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Productive Performance of Growing Calves Fed Rations Containing Different Levels of Commercial Product (Availa-4) as Feed Additive

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Abstract: Availa-4 (commercial product) is widely utilized as feed additives for ruminant animals in Egypt and many parts of the world. So this work was carried out to study the influence of adding Availa-4 as feed additives in growing calve rations to study its impact on their productive performance, drinking water and economic efficiency. Twelve of growing male cross bred calves aged 6-8 months with an average weights (209.67 ± 8.75 kg) were randomly divided into three equal groups each containing 4 calves and fed individually for 126 days. The experimental rations were offered at 4% dry matter of live body weight, experimental rations were divided in to 60% concentrate feed mixture and 40% roughage (wheat straw). Availa-4 (commercial product) was added to concentrate feed mixture (CFM) at 0, 0.5 and 1 gram per one kg CFM for R_1, R_2 and R_3, respectively. The importuned obtained result showed that Final weight, total body weight gain, average daily gain, average body weight and metabolic body weight ($kgW^{0.75}$) in significantly increased. Feed intake from concentrate feed mixture and wheat straw insignificantly (P>0.05) decreased. Values of dry matter intake (DMI), crude protein intake (CCPI), non fiber carbohydrates intake (NFCI); gross energy intake (GEI) and digestible energy intake (DEI) in significantly (P>0.05) decreased compared to control. Values of DMI, CPI and NFCI (g/ $kgW^{0.75}$) or GEI and DEI (kcal/$kgW^{0.75}$) were significantly (P<0.05) decreased comparing to control. Feed conversion significantly (P<0.05) improved with increasing level of Availa-4 in the rations. Values of drinking water parameters includes (liter /head/day, ml/ kg $W^{0.75}$, liter/ kg dry matter intake, liter/ kg crude protein intake, liter/ kg non fibrous carbohydrate intake, liter/ M cal gross energy intake and liter/ M cal digestible energy intake were levels in significantly (P<0.05) decreased. Daily profit above feeding cost was improved (12.81, 19.74 and 20.76 LE for R_1, R_2 and R_3, respectively). Relative economical efficiency was also, improved (154.1 and 162.06 % for (R_2 and R_3), respectively when assuming that the relative economic efficiency of R_1 (control ration) equals 100. Values of feed cost (LE/ kg gain) was decreased by 12.72% and 17.37% for R_2 and R_3, respectively in comparison with control (R_1). It can be mentioned that incorporation Availa-4 as feed additive in cross bred calve rations realized an improving in their performance, relative economic efficiency and decreased feed cost/ kg gain.

Key words: Feed additive · Availa-4 · Calves · Performance · Water consumption · Economic evaluation

INTRODUCTION

Modern intensive livestock and poultry production has achieved phenomenal gains in the efficient and economical production of high quality and safe animal products and by-products. Furthermore, the overall performance of livestock can be increased by improving nutrients utilization, health status, fertility and efficiency of production. The use of feed additives has been an important part of achieving efficient livestock production. Feed additives are non-nutritive substances, preparations and micro-organisms that are added to animal feed to improve productive, reproductive and health performances. Any substance is considered as a feed additive when, not having a direct utilization as nutrient, is included at an optimum concentration in diet to exert a positive action over the animal health status or the dietary nutrient utilization [1, 2].

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Hutjens [3] defined feed additives as a group of substances that can cause a desired animal response in a non-nutrient role, such as pH shift, growth, or metabolic modifier. Feed additives are added deliberately to animal feed which may favourably influences characteristics of the animal feed, feed intake, gastro-intestinal flora, digestibility of the animal feeds, animal production, health, fertility and characteristics of animal products. Because of their chemical nature as active principles, additives are generally included in very small proportions in diet.

Global economic pressures have driven a tendency of the livestock production to produce more products per unit cost. This has led to changes to animal's environment like feeding, housing and disease control. Quality of feed nutrition is influenced not only by the content but also by some other aspects such as, feed presentation, hygiene, anti-nutritional factors, digestibility and palatability [2].

Feed additives provide a mechanism by which such dietary deficiencies can be addressed and also benefits not only associated with the nutrition and thus the growth rate of the animal concerned, but also its health and welfare. Antimicrobial growth promoters are commonly fed to animals to prevent disease and metabolic disorders, as well as improve feed efficiency. However, in recent years, public concern about the potential for antibiotic resistant strains of bacteria, the search for alternatives to replace antibiotics growth promoters has gained increasing interest in animal nutrition. The use of phytogenic feed additives has gained momentum for their potential role as natural alternatives to antibiotic growth promoters in animal nutrition. Compared with synthetic antibiotics or inorganic chemicals, these plant-derived products have proven to be natural, less toxic, residue free and are thought to be ideal feed additives in food animal production. There are a large number of phytogenic feed additives which have antioxidant, antibacterial, anticoccidial, antiparasitic and anti-inflammatory effect [2].

Additives like microbial and plant secondary metabolites offer a unique opportunity manipulating ruminal fermentation. Recent research has been greatly focused to exploit bioactive plant secondary compounds like saponins, tannins, flavonoids, essential oils to improve rumen fermentation such as enhancing protein metabolism, decreasing methane production, reducing nutritional stress like bloat and improving animal health and productivity. Thus, feed additives can be used to improve feed intake, metabolism and efficiency of feed utilization for economic and eco-friendly livestock production [2].

Ruminant nutritionists and microbiologists have been interested for many years, in manipulating the microbial ecosystem of the rumen to improve production efficiency by domestic ruminants. Based on growing concern over the use of antibiotics and other growth promotants in the animal feed industry, interest in the effects of microbial feed additives on animal performance has increased as noted by Callaway and Martin [4].

Natural feed additives that can be classified as probiotics (live yeast) or prebiotics (non-living yeast). Supplementing cattle with live yeast, especially *Saccharomyces cerevisiae*, has been shown to improve the productive performance of ruminant. More specifically, live yeast derivatives reduce ruminal lactate production, alleviate dietary protein loss as ammonia and stabilize ruminal pH [5, 6].

As descried by Habeeb *et al.* [7] the widely utilized of yeast products as feed additives for ruminant animals in many parts of the world, there is a widespread belief between dairy and beef producers and ruminant nutritionists that yeast products are beneficial by enhancing feed intake and overall animal performance and is safe tool for enhancing ruminant production and safeguarding health. However, the mechanisms have been proposed to explain why yeast products could stimulate DM intake and productivity in growing and lactating cattle are showed by Robinson [8].

On the other hand, Thrune *et al.* [9] noted that the oldest hypothesis mentioned that the yeasts are able to grow at least for a short period of time, in the rumen thereby directly enhancing fiber digestion and/or producing nutrients that stimulate growth of rumen bacteria, which do the bulk of the fiber digestion. It has also been suggested that yeasts utilize nutrients, such as lactic acid which, if allowed to accumulate in the rumen, could suppress bacterial growth and/or suppress DM intake by driving rumen pH down.

A more recently suggested possibility is that growth of yeast in the rumen utilizes the trace amounts of dissolved oxygen, particularly at the interface of the cellulolytic bacteria and fiber, thereby stimulating growth of rumen bacteria, to which oxygen is toxic [10]. It seems clear that for these mechanisms to be operative, yeasts in the product have to be viable, in the sense of being able to grow for at least a short period of time in the rumen. Hence the origins of the debate between live and dead yeast products. The alternate mechanism is that it is the yeast culture itself, which is created in the yeast fermentation process, which provides a mixture of micro-nutrients to stimulate bacterial growth in the rumen thereby facilitating increased fermentation of fiber and/or utilization of end products of fiber fermentation to prevent their accumulation in the rumen. Supporters of this theory point to a limited research base showing that when cultures of live brewers or fermentation yeasts are fed to ruminants, there are few, if any, changes to rumen fermentation and/or animal performance [7].

Incorporation the yeast as feed additive in the ration has been occurred to enhance the feed intake, daily gain and feed efficiency in beef cattle, meanwhile, in lactating dairy cows noticed that a significantly increasing in milk production, milk composition and dry matter intake was obtained when yeast and yeast cultures products were added in the ration as mentioned by Britt *et al.* [11].

As Jason Russell [12] calves fed Availa-4 during a 28-day receiving period had 45 percent reduction in morbidity and a 9 to 13 percent increase in average daily gain. Additionally, feeding Availa-4 in the starter period and Availa®Zn in the finishing period improves the average daily gain in the feedlot by 6 percent and improves feed conversion by 4 percent. Feeding performance trace minerals has also been shown to help reduce the incidence of foot rot by 30 to 57 percent.

Therefore, this work was carried out to study the impact of adding Availa-4 as commercial feed additive in growing calve rations on their productive performance, drinking water and economic evaluation.

MATERIALS AND METHODS

The present study was carried out at Research and Production Station, located in El-Emam Malik Village, El-Bostan, West of Nubaria and at laboratories of Animal Production Department, National Research Centre, 33 El-Bohouth Street, Dokki, Giza, Egypt.

Animals and Feeds: Twelve of growing male cross bred Friesian X Baladi calves aged 6-8 months with an average weights (209.67 ± 8.75 kg) were randomly divided into three equal groups each containing 4 calves and fed individually for 126 days to investigate the influence of inclusion different levels of commercial product (Availa-4) that used as feed additive in ruminants ration's on their productive performance and economic evaluation.

The experimental rations were offered at 4% dry matter of live body weight, experimental rations were divided in to 60% concentrate feed mixture (CFM) and 40% roughage (wheat straw). Availa-4 was added to concentrate feed mixture (CFM) at 0, 0.5 and 1 gram per one kg CFM for R_1, R_2 and R_3, respectively.

Daily amounts of different tested rations were adjusted every two weeks according to body weight changes and it were offered twice daily in two equal portions at 800 and 1400 hours, while feed residues were daily collected, sun dried and weekly weighed. Fresh water was always offered twice daily. Individual body weight change was recorded every two weeks before receiving the morning ration.

Analytical Procedures: Chemical analysis of ingredients and experimental ration samples were analyzed according to AOAC [13] methods. Neutral detergent fiber, acid detergent fiber and acid detergent lignin were determined according to Goering and Van Soest [14] and Van Soest *et al.* [15]. Meanwhile, hemicellulose and cellulose content were calculated by difference using the following equations:

Hemicellulose = NDF - ADF. Meanwhile, Cellulose =ADF - ADL.

Calculations: Non-fibrous carbohydrates (NFC) were calculated according to Calsamiglia *et al.* [16] using the following equation:

NFC = 100 - {CP + EE + Ash + NDF}.

Gross energy (kcal/ kg DM) was calculated according to Blaxter [17]. where, each g CP = 5.65 Kcal, g EE = 9.40 kcal and g CF and NFE = 4.15 Kcal.

Digestible energy (DE) was calculated according to NRC [18] by applying the following equation:

DE (kcal/ kg DM) = GE × 0.76.

Economic Evaluation: Economical efficiency for the experimental rations used in the present study depended on both local market price of ingredients and price of calves live body weight. Economic evaluation was calculated as follows:

The cost for 1-kg gain = total cost per Egyptian pound (LE) of feed intake/ total gain (kilogram).

Statistical Analysis: Data collected of live weight, average daily gain, feed intake, feed conversion and drinking water were subjected to statistical analysis as one-way analysis of variance according to SPSS [19]. Duncan's Multiple Range Test [20] was used to separate means when the dietary treatment effect was significant according to the following model:

$Y_{ij} = \mu + T_i + e_{ij}$

where:

Y_{ij} = Observation.

μ = Overall mean.

T_i = Effect of experimental rations for i = 1-3, 1 = (R_1: first[1st] experimental ration assigned as control and it contained 0% Availa-4, 2= {$R_{2:}$ second[2nd] experimental contained 0.05% Availa-4 (0.5 gram /kg CFM) and 3 = ($R_{3:}$ third[3rd] experimental ration contained 0.10% Availa-4 (1 gram / kg CFM).

e_{ij} = The experimental error.

RESULTS AND DISCUSSION

Chemical Analysis of Feed Ingredients, Concentrate Feed Mixture and the Experimental Rations: Chemical analysis of the different ingredients includes (yellow corn, wheat bran, soybean meal and wheat straw) that presented in (Table 1) seemed to be near from the values reported by [21-31].

Meanwhile, data of composition and chemical analysis of the concentrate feed mixture and the experimental rations (Table 2) cleared that concentrate feed mixture formulation covered the nutrient requirement of growing sheep. It contains 16.38 % CP; 4321 kcal/kg DM of gross energy, this related to depending on using high quality sources of feedstuffs in CFM formulations. Meanwhile, the experimental ration contains 11.13% CP; 18.33% CF; 2.68% EE; 58.19% NFE; 9.67% ash; 4056 and 3083 kcal/kg DM of gross and digestible energy, respectively. Values of cell wall constituents includes NDF, ADF, ADL, hemicellulose and cellulose were 48.62; 35.44; 5.61; 13.18 and 29.83, respectively.

Productive Performance: Results of productive performance presented in Table 3 cleared that in significantly increased final weight (FW), total body weight gain, average daily gain (ADG), average body weight metabolic body weight ($kgW^{0.75}$). On the other hand, values of feed intake on DM basis for concentrate feed mixture (CFM) and wheat straw (WS) were insignificantly ($P>0.05$) decreased. In addition to, values of dry matter intake (DMI), crude protein intake (CPI) and non fiber carbohydrates intake (NFCI) that expressed as (g/h/day) or gross energy intake (GEI) and digestible energy intake (DEI) that expressed as (kcal/h/day) were in significantly ($P>0.05$) decreased in comparison with control. Meanwhile, values of the same parameters that mentioned above when expressed as g/ $kgW^{0.75}$ for DMI, CPI and NFCI or that expressed as kcal/$kgW^{0.75}$ for GEI and DEI were significantly ($P<0.05$) decreased in comparison with the control. Values of feed conversion expressed as g. intake/ g. gain of dry matter, crude protein

Table 1: Chemical analysis of the different ingredients and concentrate feed mixture

Item	Feed ingredients				
	Yellow corn	Wheat bran	Soybean meal	Wheat straw	CFM
Moisture	9.36	9.40	7.66	6.04	8.88
Chemical analysis (%) *on DM basis*					
Organic matter (OM)	98.30	95.07	94.74	84.79	94.02
Crude protein (CP)	9.10	14.36	44.00	3.26	16.38
Crude fiber (CF)	4.66	8.85	5.16	37.41	5.61
Ether extract (EE)	4.15	3.65	0.75	1.76	3.30
Nitrogen free extract (NFE)	80.39	68.21	44.83	42.36	68.73
Ash	1.70	4.93	5.26	15.21	5.98
Cell wall constituents					
Neutral detergent fiber (NDF)	36.38	35.07	36.39	75.31	30.84
Acid detergent fiber (ADF)	20.12	17.85	27.18	58.26	20.24
Acid detergent lignin (ADL)	2.35	2.95	6.28	9.32	3.13
Hemicellulose[1]	16.26	17.22	9.21	17.05	10.60
Cellulose[2]	17.77	14.90	20.90	48.94	17.11
Cell soluble-NDF[3]	63.62	64.93	63.61	24.69	69.16
Non fibrous carbohydrates (NFC)	48.67	41.99	13.60	4.46	43.50
Gross energy (kcal/kg DM)	4434	4352	4631	3660	4321
Digestible energy (kcal/kg DM)	3370	3308	3520	2782	3284

[1]Hemicellulos = NDF – ADF. [2]Cellulose = ADF – ADL. [3]Cell soluble-NDF = 100 – NDF.

[4]NFC = 100 – {CP + EE + Ash + NDF}.

Table 2: Composition and chemical analysis of the concentrate feed mixture and the experimental rations

			Experimental rations			
Item	CFM	WS	R_1	R_2	R_3	Price of one kg (LE)
Level of rumi yeast (RY) addition			0 % Availa-4	0.05 % Availa-4	0.10 % Availa-4	
Composition (kg/ ton)						
Yellow corn	550		Basal ration cmposed	Basal ration + 0.5 gram	Basal ration + 1 gram	4.750
Soybean meal	180		of 60 % CFM + 40 % WS	Availa 4 / kg CFM	Availa 4 / kg CFM	7.500
Wheat bran	240					4.500
Lime stone	10					0.250
Sodium chloride	10					1.500
Vitamin and mineral mixture*	5					20.000
Anti toxic	5					20.000
Availa 4**	-					25.000
Price of Ton (LE)	5260	1500	Experimental rations composed of 60% CFM + 40% wheat straw			
Calculated of chemical analysis (%)						
Moisture	8.88	6.04		7.70		
Chemical analysis on DM basis (%)						
Organic matter	94.02	84.79		90.33		
Crude protein	16.38	3.26		11.13		
Crude fiber	5.61	37.41		18.33		
Ether extract	3.30	1.76		2.68		
Nitrogen free extrct	68.73	42.36		58.19		
Ash	5.98	15.21		9.67		
Cell wall constituents (%)						
Neutral detergent fiber (NDF)	30.84	75.31		48.62		
Acid detergent fiber (ADF)	20.24	58.26		35.44		
Acid detergent lignin (ADL)	3.13	9.32		5.61		
Hemicellulose[2]	10.60	17.05		13.18		
Cellulose[3]	17.11	48.94		29.83		
Cell soluble-NDF[4]	69.16	24.69		51.38		
Non fiber carbohydrates (NFC)[5]	43.50	4.46		27.90		
Gross energy (GE), kcal/ kg DM[6]	4321	3660		4056		
Digestible energy (DE), kcal/ kg DM[7]	3284	2782		3083		

* Vitamin & Mineral mixture: Each kilogram of Vit. & Min. mixture contains: 2000.000 IU Vit. A, 150.000 IU Vita. D, 8.33 g Vit. E, 0.33 g Vit. K, 0.33 g Vit. B_1, 1.0 g Vit. B_2, 0.33g Vit. B_6, 8.33 g Vit.B_5 1.7 mg Vit. $B1_2$, 3.33 g Pantothenic acid, 33 mg Biotin, 0.83g Folic acid, 200 g Choline chloride, 11.7 g Zn, 12.5 g Fe, 16.6 mg Se, 16.6 mg Co, 66.7 g Mg and 5 g Mn.

** Availa® 4 mineral for beef containing 5.00 % crude protein, 3.00 % crude fat, 2.00 % crude fiber, 35.00 % ash, 5.00 % calcium (Ca), 4.00 % phosphorus (P), none salt (NaCl), 1.00 % magnesium (Mg), 3.00 % potassium (K), 10165 ppm manganese (Mn), 75 ppm Cobalt (Co), 750 ppm copper (Cu), 68 ppm Iodine (I), 13 ppm selenium (Se), 2150 ppm zinc (Zn), 80.000 I.U./lb Vitamin A, 20.000 I.U./lb Vitamin D and 100 I.U./lb Vitamin E.

CFM: concentrate feed mixture. WS: Wheat straw.

[2]Hemicellulos = NDF - ADF. [3]Cellulose = ADF – ADL.

[4]Cell soluble-NDF = 100 – NDF.

[5]NFC = 100 – {CP + EE + Ash + NDF} was calculated according to Calsamiglia *et al.* [16].

Gross energy (GE), kcal/ kg DM[6] was calculated according to Blaxter [17].

Digestible energy (DE), kcal/ kg DM[7] was calculated according to NRC [18]

and non fiber carbohydrates or that expressed as kcal intake/ g. gain of gross energy, digestible energy were significantly ($P<0.05$) improved with increasing level of tested material (Availa-4) in the rations. Most studies mentioned that, where a response is observed, fungal feed additives increase feed intake rather than alter feed conversion efficiency [32-38]. Only occasionally is improved feed efficiency a possible benefit [39]. Williams and Newbold [40] noted that the improvement in the intake of dairy cows corresponded well with the observed effects on productivity. The main effects of fungal feed additives are therefore regarded as being intake-driven. Many factors are known to influence appetite, but the ones that have been considered for yeast

Table 3: Productive performance of the experimental groups

	Experimental rations				
Item	0 % Availa 4 R_1	0.05 % Availa 4 R_2	0.10 % Availa 4 R_3	SEM	Sig.
Calves number	4	4	4	-	-
Initial weight (kg)	211	208	210	8.75	NS
Final weight (FW, kg)	313	324	328	11.62	NS
Total body weight gain (TBWG, kg)	102	116	118	4.64	NS
Experimental duration period		126 days			
Average daily gain (ADG, g/day)	810	921	937	36.68	NS
Average body weight, kg*	262	266	269	9.95	NS
Metabolic body weight ($kgW^{0.75}$)	65.12	65.87	66.42	1.81	NS
Feed intake on DM basis					
Concentrate feed mixture (CFM), g	5425	5373	5352	16.98	NS
Wheat straw (WS), g	2797	2770	2760	8.76	NS
Dry matter intake (DMI) as					
g/h/day	8222	8143	8112	24.86	N
$g/kgW^{0.75}$	126.26^{a}	123.62^{b}	122.13^{b}	0.48	*
Crude protein intake (CPI) as					
g/h/day	915.11	906.32	902.87	2.77	NS
$g/kgW^{0.75}$	14.05^{a}	13.76^{b}	13.59^{b}	0.05	*
Non fiber carbohydrates intake (NFCI) as					
g/h/day	2294	2272	2263	6.93	NS
$g/kgW^{0.75}$	35.23^{a}	34.49^{b}	34.07^{b}	0.14	*
Gross energy intake (GEI) as					
kcal/h/day	333.48	33028	32902	100.9	NS
$kcal/kgW^{0.75}$	512.10^{a}	501.41^{b}	495.36^{b}	1.97	*
Digestible energy intake (DEI) as					
kcal/h/day	25648	25105	25009	76.63	NS
$kcal/kgW^{0.75}$	389.25^{a}	381.13^{b}	376.53^{b}	1.50	*
Feed conversion expressed as g. intake / g. gain of					
Dry matter	10.151^{c}	8.841^{b}	8.657^{a}	0.133	*
Crude protein	1.130^{c}	0.984^{b}	0.964^{a}	0.015	*
Non fiber carbohydrates	2.832^{c}	2.467^{b}	2.415^{a}	0.037	*
Feed conversion expressed as kcal intake / g. gain of					
Gross energy	41.170^{c}	35.861^{b}	35.114^{a}	0.539	*
Digestible energy	31.294^{c}	27.258^{b}	26.691^{a}	0.410	*

a b and c: Means in the same row having different superscripts differ significantly ($P<0.05$).
SEM: Standard error of mean. Sig.: Significant *: Significant at level ($P<0.05$).
NS: Not significant at level ($P<0.05$). *Average body weight, kg = (Initial weight + final weight) / 2

culture in ruminants have been palatability, the rate of fiber digestion (thus directly affecting gut fill), the rate of digesta flow and protein status. Yeast extracts fermentation products are widely used as flavors enhancers in human foods. Similar effects of yeast culture on the acceptability of feeds to ruminants cannot be ruled out. The products certainly have a pleasant odor, consequently, Lyons [41] and Rose [42] mentioned that the ability of yeast to produce glutamic acid could benefit the taste of feedstuffs supplemented with yeast culture. While palatability improvements can certainly do no harm, there is now strong evidence that fungal feed additives have a more fundamental metabolic effect [43]. Lesmeister *et al.* [44] noted that added *Saccharomyces cerevisiae* in Holstein calves starter from 2 to 42 days of age they found that average daily gain and DMI was higher for the treatment group. Laborde [45] showed that calves that received starter containing yeast culture showed significant increased body weight when compared to other calves at week 6 and 8 and concluded that yeast cultures have been shown to improve growth performance and health of calves when supplemented in the diet. Furthermore, Blezinger [46] recorded an improvement in weight gains of cattle fed concentrate feed mixture containing yeast culture and grazing fescue pasture, they found that yeast products such as *Saccharomyces cerevisiae* may assist in digestion of forages. Positive effect of feed additives are usually expressed through better feed intake, improved feed conversion, stimulation of the immune system and increased vitality, regulation of the intestinal micro-flora, etc. Because of the fact that feed additives have different mechanisms of action as mentioned by Singh [47]. As noted by Hefel [48]; Ozawa *et al*. [49]; Maeng *et al.* [50]; Svozil *et al.* [51] and Tournut [52] when *Streptococcus faecium* used in calves rations caused an improvements feed intake of calves. Also, Fallon and Harte [53] and Hughes [54] (when calves received rations containing *Saccharomyces cerevisiae* their feed intake improved. The general pattern with ruminants receiving fungal feed additives is that production, whether of meat or milk, is improved.

Williams and Newbold [40] reviewed this area and they noted that 8 trials with *Aspergillus* oryzae extract (AO) produced an average 4.3% improvement in milk yield. A similar analysis of 9 yeast culture (YC) trials resulted in an average improvement of 5.1%. These averages were calculated from ranges of 91.0-112.0% for AO and 96.3-116.7% for YC and they may therefore conceal an even better response under optimum dietary or nutritional circumstances. More recently, Wallace and Newbold [55] summarized results from 18 lactation studies with yeast and concluded that the response ranged from a 6.8% decrease to a 17.4 % increase in milk yield. The average value was 7.8%. Latest trials continue to reflect the variability in response to fungal additives. Smith *et al.* [56] found no effect of (YC) in dairy cows receiving three corn silage/alfalfa hay diets, yet Piva *et al.* [57] found increases in total and fat-corrected milk production of 3.1 and 9.3% respectively in response to YC. AO gave an increase in milk protein content of 2% in a commercial dairy herd [58], meanwhile, Sievert and Shaver [59] noticed no response in a smaller trial. Improved live weight gain has, like milk production, been observed in some studies but not in others. Adams *et al.* [32] found that steers had an improved daily weight gain of 1.39 kg with YC compared with 1.34 kg in controls. As with many responses of this magnitude, the increase did not reach statistical significance. Edwards *et al.* [36] found no significant improvement with YC in live weight gain from 135 kg to slaughter, although once more the trend was favorable. The opposite trend was observed by Deaville and Galbraith [60] with Angora goats. Beef cows and calves fed a poor quality pasture improved weight gain [61]. Furthermore, Mir and Mir [62] recorded an improved feed utilization efficiency in the first year with steers, but no other significant positive effects. Relatively few experiments have been done in adult ruminants with the types of bacterial preparation that are used in young ruminants or monogastric animals. Jaquette *et al.* [63] and Ware *et al.* [64] observed a significant increases (6.2 and 5.7% respectively) in milk production from cows receiving L. acidophilus. The mode of action of a lactobacillus preparation in the rumen is difficult to imagine. Lactobacilli produce lactate, sometimes to the severe detriment of the animal in cases of lactic acidosis [65]. Seven species of rumen bacteria were unaffected by lactobacilli or enterococci that are used in bacterial probiotics to inhibit pathogens [66]. It is nonetheless possible that less common, possibly detrimental species are inhibited by lactobacilli. Bacterial probiotics may have no advantage over fungal products in the adult animal, however. A mixed YC + Lactobacillus + Streptococcus preparation was little different to YC alone in its influence on rumen fermentation [67].

Drinking Water: Data presented in Table 4 mentioned that incorporation Availa-4 at different levels in significantly ($P<0.05$) decreased the all different drinking water parameters that includes (liter /head/day, ml/ kg $W^{0.75}$, liter/ kg dry matter intake, liter/ kg crude protein intake, liter/ kg non fibrous carbohydrate intake, liter/ M cal gross energy intake and liter/ M cal digestible energy intake. These results in agreement with those obtained by Omer *et al.* [30] who noticed that average daily water intake were insignificantly ($P>0.05$) decreased with increasing the Rumi yeast (RY) that used as feed additive in sheep rations. They found that corresponding values were 4100, 3600 and 3400 ml/h/day for R_1, R_2 and R_3, respectively. In addition to they observed that generally, experimental sheep fed ration contained 0.20% RY recorded the lowest value of water intake that expressed as (ml/h/day, ml/ $kgw^{0.75}$, liter/ 100 kg live body weight, liter/ kg dry matter intake, liter/ kg non fibrous carbohydrate intake, liter/ M cal gross energy intake and liter/ Mcal digestible energy intake and it was insignificantly ($P>0.05$) decreased comparing to that fed ration contained 0 or 0.10% Rumi yeast (RY). On the other hand, Sonone *et al.* [68] noted that when crossbred calves in four groups received for 90 days different sources of roughage includes Jowar Kadbi, soybean straw, green fodder (Hy. Napier) with concentrate to study its impact on their feed and water intake. They divided the groups as (T_1) composed of Jowar Kadbi, green fodder (Hy. Napier) and concentrate; (T_2) composed of Soybean straw, green fodder (Hy. Napier) and concentrate; (T_3) composed

Table 4: Drinking water by the experimental groups

Item	Experimental rations 0 % Availa 4 R_1	 0.05 % Availa 4 R_2	 0.10 % Availa 4 R_3	SEM	Sig.
Drinking water calculated as					
Initial weight (kg)	211	208	210	8.75	NS
Final weight (FW, kg)	313	324	328	11.62	NS
Average body weight, kg*	262	266	269	9.95	NS
Metabolic body weight (kg$W^{0.75}$)	65.12	65.87	66.42	1.81	NS
Liter /head/day	25	22	24	1.18	NS
ml/ kg $W^{0.75}$	384	334	361	17.90	NS
Liter/ kg dry matter intake	3.041	2.702	2.959	0.14	NS
Liter/ kg crude protein intake	27.319	24.274	26.582	1.29	NS
Liter/ kg non fibrous carbohydrate intake	10.898	9.683	10.605	0.52	NS
Liter/ M cal gross energy intake	0.750	0.666	0.729	0.036	NS
Liter/ M cal digestible energy intake	0.986	0.876	0.960	0.047	NS

SEM: Standard error of mean. Sig.: Significant *: Significant at level ($P<0.05$).

NS: Not significant at level ($P<0.05$). *Average body weight = initial weight + final weight / 2.

Table 5: Economic evaluation of the experimental groups

Item	Experimental rations 0 % Availa 4 R_1	 0.05 % Availa 4 R_2	 0.10 % Availa 4 R_3
Quantity of daily fresh intake of CFM, kg	5.954	5.897	5.874
Value of 1-kg concentrate feed mixture (LE)		5.260	
Costing of CFM intake (LE)	31.32	31.02	30.90
Quantity of daily feed intake of WS	2.977	2.948	2.937
Value of 1-kg wheat straw (LE)		1.500	
Costing of WS intake (LE)	4.47	4.42	4.41
Quantity of daily fresh intake of Availa 4, g	without	3 grams	6 grams
Value of one gram Availa 4 (LE)		0.025	
Costing of Availa 4 intake (LE)	-	0.08	0.15
Total daily feeding cost (LE) [a]	35.79	35.52	35.46
Average daily gain (kg)	0.810	0.921	0.937
Value of one kg live body weight (LE)		60	
Value of daily gain (LE)	48.60	55.26	56.22
Daily profit above feeding cost (LE)	12.81	19.74	20.76
Relative economical efficiency [b]	100	154.10	162.06
Feed cost (LE/ kg gain)	44.19	38.57	37.84

LE = Egyptian pound equals 0.06 American dollars ($) approximately.

[a]: based on price of 2020.

[b]: Assuming that the relative economic efficiency of control ration (R_1) equals 100

of Soybean straw and concentrate and (T_4) composed of soybean straw only. They noticed that the daily water intake of the calves was differ significantly between the feeding group, the calves from T_2 group drunk more (12.88) than that T_1 (12.50), T_3 (12.13) and T_4 (11.84). This trend indicated that the water in treatment T_1, T_2, T_3, T_4 were significant, indicating, that level of soybean straw had effect on the water consumption of calves. Also, the present results in agreement with those found by Omer *et al.* [27] who noted that values of water consumption were 2833, 3000 and 3250 ml/h/day when growing male Barki lambs fed complete feed mixture (CFM) replaced sesame meal (SM) 50 or 100% of soy bean meal (SBM). These values less than that recorded in the present study (4000, 3600 and 3100 ml/h/day). These may be related to differences in live body weight of the experimental sheep, the ingredient used in ration formulation and chemical analysis contents especially ash and CF in two comparison studies. DMI and water intake are positively associated [69] so ash is not the only constituent of dry matter in the feed, therefore, the ash contents could not be the sole cause of the changes in the water consumption. Meanwhile, Omer *et al.* [70] reported that when Ossimi sheep received rations composed of 50% concentrate feed mixture plus 50% of peanut vein hay, beans straw, kidney beans straw, or linseed straw increased ($P<0.05$) drinking water compared to control group that offered ration composed of (50% concentrate feed mixture plus 50% berseem hay). Also, they recorded that the corresponding values of drinking water were 3088, 3742, 4650, 3660 and 3038 ml/h/day for control and the other four experiment groups mentioned above. On the other hand, Ahmed and Abdalla [71] showed that replacing 50% of cotton seed cake (CSC) by sesame seed cake (SSC) in yearling sheep had no effect on water intake (3.04 vs. 3.00 l/kg DM intake) for CSC and SSC, respectively. They also, think that ash content in the two sources in the same range had not caused any adverse effect on quantity water consumption.

Economic Evaluation: Results of economic evaluation presented in (Table 5) showed that daily feeding cost decreased from 35.79 to 35.52 and 35.46 LE for R_1, R_2 and R_3, respectively. Resulting for increasing daily gain from 0.810 to 0.921 or 0.937 in R_1, R_2 and R_3, respectively caused an improvements in daily profit above feeding cost that recorded 12.81, 19.74 and 20.76 LE for R_1, R_2 and R_3, respectively. Also, relative economical efficiency was improved by 154.1 and 162.06 % for (R_2 and R_3), respectively when assuming that the relative economic efficiency of R_1 (control ration) equals 100. Values of feed cost (LE/ kg gain) was decreased from 44.19 to 38.57 and 37.84 LE for R_1, R_2 and R_3, respectively. These decreasing in feed cost (LE/ kg gain) equals 12.72% and 17.37% for R_2 and R_3, respectively comparing to R_1.

These results in harmony with those found by Omer *et al.* [21] who noted that when sheep received rations contained Rumi yeast (RY) at 0, 0.10% and 0.20% occurred an improving in daily profit above feeding cost that recorded by 5.62, 6.45 and 7.43 LE for R_1, R_2 and R_3, respectively. Also, they noted that relative economical efficiency was improved by 114.8 and 132.2% for (R_2 and R_3), respectively when assuming that the relative economic efficiency of R_1 (control ration) equals 100. Values of feed cost (LE/ kg gain) was decreased from 32.53 to 30.91 and 29.84 LE for R_1, R_2 and R_3, respectively. Also, In the present study we using wheat straw in feeding cross bred Frisian calves as a main source of roughage, our results were in agreement with those found by Adangale *et al.* [72] who, compared among jowar straw and soybean straw through out designed an experiment using Nine H.F.X Deoni cross bred interse calves aged 6 to 12 months and it divided into three groups. First 1st composed of jowar straw ad lib plus concentrate and considered as control (T_0); meanwhile the (T_1) received jowar straw 50 % and soybean straw 50 % + concentrate, but (T_2) received 100% soybean straw + concentrate as per requirement. They noted that feeding cost per kg body weight gain was decreased with increasing the level of soybean straw. The corresponding values were 48.99, 43.09 and 39.11 for T_0, T_1 and T_2, respectively. Also, the similar trend was reported by Talokar [73] when buffalo heifers fed soybean straw or Jowar straw as main source of roughage with concentrate. Moreover, Mahmoud and Ghoneem [74] observed depressing in feed cost per one kg 7% fat corrected milk (FCM) in Egyptian lactating buffaloes fed ration composed of (50% roughage and 50% concentrate feed mixture.

CONCLUSION

From the results obtained in this work and under condition as that available through out carrying the present study it can be mentioned that adding Availa-4 (commercial product) as feed additive in growing calve rations occurring an improvements in their performance, consequently it caused improving in their relative economic efficiency and decreased feed cost (LE/ kg gain). So this will be encourage the farmers to use as this additive in calve rations to obtained an improvements in profitability or net revenue through out decreasing feed cost/ kg gain.

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