moreover, cow hyperventilation could be explained by PG induced destruction of red blood cells (RBC) and thereby a shortage of oxygen and hemolysis **(Nielsen and Ingvartsen, 2004)**. **Christopher *et al.,* (1990)** suggested, that cows on the basis of an experiment with PG was adaptation to an increased production of RBC's and maintenance of normal hematocrit value through to eliminate the above-mentioned symptoms.

Factors, such as animal metabolic status, time of blood sampling, time relation of feeding PG and PG supplementation method had an influence the magnitude response in blood parameters.

CONCLUSIONS

It can be concluded that Ca-Pr and PG oral administration buffalo calves indicated beneficial some nutrients digestibility, and nutritive values with no major effects on blood biochemical variables as, protein fractions,liver enzymes activity, kidney functions,T3,T4,plasma minerals concentrations and reduced serum BUN levels, implying reduced catabolism of body tissue and increased energy metabolism.Moreover calcium propionate was found to be a satisfactory source of calcium and could be new sources for growth without biochemical disturbance health complication.

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تقيم كفاءة الهضم وبعض قياسات الدم لاضافة الجليكوبروبيلين وبروبيونات الكالسيوم للعجول الجاموسى

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الملخص العربى

اجريت هذه التجربة بهدف دراسة اثر التجريع بالبروبيولين جليكول وبروبيونات الكالسيوم لعجول الجاموس المصرى كمصدر للطاقة على كفاءة الهضم وبعض قياسات الدم, وقد تم استخدام 15عجل جاموسى بمتوسط وزن 212.27 ± 8.684 كجم وزن حى) تم تقسيمهم عشوائيا لثلاث مجاميع متماثلة على اساس وزن الجسم بكل مجموعة خمسة حيوانات , المجموعة الاولى (كونترول) تم تجريعها ب3 لتر محلول ملحى (0.9 % كلوريد صوديوم) وبدون اضافات , المجموعة الثانية تم تجريعها ب3 لتر محلول ملحى مذاب فيه 300مل بروبيولين جليكول (310 جم) , والمجموعة الثالثة تم تجريعها ب3 لتر محلول ملحى مذاب فيه 335جم بروبيونات الكالسيوم بالتجريع مرتين اسبوعيا خلال الفترة الكلية للتجربة (6 اشهر) . وتم تقديرمعاملات الهضم للمركبات الغذئية والقيمة الهضمية بالاضافة لتقدير بعض القياسات لوظائف الدم وقد اظهرت النتائج ان المعاملة ببربيولين الجليكول وبربيونات الكالسيوم خفضا من المادة الجافة اليومية الماكولة الا ان هضم المادة العضوية والالياف المتعادلة والدهون لم تتاثر نتيجة المعاملتين بالرغم من ان المعاملة ببربيونات الكالسيوم اظهرت ارتفاعا معنويا لمعامل هضم البروتين والالياف الخام مع تحسن طفيف للقيمة الهضمية كمادة جافة كلية وبروتين خام مهضوم . كما ان متوسط تركيزات البروتين الكلى والجلوبيولين وانزيمات الكبد والنسبة بينهما واليوريا والكرياتينين والاحماض الثلاثية والكوليسترول بالدم لم تتاثر نتيجة المعاملتين بالرغم من ان تركيز الالبيومين والنسبة بين الالبيومين والجلوبيولين كان مرتفعا معنويا نتيجة المعاملات بالمقارنة بمجموعة المقارنة, بينما اظهرت النتائج تناقص عدد كرات الدم والPVC نتيجة المعاملة بالبربيولين جليكول بينما لم تحدث المعاملات اية تغيرات معنوية لكرات الدم البيضاء والهيموجلوبين, كذلك لم تحدث تغيرات فى تركيزات الفوسفور والبوتاسيوم والصوديوم فى بلازما العجول المعا ملة الا انه قد حدثت زيادة غير معنوية لتركيزات الكالسيوم بالدم للعجول المعاملة ببربيونات الكالسيوم بالمقارنة بمجموعة ببربيولين الجليكول والكونترول كما ارتفعت قيم هرمونات الغدة الدرقية T3& T4 نتيجة المعاملة ببربيونات الكالسيوم و ببربيولين الجليكول. ومن النتائج السابقة فإنه يمكن استخدام كلا من بربيونات الكالسيوم و ببربيولين الجليكول بالنسب السابقة كاحد الاضافات الغذائية التى تستخدم فى امداد العجول الجاموسي فى مرحلة النمو بالطاقة والكالسيوم خاصة لببربيونات الكالسيوم وبدون تاثيرات جانبية على العمليات التمثلية بالدم خاصة وظائف الدم الكبد والكلى .