PRODUCTIVE PERFORMANCE OF EARLY WEANING FRIESIAN CALVES SUPPLEMENTED WITH BEE POLLEN AND BLACK SEEDS

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Abstract

The current work was carried out to investigate the effect of bee pollen (BP) and black seeds (BS) as natural additives on performance of early weaning Friesian calves. Twenty-four newly born Friesian calves (12 males and 12 females) with average live body weight of 31 ± 0.26 kg were suckled their dam's colostrum for three days and divided into six similar groups (2 males and 2 females in each group) according to their live body weight and month of birth. The experimental period lasted 180 days over three consecutive periods (60 days each). All claves were fed a basal diet consisted of whole milk, calf starter and fresh berseem during suckling period and on calf starter and fresh berseem during 1st post weaning period or concentrate feed mixture, berseem hay and rice straw during 2nd post weaning period. Group1 given their diet without any additives and served as control, while G2 and G3 groups were supplemented with 5 or 10g BP/head/day in their diets, respectively. While, the diets of G4 and G5 were supplemented with 5 or 10 g BS/head/day, respectively. Lastly, G6 group was supplemented with 2.5 g BP + 2.5 g BS/head/day. Results showed that BP and BS additives improved significantly ($P<0.05$) the digestibility coefficients of DM, OM, CP, CF, EE and NFE as well as feeding values (TDN and DCP) during the different experimental periods, where, the high level (10 g) of both two additives showed significantly the highest ($P<0.05$) values. Ruminal pH value and ammonia-N concentration were significantly lower ($P<0.05$), while, TVFA's concentration was significantly higher ($P<0.05$) in rumen liquor at the higher levels of additives (G3 and G5) But, there were no significantly differences among G1, G2, G4 and G6. Ruminal pH value tended to decrease while, the concentrations of TVFA's and NH_3-N increased with advancing age. Likewise, the intake of DM, CP, TDN and DCP were significantly higher ($P<0.05$) in G3 and G5 compared to the other groups. Calves in G3 and G5 recorded significantly ($P<0.05$) the highest live body weight, total weight gain and average daily gain followed by calves in G2, G4 and G6, whereas those in G1 had the lowest values during the different periods. The BP and BS additives significantly improved ($P<0.05$) feed conversion ratio for DM, CP, TDN and DCP per kg live body gain. Effectively the diets G3 and G5 showed the highest total revenue and net revenue compared to other groups. From these results, it could be concluded that both BP and BS additives at the level of 10 g/head/day for Friesian calves during suckling and post weaning periods improved the digestibility, feeding values, rumen fermentation activity, growth performance, feed conversion and economic efficiency.

Keywords: Friesian calves, bee pollen, black seeds, digestibility, feed intake, growth performance.

INTRODUCTION

Raising young calves is a labor intensive and expensive segment of livestock production. Weaning calve at an early age is a potential practice to reduce the total cost managements and feeding (Quigley *et al.*, 1991). Bee pollen is apicultural product composed of nutritionally valuable substances (Aliyazicioglu *et al.*, 2005). It is rich in protein (25%), essential amino acids, oil (6%) and containing more than 51% poly unsaturated fatty acids of which 39% linolenic, 20% palmitic and 13% linoleic acid, 11 enzymes or co-enzymes and also abounds with carbohydrate (35-61%, mainly glucose, fructose and sucrose), lipid and more than 12 vitamins, 28 mineral elements (Xu *et al.*, 2009) and carotenoids (Izuta *et al.*, 2009). Another very interesting bee product is propolis, which has antibiotic properties and may improve growth performance, feed efficiency and feed intake of animals (Sarker and Yang, 2010). These effects may be due to the content of antioxidants, vitamins, minerals, phenolic constituents and enzymes (El-Hanoun *et al.*, 2007). Additive of bee pollen at 25 g d^{-1} and polysaccharides at 5 g d^{-1} in milk replacer for calves could improve their growth performance and feed conversion ratio significantly (Zhang *et al.*, 2010). Butt and Sultan (2010) concluded that *Nigella sativa* oil contains thymoquinone, which has potent antioxidant effect. The mechanism underlying the protective effect of *Nigella sativa* oil on the test is might be due to its direct cytoprotective effect and/ or indirect antioxidant and androgen like activities (Wahba, 2011). *Nigella sativa* have been investigated by various researchers as a potential feed additive in the diets of different classes of livestock and a wide spectrum of its pharmacological actions have been explored which may include antidiabetic, anticancer, immunomodulator, analgesic, antimicrobial, anti-inflammatory, spasmolytic, bronchodilator, hepatoprotective, renal protective, gastro-protective, antioxidant properties (Desai *et al.*, 2015). Mahmoud and Bendary (2014) found that the use of Nigella sativa seed meal reduced feed cost and therefore it can be used for growing lambs and calves diets to improve performance and therefore economic efficiency.

The objective of this study was to investigate the effect of bee pollen and black seed additives on the feed intake, digestibility, rumen fermentation activity, growth performance, feed conversion and economic efficiency of early weaning Friesian calves.

MATERIALS AND METHODS

The current work was carried out at El-Karada Animal Production Research Station belonging to Animal Production Research Institute (APRI), Agricultural Research Center, Ministry of Agriculture in co-operation with Department of Animal Production, Faculty of Agriculture, Kafr El-Sheikh University during the period from January to August 2014.

1- Experimental animals

Twenty-four newly born Friesian calves (12 males and 12 females) with average live body weight of 31 ± 0.26 kg were used after suckling their dam's colostrum for three days. Calves were divided into six similar groups (2 males and 2 females in each group) according to live body weight and month of birth.

2- Experimental rations

The whole experimental period was lasted for 180 days where it staged for consecutive three periods (60 days each), the first one was serves as suckling period form the birth until the weaning at 60 days of age (suckling period), the second one was extended from 61 to 120 days post weaning and third period was continued from 121 to 180 days of age. All claves were fed a basal diet consisted of whole milk, calf starter and 2nd cut fresh berseem during suckling period, calf starter and 3rd cut fresh berseem during the second period or concentrate feed mixture, berseem hay and rice straw during the third one. The group (G1) was unsupplemented and served as control, while G2 and G3 groups were supplemented with 5 or 10 g BP/head/day and G4 and G5 groups were supplemented with 5 or 10 g BS/head/day, respectively, and lest group G6 was supplemented with 2.5 g BP + 2.5 g BS/head/day.

3- Management procedures

Calves were fed individually their allowance during the suckling and post weaning periods to cover their nutritional requirements according to NRC (2001). During suckling period, calves were suckled the whole milk in plastic buckets in two equal parts at 7 a.m. and 4 p.m., calf starter (CS) once time at 8 a.m. and fresh berseem (FB) at 11 a.m. During post weaning period, CS or concentrate feed mixture (CFM) was offered two times daily at 8 a.m. and 4 p.m., fresh berssem or berseem hay (BH) once daily at 9 a.m., RS was given at 11 a.m. Bee pollen and black seeds additives were supplemented in milk during suckling period or on calf starter or concentrate feed mixture during post weaning period. Fresh water was free available for calves all the day round. Calf starter was consisted (as fed) of 20% soybean meal, 5% linseed cake, 34% ground yellow corn grain, 20% wheat bran, 15% rice bran, 3%

molasses, 2% limestone and 1% common salt. While, CFM consisted (as fed) of 30% undecorticated cottonseed cake, 5% linseed cake, 25% wheat bran, 22% ground yellow corn grains, 12% rice bran, 3% molasses, 2% limestone and 1% common salt. Composition of whole milk was 3.90% fat, 3.16% protein, 5.02% lactose, 8.90% solids not fat (NFS), 12.8% total solids (TS) and 0.71% ash. Chemical composition of different feedstuffs are shown in Table (1).

Table 1. Chemical analysis of feedstuffs and basal diets (% on dry matter basis).

Item	DM %	Composition of DM %					
		OM	CP	CF	EE	NFE	Ash
Feedstuffs:							
Calf starter	91.58	90.68	18.43	5.96	3.91	62.38	9.32
Concentrate feed mixture	91.60	88.66	17.54	11.73	3.15	56.24	11.34
2nd cut fresh berseem	15.45	87.97	15.87	24.35	3.60	44.15	12.03
3rd cut fresh berseem	16.30	87.60	15.42	24.70	3.45	44.03	12.40
Berseem hay	90.10	88.19	14.32	27.87	2.84	43.16	11.81
Rice straw	89.85	83.85	2.52	30.47	2.10	48.76	16.15
Basal rations							
Suckling period	18.08	92.03	21.06	6.66	17.14	47.17	7.97
1st post weaning period	35.00	89.60	17.38	12.52	3.75	55.95	10.40
2nd post weaning period	90.88	87.80	14.32	19.38	2.90	51.20	12.20

4- Live body weight

Calves were weighed at birth and weekly thereafter during the suckling period and biweekly during the 1st and 2nd post weaning periods. Total and daily weight gain were calculated for each calf during the suckling, 1st and 2nd post weaning periods as well as the whole experimental period.

5- Feed intake

The amounts of daily feed intake from the different feedstuffs were recorded for each animal and adjusted weekly during the suckling period and biweekly during the 1st and 2nd post weaning periods according to body weight changes.

6- Digestibility trials

Three digestibility trials were conducted at the end week of suckling, 1st and 2nd post weaning periods using all calves to determine nutrient digestion coefficients and feeding values of the experimental diets. Acid insoluble ash (AIA) was used as a natural marker as described by Van Keulen and Young (1977). Feces samples were taken from the rectum of each calf twice daily with 12 hours interval during the collection period of each digestibility trial. Milk samples were analyzed for fat, protein, lactose, solids not fat (SNF), and total solids (TS) by Milko-Scan (model 133B), and ash by difference. While, samples of feedstuffs and feces were dried in a forced air oven at 65 ˚C for 48 hours, ground and representative samples were carried out according to the methods of AOAC (2000).

7- Rumen liquor samples

Rumen liquor samples were taken at the same time of digestibility trials from calves at three hours after the morning feeding by using a stomach tube and filtered through a double layer of cheesecloth. pH value was determined directly using Orian digital pH meter, then samples were stored in dry clean glass bottles with addition of few drops of saturated mercuric chloride solution to kill microorganisms. The concentration of TVFA's was determined by the steam distillation method (Warner, 1964) using Markham micro-distillation apparatus. The concentration of NH_3-N was determined using saturated solution of magnesium oxide distillation according to the method of AOAC (2000).

8- Feed conversion ratio (FCR)

Feed conversion ratio was calculated as the amounts of DM, TDN, CP and DCP required for producing 1 kg live body weight gain.

9- Economic evaluation

Economic evaluation expressed as average daily feed cost, feed cost per 1 kg weight gain, total revenue of average daily weight gain and net revenue (the difference between price of daily weight gain and average daily feed cost). Where: price of one ton was 2750 LE for calf starter, 2500 LE for concentrate feed mixture, 250 LE for fresh berseem, 1200 LE for berseem hay and 300 LE for rice straw. While, the price of one kg was 80 LE for bee pollen, 20 LE for black seeds, 2.5 LE for whole milk and 30 LE for live body weight according to the prices of the period from January to August 2014.

10- Statistical analysis

The data were analyzed using general linear models procedure adapted by IBM SPSS Statistics (2014) for user’s guide with one-way ANOVA. Significant differences in the mean values among dietary treatments were analyzed by Duncan’s tests within SPSS program set at the level of significance $P<0.05$.

RESULTS AND DISCUSSION

1- Nutrient digestion coefficients and feeding values

The effect of BP and BS additives on nutrient digestion coefficients and feeding values by male and female Friesian calves during suckling, 1^{st} and 2^{nd} post weaning periods are presented in Table (2). The BP and BS additives improved significantly ($P<0.05$) the digestion coefficients of all nutrients during suckling, 1^{st} and 2^{nd} post weaning periods. Groups 3 and 5 which received the high levels of both additives showed significantly ($P<0.05$) the highest digestion coefficients of all nutrients followed by G2, G4 and G6, where G1 had the lowest values. The combination of BP + BS (G6) tended to increase the digestion coefficients of all nutrients compared to G2 or G4 with non-significant differences among them. The digestion coefficients of DM, OM, CP, EE and NFE were higher during suckling period and decreased gradually after weaning of the two phases, which might be attributed to the high feeding value of whole milk during suckling period. However, CF digestibility was lower during the suckling period and increased sharply at 1^{st} post weaning period and then decreased at 2^{nd} post weaning period, which may be due to that the rumen of suckling calves was not complete their development and CF digestibility depends on the activity of rumen microorganisms. Wang *et al*., (2007) suggested that BP promoted the early development of the digestive system. The present results are precisely in agreement with those obtained by Zhang *et al*. (2010) who added 25 g d^{-1} bee pollen and 5 g d^{-1} polysaccharides in milk replacer of calves and found that digestibility of dry matter and crude protein were marked improved. Apparent digestibility of almost nutrients OM, CP, CF, EE and NFE were significantly ($P<0.05$) increased with Black cumin seed meal compared with the control diet (El-Nomeary *et al*., 2015).

Table 2. Digestibility coefficients and feeding values of dietary treatments during the three stages of the experiment.

Items	**Experimental groups**						**MSE**
	G1	**G2**	**G3**	**G4**	**G5**	**G6**	
Suckling period:							
Digestibility coefficients %:							
DM	70.24^{c}	71.90^{bc}	74.58^{a}	71.98^{bc}	74.76^{a}	73.14^{ab}	0.39
OM	71.84^{c}	73.53^{bc}	76.47^{a}	72.88^{bc}	76.65^{a}	74.54^{ab}	0.46
CP	70.22^{c}	71.82^{bc}	74.53^{a}	71.73^{bc}	74.64^{a}	73.11^{ab}	0.38
CF	50.46^{c}	51.93^{bc}	54.11^{a}	52.00^{bc}	53.91^{a}	52.93^{ab}	0.34
EE	78.85^{c}	80.77^{bc}	83.92^{a}	80.58^{bc}	83.71^{a}	81.87^{ab}	0.46
NFE	71.23^{c}	73.30^{bc}	76.58^{a}	73.35^{bc}	76.77^{a}	74.47^{ab}	0.49
Nutritive values %:							
TDN	82.16^{c}	84.31^{b}	87.78^{a}	84.24^{b}	87.80^{a}	85.62^{b}	0.47
DCP	14.79^{c}	15.12^{bc}	15.70^{a}	15.11^{bc}	15.72^{a}	15.40^{ab}	0.08
1st post weaning period:							
Digestibility coefficients %:							
DM	67.05^{c}	69.27^{bc}	71.86^{a}	69.32^{bc}	72.01^{a}	70.42^{ab}	0.45
OM	67.94^{c}	69.98^{bc}	72.66^{a}	69.92^{bc}	72.81^{a}	70.70^{ab}	0.46
CP	67.59^{c}	69.48^{bc}	72.34^{bc}	69.35^{bc}	72.42^{a}	70.49^{ab}	0.42
CF	65.59^{c}	67.40^{bc}	70.44^{a}	67.57^{bc}	70.34^{a}	68.66^{ab}	0.45
EE	70.13^{c}	71.94^{bc}	74.67^{a}	72.00^{bc}	74.73^{a}	73.01^{ab}	0.42
NFE	67.61^{c}	69.75^{bc}	72.62^{a}	69.51^{bc}	72.71^{a}	70.67^{ab}	0.45
Nutritive values %:							
TDN	63.70^{c}	65.61^{b}	68.32^{a}	65.48^{b}	68.38^{a}	66.55^{b}	0.38
DCP	11.75^{c}	12.08^{bc}	12.57^{a}	12.05^{bc}	12.59^{a}	12.25^{ab}	0.07
2nd post weaning period:							
Digestibility coefficients %:							
DM	62.60^{c}	64.15^{bc}	67.00^{a}	63.94^{bc}	67.15^{a}	65.50^{ab}	0.40
OM	64.24^{c}	65.90^{bc}	69.03^{a}	65.81^{bc}	68.90^{a}	66.85^{ab}	0.44
CP	62.05^{c}	63.69^{bc}	66.73^{a}	63.53^{bc}	66.34^{a}	65.57^{ab}	0.45
CF	60.27^{c}	62.11^{bc}	64.23^{a}	62.10^{bc}	64.07^{a}	62.89^{ab}	0.35
EE	68.63^{c}	70.87^{bc}	73.57^{a}	70.80^{bc}	73.70^{a}	71.88^{ab}	0.46
NFE	66.11^{c}	68.15^{bc}	70.80^{a}	67.96^{bc}	70.88^{a}	68.88^{ab}	0.43
Nutritive values %:							
TDN	58.89^{c}	60.67^{b}	63.05^{a}	60.55^{b}	63.02^{a}	61.53^{b}	0.35
DCP	8.89^{c}	9.12^{bc}	9.56^{a}	9.10^{bc}	9.50^{a}	9.39^{ab}	0.06

a, b, c: Values in the same row for each item with different superscripts differ significantly ($P<0.05$).

G1: control G2: 5 g BP G3: 10 g BP G4: 5g BS G5: 10 g BS G6: 2.5 g BP + 2.5 g BS

Feeding values in terms of TDN and DCP were significantly higher ($P<0.05$) for G3 and G5 compared with G1, where the values for G2, G4 and G6 was intermediate between them with insignificant differences among these treatments. The combination of BP + BS in G6 tended to insignificantly increase the TDN and DCP values compared to G2 or G4. Moreover, the TDN and DCP values were higher during suckling period and decreased after weaning and this could be attributed to the high contents of fat, protein and lactose in whole milk and the higher CP (21.36%) and EE (17.98%) contents in the diet used during suckling period (Table 1). These results are in accordance with those obtained by El-Neney and El-Kholy (2014) who found that feeding value of the diet enriched with BP additive led to increases in these values. Feeding values as TDN and DCP were significantly ($P<0.05$) increased with Black cumin seed diet compared with the control one (El-Nomeary *et al.*, 2015).

2- Rumen fermentation activity

Data in Table (3) showed the effect of BP and BS additives on rumen fermentation activity of the experimental animals during suckling, 1st and 2nd post weaning periods. Ruminal pH value and ammonia-N concentration were significantly ($P<0.05$) lower, while TVFA's concentration was significantly ($P<0.05$) higher in rumen liquor of G3 and G5 than those of G1. Whereas, ruminal pH value and the concentrations of ammonia-N and TVFA's values of G2, G4 and G6 were in an intermediate between values of control and the high levels additive ones, without significant differences ($P>0.05$). On the other hand, ruminal pH value tended to decrease, but the concentrations of TVFA's and NH_3-N increases with advancing age from suckling period to the post weaning period. These results agreed with those obtained by Van Soest (1982) who stated that the optimum pH value for growth of cellulolytic microorganisms was 6.7 and the range for normal condition with about ±0.5 pH degree. Moreover, Hungate (1966) reported that the acidity of cellulolytic bacteria during ruminal fermentation may be inhibited when pH value of rumen liquor is below 6. Rumen microorganisms utilize more NH_3-N when more energy sources are fermented. Russell and Dombrowski (1980) indicated that ruminal VFAs production was closely related to ruminal pH, which can be considered as an important regulator of microbial yield.

Table 3. Rumen fermentation activity of Friesian calves during the three stages of the experiment.

Items	Experimental groups						MSE
	G1	G2	G3	G4	G5	G6	
Suckling period:							
pH value	7.29^{a}	7.14^{ab}	6.93^{b}	7.11^{ab}	6.95^{b}	7.06^{ab}	0.04
TVFA's (meq/100 ml)	9.59^{b}	9.88^{ab}	10.25^{a}	9.89^{ab}	10.27^{a}	10.05^{ab}	0.08
NH_3-N (mg/100 ml)	8.35^{a}	7.84^{ab}	7.20^{b}	7.82^{ab}	7.16^{b}	7.55^{ab}	0.15
1st post weaning period:							
pH value	7.11^{a}	6.96^{ab}	6.76^{b}	6.94^{ab}	6.78^{b}	6.89^{ab}	0.04
TVFA's (meq/100 ml)	15.98^{b}	16.47^{ab}	17.08^{a}	16.49^{ab}	17.12^{a}	16.75^{ab}	0.14
NH_3-N (mg/100 ml)	11.93^{a}	11.21^{ab}	10.29^{b}	11.18^{ab}	10.23^{b}	10.78^{ab}	0.21
2nd post weaning period:							
pH value	6.98^{a}	6.83^{ab}	6.63^{b}	6.80^{ab}	6.65^{b}	6.75^{ab}	0.04
TVFA's (meq/100 ml)	19.97^{b}	20.58^{ab}	21.35^{a}	20.61^{ab}	21.41^{a}	20.94^{ab}	0.17
NH_3-N (mg/100 ml)	17.05^{a}	16.01^{ab}	14.70^{b}	15.96^{ab}	14.61^{b}	15.40^{ab}	0.30

a, b: Values in the same row for each item with different superscripts differ significantly (P<0.05).

G1: control G2: 5 g BP G3: 10 g BP G4: 5g BS G5: 10 g BS G6: 2.5 g BP + 2.5 g BS

3- Feed intake

Daily feed intake in terms of DM, TDN, CP and DCP as affected by BP and BS additives during suckling, 1st, 2nd weaning and the whole periods are shown in Table (4). The G3 and G5 recorded significantly (P<0.05) higher feed intake of DM, CP, TDN and DCP compared with G1 during the three stages and the whole period. While, G2, G4 and G6 showed intermediate values of feed intake with insignificant differences. Average daily feed intake in calves supplemented with BP and BS combination (G6) tended to be higher than those supplemented with BP (G3) or BS (G4) alone. These effects may be due to the content of antioxidants, vitamins, minerals, phenolic constituents and enzymes in bee pollen (El-Hanoun *et al.*, 2007). The addition of BS to the diet of broiler resulted in significantly higher feed intake as compared to that of control group (Saeid *et al.*, 2013).

Table 4. Feed intake (kg/head/day) by Friesian calves for different groups and periods.

Items	Experimental groups						MSE
	G1	G2	G3	G4	G5	G6	
Suckling period:							
Whole milk	4.12^{b}	4.22^{ab}	4.40^{a}	4.24^{ab}	4.37^{a}	4.28^{ab}	0.04
Starter	0.35^{b}	0.35^{b}	0.37^{a}	0.36^{ab}	0.37^{a}	0.36^{ab}	0.003
Fresh berseem	1.37^{b}	1.40^{ab}	1.46^{a}	1.40^{ab}	1.45^{a}	1.42^{ab}	0.01
Total DM	1.06^{b}	1.08^{ab}	1.13^{a}	1.09^{ab}	1.12^{a}	1.10^{ab}	0.01
TDN	0.87^{b}	0.91^{ab}	0.99^{a}	0.91^{ab}	0.98^{ab}	0.94^{ab}	0.01
CP	0.22^{b}	0.23^{ab}	0.24^{a}	0.23^{ab}	0.24^{a}	0.23^{ab}	0.002
DCP	0.16^{b}	0.16^{b}	0.18^{a}	0.16^{b}	0.18^{a}	0.17^{ab}	0.002
1st post weaning period:							
Starter	1.47^{b}	1.50^{ab}	1.55^{a}	1.51^{ab}	1.54^{a}	1.53^{a}	0.01
Fresh berseem	4.45^{b}	4.54^{ab}	4.68^{a}	4.56^{ab}	4.66^{a}	4.64^{a}	0.04
Total DM	2.07^{b}	2.11^{ab}	2.18^{a}	2.13^{ab}	2.17^{a}	2.16^{a}	0.02
TDN	1.32^{b}	1.39^{ab}	1.49^{a}	1.39^{ab}	1.48^{a}	1.44^{ab}	0.02
CP	0.36^{b}	0.37^{ab}	0.38^{a}	0.37^{ab}	0.38^{a}	0.38^{a}	0.003
DCP	0.24^{b}	0.26^{ab}	0.27^{a}	0.26^{ab}	0.27^{a}	0.26^{ab}	0.003
2nd post weaning period:							
Concentrate feed mixture	2.22^{b}	2.28^{ab}	2.34^{a}	2.26^{ab}	2.33^{a}	2.30^{ab}	0.02
Berseem hay	1.23^{b}	1.26^{ab}	1.30^{a}	1.25^{ab}	1.29^{a}	1.28^{ab}	0.01
Rice straw	0.62^{b}	0.63^{ab}	0.65^{a}	0.63^{ab}	0.65^{a}	0.64^{ab}	0.01
Total DM	3.69^{b}	3.79^{ab}	3.90^{a}	3.76^{ab}	3.88^{a}	3.83^{ab}	0.04
TDN	2.17^{b}	2.30^{ab}	2.46^{a}	2.28^{ab}	2.45^{a}	2.36^{ab}	0.03
CP	0.53^{b}	0.54^{ab}	0.56^{a}	0.54^{ab}	0.56^{a}	0.55^{ab}	0.01
DCP	0.33^{b}	0.35^{ab}	0.37^{a}	0.34^{ab}	0.37^{a}	0.36^{ab}	0.01
Whole period:							
Total DM	2.27^{b}	2.33^{ab}	2.40^{a}	2.32^{ab}	2.39^{ab}	2.36^{ab}	0.13
TDN	1.45^{b}	1.53^{ab}	1.65^{a}	1.53^{ab}	1.64^{a}	1.58^{ab}	0.07
CP	0.37^{b}	0.38^{ab}	0.39^{a}	0.38^{ab}	0.39^{a}	0.39^{ab}	0.02
DCP	0.24^{b}	0.25^{ab}	0.27^{a}	0.25^{ab}	0.27^{a}	0.26^{ab}	0.01

a, b: Values in the same row for each item with different superscripts differ significantly ($P<0.05$).

G1: control G2: 5 g BP G3: 10 g BP G4: 5g BS G5: 10 g BS G6: 2.5 g BP + 2.5 g BS

4- Live bodyweight and weight gain

Live body weight (LBW), total weight gain (TWG) and average daily gain (ADG) of calves in different groups over the successive pre and post weaning periods and its averages on the whole period of the experiment are presented in Table (5). Almost the addtion of BP and BS to the ratio incresed significantly (P<0.05) LBW, TWG and ADG during the experimental periods. Calves on G3 and G5 showed significantly (P<0.05) the highest LBW, TWG and ADG followed by calves in G2, G4 and G6, where the lowest values was occured with calves in G1. Also, TWG and ADG tended to decrease with advancing age of calves. The obtained results here are in harmony with those obtained by Zhang *et al.*, (2010) who showed that the addition of 25 g d^{-1} bee pollen and 5 g d^{-1} polysaccharides in milk replacer of calves could improve body weight of calves. Also, treated growing male rabbit diet with BP increased significantly the final body weight (El-Neney and El-Kholy, 2014). Furthermore, Mahmoud and Bendary (2014) found that Nigella sativa seed meal can be used to improve live body weight of growing lambs and calves.

Table 5. Live body weight, total and daily weight gain of Friesian calves for different groups from birth to 6 months of age.

Age (month)	Experimental groups						MSE
	G1	G2	G3	G4	G5	G6	
Live body weight (LBW), kg:							
0	30.50	31.25	31.50	30.75	31.50	30.50	0.26
2	69.24^{c}	73.11^{abc}	77.03^{a}	71.97^{bc}	76.50^{a}	73.63^{ab}	0.74
4	105.99^{d}	112.96^{bc}	120.43^{a}	111.22^{cd}	119.16^{ab}	114.65^{abc}	1.25
6	142.20^{d}	152.00^{bcd}	162.90^{a}	149.65^{cd}	161.15^{ab}	154.90^{abc}	1.86
Total weight gain (TWG), kg:							
0-2	38.74^{c}	41.86^{b}	45.53^{a}	41.22^{bc}	45.00^{a}	43.13^{ab}	0.58
2-4	36.75^{c}	39.85^{b}	43.40^{a}	39.25^{bc}	42.66^{a}	41.03^{ab}	0.54
4-6	36.21^{c}	39.04^{b}	42.47^{a}	38.43^{bc}	41.99^{a}	40.25^{ab}	0.62
0-6	111.70^{c}	120.75^{b}	131.40^{a}	118.90^{bc}	129.65^{a}	124.40^{ab}	1.72
Average daily gain (ADG), kg/day:							
0-2	0.65^{c}	0.70^{b}	0.76^{a}	0.69^{bc}	0.75^{a}	0.72^{ab}	0.01
2-4	0.61^{c}	0.66^{b}	0.72^{a}	0.65^{bc}	0.71^{a}	0.68^{ab}	0.01
4-6	0.60^{c}	0.65^{b}	0.71^{a}	0.64^{bc}	0.70^{a}	0.67^{ab}	0.01
0-6	0.62^{c}	0.67^{b}	0.73^{a}	0.66^{bc}	0.72^{a}	0.69^{ab}	0.01

a, b, c, d: Values in the same row for each item with different superscripts differ significantly (P<0.05).

G1: control G2: 5 g BP G3: 10 g BP G4: 5g BS G5: 10 g BS G6: 2.5 g BP + 2.5 g BS

6- Feed conversion ratio

Feed conversion ratio for male and female Friesian calves as affected by BP and BS additives during suckling, 1st, 2nd post weaning and the whole periods are shown in Table (6). Totally the BP and BS additives into the diets of calves could be improved the feed conversion ratio expressed as DM, CP, TDN and DCP required per one kg live weight gain. Control group (G1) recorded significantly ($P<0.05$) the highest amounts (poorest one) of DM, CP, TDN and DCP/kg weight gain during suckling, 1st, 2nd post weaning and the whole periods. Inversely, the feed conversion ratio was the best with calves fed G3, G5 and G6 in comparison with the control (G1) and the other tested diets (G2 and G4). Mostly the differences in feed conversion were significantly among diets G3, G5 and G6 versus G1. Addition of 25 g d^{-1} bee pollen and 5 g d^{-1} polysaccharides in milk replacer of calves improved feed conversion ratio significantly (Zhang *et al.*, 2010). Treated growing male rabbits diet with BP improved in feed conversion compared with control group (El-Neney and El-Kholy, 2014). Mahmoud and Bendary (2014) found that the use of Nigella sativa seed meal in ration of growing lambs and calves improved feed efficiency.

Table 6. Feed conversion ratio (kg/kg gain) for calves fed experimental diets during the three stages of the trail.

Items	Experimental groups						MSE
	G1	G2	G3	G4	G5	G6	
Suckling period:							
DM	1.63^{a}	1.55^{abc}	1.48^{c}	1.58^{ab}	1.49^{c}	1.53^{bc}	0.01
TDN	1.34^{a}	1.31^{ab}	1.30^{b}	1.33^{ab}	1.31^{ab}	1.31^{ab}	0.01
CP	0.34^{a}	0.33^{ab}	0.31^{b}	0.33^{ab}	0.31^{b}	0.32^{ab}	0.002
DCP	0.24	0.23	0.23	0.24	0.23	0.23	0.001
1st post weaning period:							
DM	3.39^{a}	3.18^{b}	3.01^{c}	3.25^{ab}	3.05^{c}	3.16^{b}	0.03
TDN	2.16^{a}	2.09^{ab}	2.06^{b}	2.13^{ab}	2.09^{ab}	2.10^{ab}	0.01
CP	0.59^{a}	0.55^{ab}	0.52^{b}	0.56^{ab}	0.53^{b}	0.55^{ab}	0.005
DCP	0.40^{a}	0.38^{b}	0.38^{b}	0.39^{ab}	0.38^{b}	0.38^{b}	0.002
2nd post weaning period:							
DM	6.12^{a}	5.83^{b}	5.51^{c}	5.88^{b}	5.55^{c}	5.72^{bc}	0.05
TDN	3.60^{a}	3.54^{ab}	3.47^{b}	3.56^{ab}	3.50^{ab}	3.52^{ab}	0.02
CP	0.88^{a}	0.83^{ab}	0.79^{b}	0.84^{ab}	0.79^{b}	0.82^{ab}	0.01
DCP	0.54	0.53	0.53	0.53	0.53	0.54	0.002
Whole period:							
DM	3.71^{a}	3.52^{b}	3.34^{c}	3.57^{b}	3.36^{c}	3.47^{bc}	0.21
TDN	2.37^{a}	2.31^{ab}	2.28^{b}	2.34^{ab}	2.30^{ab}	2.31^{ab}	0.11
CP	0.60^{a}	0.57^{ab}	0.54^{b}	0.58^{ab}	0.55^{b}	0.56^{ab}	0.02
DCP	0.39	0.38	0.38	0.39	0.38	0.39	0.01

a, b, c: Values in the same row for each item with different superscripts differ significantly ($P<0.05$).

G1: control G2: 5 g BP G3: 10 g BP G4: 5g BS G5: 10 g BS G6: 2.5 g BP + 2.5 g BS

7- Economic efficiency

The effect of BP and BS additives on economic efficiency of Friesian calves are presented in Table (7). Average daily feed cost increased significantly ($P<0.05$) with BP and BS additives, being G3 recorded the highest feed cost followed by G5, G2, G6 and G4 then G1 that showed the lowest value. These results may be attributed to increase feed intake (Table 4) as well as the cost of BP and BS additives and also increase feed cost of BP diet vs. the BS one due to the high price of BP against BS (60 vs. 20 LE). Otherwise, feed cost per 1 kg live body weight gain decreased significantly ($P<0.05$) with BP and BS additives, where G5 diet recorded the lowest feed cost per kg gain followed by G6, G4, G3 and then G2 and lastly G1 had the highest value. These results may be attributed to the improvement of ADG with BP and BS additives (Table 5). Moreover, total and net revenue increased significantly ($P<0.05$) with BP and BS additives, being G3 showed the highest total revenue and G5 recorded the highest net revenue followed by G3, G6, G2 and G4, while G1 had the lowest values. Similar effect was found by (El-Neney and El-Kholy, 2014) who showed higher economic efficiency when added 400 mg BP to the diet of rabbits than that of control group. Consistent with the present results, Mahmoud and Bendary (2014) found that using Nigella sativa seed meal reduced feed cost and therefore it can be used to improve the total revenue, net revenue, economic efficiency and relative economic efficiency in ration of growing lambs and calves.

Table 7. Economic efficiency for calves fed experimental diets during suckling and post weaning stages.

Items	Experimental groups						MSE
	G1	G2	G3	G4	G5	G6	
Suckling period:							
Feed cost (LE/day)	11.60^{c}	12.28^{bc}	13.17^{a}	12.03^{bc}	12.50^{ab}	12.30^{bc}	0.13
Feed cost (LE)/kg gain	17.97^{a}	17.61^{ab}	17.35^{b}	17.51^{ab}	16.66^{c}	17.12^{bc}	0.10
Total revenue (LE/day)	19.37^{c}	20.93^{b}	22.77^{a}	20.61^{bc}	22.50^{a}	21.56^{ab}	0.29
Net revenue (LE/day)	7.77^{c}	8.65^{bc}	9.60^{ab}	8.58^{bc}	10.00^{a}	9.26^{abc}	0.17
Net revenue improvement %	100.00^{c}	111.52^{bc}	123.66^{ab}	110.79^{bc}	128.98^{a}	119.29^{ab}	2.45
1st post weaning period:							
Feed cost (LE/day)	5.16^{c}	5.66^{b}	6.22^{a}	5.39^{bc}	5.60^{b}	5.63^{b}	0.08
Feed cost (LE)/kg gain	8.43^{ab}	8.52^{a}	8.60^{a}	8.24^{b}	7.88^{c}	8.23^{b}	0.06
Total revenue (LE/day)	18.37^{c}	19.92^{b}	21.70^{a}	19.62^{b}	21.33^{a}	20.51^{ab}	0.27
Net revenue (LE/day)	13.21^{c}	14.27^{b}	15.48^{a}	14.24^{b}	15.73^{a}	14.89^{ab}	0.20
Net revenue improvement %	100.00^{c}	108.11^{bc}	117.26^{ab}	107.93^{bc}	119.27^{a}	112.82^{ab}	1.73
2nd post weaning period:							
Feed cost (LE/day)	7.20^{c}	7.79^{b}	8.40^{a}	7.44^{bc}	7.77^{bc}	7.73^{bc}	0.10
Feed cost (LE)/kg gain	11.93^{ab}	11.99^{a}	11.88^{ab}	11.63^{abc}	11.10^{c}	11.53^{bc}	0.07
Total revenue (LE/day)	18.11^{c}	19.52^{abc}	21.23^{a}	19.21^{bc}	20.99^{ab}	20.12^{ab}	0.31
Net revenue (LE/day)	10.91^{c}	11.73^{bc}	12.83^{ab}	11.77^{bc}	13.22^{a}	12.39^{ab}	0.22
Net revenue improvement %	100.00^{c}	107.82^{bc}	117.84^{ab}	108.34^{bc}	121.71^{a}	114.00^{abc}	2.25
Whole period:							
Feed cost (LE/day)	7.98^{c}	8.58^{b}	9.26^{a}	8.29^{bc}	8.62^{b}	8.55^{b}	0.34
Feed cost (LE)/kg gain	12.78^{a}	12.71^{a}	12.61^{ab}	12.46^{ab}	11.88^{c}	12.29^{bc}	0.45
Total revenue (LE/day)	18.62^{c}	20.13^{bc}	21.90^{a}	19.82^{bc}	21.61^{ab}	20.73^{ab}	0.18
Net revenue (LE/day)	10.63^{c}	11.55^{bc}	12.64^{ab}	11.53^{bc}	12.99^{a}	12.18^{abc}	0.30
Net revenue improvement %	100.00^{d}	109.15^{c}	119.59^{ab}	109.02^{c}	123.32^{a}	115.37^{bc}	1.26

a, b, c, d: Values in the same row for each item with different superscripts differ significantly ($P<0.05$).

G1: control G2: 5 g BP G3: 10 g BP G4: 5g BS G5: 10 g BS G6: 2.5 g BP + 2.5 g BS

Price of one ton was 2750 LE for calf starter, 2500 LE for concentrate feed mixture, 250 LE for fresh berseem, 1200 LE for berseem hay and 300 LE for rice straw. While, the price of one kg was 80 LE for bee pollen, 20 LE for black seeds, 2.5 LE for whole milk and 30 LE for live body weight according to the prices of the period from January to August 2014.

CONCLUSION

From the present results, it could be concluded that both bee pollen and black seeds additives at the level of 10 g/head/day for the diet of Friesian calves during suckling and post weaning periods led to an improvement of feed intake, digestibility, feeding values, rumen fermentation activity, growth performance, feed conversion and economic efficiency.

REFERENCES

1. AOAC. 2000. Official Methods of Analysis, 17th Ed. Association of Official Analytical Chemists, Washington, DC, USA.
2. Aliyzicioglu, Y.; O. Deger; E. Ovali; Y. Barlak; I. Hosver; Y. Tekelloglu and S.C. Karaman. 2005. Effect of Turkish pollen and propolis extracts on respiratory burst for K-562 cell lines. In International Immunopharmacology, 5(11): 1652-1657.
3. Butt, M.S. and M.T. Sultan. 2010. Nigella sativa: reduces the risk of various maladies. Crit. Rev. Food Sci. Nutr., 50: 654-65.
4. Desai, S.D.; Sh.H. Saheb; K.K. Das and S. Haseena. 2015. Phytochemical analysis of Nigella sativa and it`s antidiabetic effect. J. Pharm. Sci. and Res., 7: 527-532.
5. El-Hanoun, A.M.; H. Hedia; M.S. El-Sbeiy and K.I. Kamel. 2007. Effect of bee pollen supplementation on some productive, reproductive and biochemical traits of growing male rabbits during winter and summer seasons. 5th Int. Conf. on Rabbit Prod. in Hot Seasons, Hurghada, Egypt, 4–7 December, 417–433.
6. El-Neney, Battaa A. M. and K.H. El-Kholy. 2014. Effect of natural additive (bee pollen) on immunity and productive and reproductive performances in rabbits. 1-Growth performance, digestive and immune responses in growing rabbits. Egypt. Poult. Sci., 34: 579-606.
7. El-Nomeary, Y.A.A.; R. I. El- Kady and A. A. El-Shahat. 2015. Effect of some medicinal plant seed meals supplementation and their effects on the productive performance of male rabbits. International Journal of Chem. Tech. Research, 8: 401-411.
8. Hungate, R.E. 1966. The Rumen and Its Microbes. P. 533. Academic Press, New York.
9. IBM SPSS Statistics 22. 2014. Statistical package for the social sciences, Release 22, SPSS INC, Chicago, USA.
10. Izuta, H.; M. Shimazawa; K. Tsuruma; Y. Araki; S. Mishima and H. Hara. 2009. Bee products prevent VEGF-induced angiogenesis in human umbilical vein endothelial cells. BMC Complement. Altern. Med., 32: 1947-1951.

11. Mahmoud, A.E.M. and M.M. Bendary. 2014. Effect of whole substitution of protein source by *Nigella sativa* meal and Sesame seed meal in ration on performance of growing lambs and calves. Global Veterinarian, 13: 311-396.
12. NRC (2001). Nutrient Requirements of Dairy Cattle. 7th Rev. Ed. National Academy Press, Washington, DC.
13. Quigley, J.D.; L.A. Caldwell; G.D. Sinks and R.N. Heitmann. 1991. Changes in blood glucose, non-esterified fatty acids, and ketones in response to weaning and feed intake in young calves. J. Dairy Sci., 74: 250-257.
14. Russell, J.B. and D. Dombrowski. 1980. Effect of pH on the efficiency of growth by pure cultures of rumen bacteria in continuous culture. Appl. Environ. Microbiol., 39: 604-610.
15. Saeid, J.M.; A.B. Mohamed and M.A. AL-Baddy. 2013. Effect of adding Garlic Powder (*Allium sativum*) and Black Seed (*Nigella sativa*) in Feed on Broiler Growth Performance and Intestinal Wall Structure. Journal of Natural Sciences Research, 3: 35-41.
16. Sarker, M.S.K. and C.J. Yang. 2010. Propolis and illite as feed additives on performance and blood profiles of pre-weaning Hanwoo calves. J. Anim. Vet. Advanc., 9: 2526-2531.
17. Van Keulen, J.V. and B.A. Young. 1977. Evaluation of acid insoluble ash as a natural marker in ruminant digestibility studies. J. Animal. Sci., 44: 282.
18. Van Soest, P.J. 1982. Nutritional ecology of the ruminant. Cornell University Press, Ithaca, NY, USA.
19. Wahba, Hala M.A. 2011. Protective effect of nigella sativa, linseed and celery oils against testicular toxicity induced by sodium valproate in male rats. Journal of American Science, 7: 687-693.
20. Wang, J.L.; Q. Wang; B. Xin and H. Wang. 2007. Trophic effect of bee pollen on small intestine in broiler chickens. J. Med. Food, 10: 276−280.
21. Warner, A.C.I. 1964. Production of volatile fatty acids in the rumen, method of measurements. Nut. Abst. and Rev., 34: 339.
22. Xu, X.; L. Sun; J. Dong and H. Zhang. 2009. Breaking the cells of rape bee pollen and consecutive extraction of functional oil with supercritical carbon oxide. Innovative Food Sci. and Emerging Tech., 10: 42–46.
23. Zhang, G.F.; Q.Y. Diao and Y. Tu. 2010. Effects of bee pollen and its polysaccharides on growth performance, nutrient digestibility and serum biochemical indexes in calves. Journal of Acta Veterinaria et Zootechnica Sinica, 41: 981-987.

الأداء الإنتاجى للعجول الفريزيان مبكرة الفطام مع اضافة حبوب لقاح النحل وحبة البركة

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أجرى هذا البحث بهدف دراسة تأثير حبوب لقاح النحل وحبة البركة كاضافات طبيعية على الأداء الانتاجى للعجول الفريزيان مبكرة الفطام لمدة ١٨٠ يوم قسمت الى ٣ فترات متتالية (كل منها ٦٠ يوم) حيث استخدم عدد ٢٤ عجل فريزيان حديث الولادة (١٢ ذكر+ ١٢ أنثى) متوسط وزنها ٣١ ± ٠،٢٦ كجم بعد رضاعة السرسوب من أمهاتها لمدة ثلاثة أيام ثم قسمت إلى ٦ مجموعات مماثلة (٢ ذكر + ٢ انثى في كل مجموعة) طبقا لوزن الجسم وشهر الميلاد. تم تغذية جميع العجول خلال فترة الرضاعة على غذاء يتكون أساسا من اللبن بالاضافة الى بادئ العجول والبرسيم الطازج و خلال الفترة الأولى بعد الفطام تتغذى على بادئ العجول والبرسيم الطازج أما خلال الفترة الثانية بعد الفطام غذيت على مخلوط العلف المركز ودريس البرسيم وقش الأرز. المجموعة الأولى لم تعطى أى اضافات طبيعية واعتبرت مجموعة المقارنة (ج١)، أما فى المجموعتين الثانية والثالثة تم اضافة ٥، ١٠ جم حبوب لقاح النحل/ رأس/ يوم (ج٢،ج٣)، وفى المجموعتين الرابعة والخامسة تم اضافة ٥، ١٠ جم حبة البركة/ رأس/ يوم (ج٤،ج٥)، بينما فى المجموعة السادسة تم اضافة ٢،٥ جم حبوب لقاح النحل + ٢،٥ جم حبة البركة/ رأس/ يوم (ج٦).

وأظهرت النتائج أن اضافة حبوب لقاح نحل العسل وحبة البركة أدى الى تحسن معنوى عند مستوى ٠،٠٥ في معاملات هضم كل من المادة الجافة، المادة العضوية، البروتين الخام، الألياف الخام، المستخلص الايثيرى، المستخلص الخالى من الأزوت والقيم الغذائية مثل محتوى كل من المركبات الكلية المهضومة، البروتين المهضوم أثناء الفترات المختلفة، حيث أظهرت ج٣، ج٥ أعلى القيم.

حدث انخفاض لقيمة درجة حموضة الكرش وتركيز نيتروجين الأمونيا، بينما ارتفع تركيز الأحماض الدهنية الطيارة الكلية معنويا عند مستوى ٠،٠٥ فى سائل الكرش فى مجموعتى ج٣، ج٥ مقارنة بمجموعة ج١. علاوة على ذلك، تميل قيمة درجة حموضة الكرش نحوالانخفاض، بينما يزيد تركيز الأحماض الدهنية الطيارة الكلية ونيتروجين الأمونيا مع تقدم العمر. كما لوحظ زيادة معنوية عند مستوى ٠،٠٥ فى الكميات المأكولة من المادة الجافة، المركبات الكلية المهضومة، البروتين الخام، البروتين الخام المهضوم فى مجموعتى ج٣، ج٥ مقارنة بمجموعة ج١، في حين سجلت ج٢، ج٤، ج٦ قيم وسطية.

سجلت العجول في ج٣، ج٥ زيادة معنوية عند مستوى ٠،٠٥ أبالنسبة لوزن الجسم ، الزيادة الكلية والزيادة اليومية في الوزن تليهما ج٢، ج٤، ج٦، بينما كانت أقل القيم فى ج١ خلال

فترات التجربة المختلفة. علاوة على ذلك، زاد كل من وزن الجسم. أدت اضافة حبوب لقاح نحل العسل وحبة البركة الى تحسن معنوى عند مستوى ٠،٠٥ فى معدل التحويل الغذائي، حيث انخفضت كميات المادة الجافة، المركبات الكلية المهضومة، البروتين الخام، البروتين الخام المهضوم اللازمة لكل كجم زيادة فى وزن الجسم. سجلت ج٣ أعلى متوسط فى تكلفة التغذية اليومية، بينما سجلت ج٥ أقل تكلفة تغذية لكل كجم نمو. علاوة على ذلك، أظهرت ج٣ أعلى عائد كلى وج٥ أعلى عائد صافى.

من هذه النتائج نستخلص أن اضافة حبوب لقاح النحل وحبة البركة بمعدل ١٠ جم / رأس / يوم لذكور و اناث العجول الفريزيان أثناء الرضاعة وبعد الفطام حتى عمر ٦ شهور أدت الى تحسن معنوى فى معاملات الهضم والقيم الغذائية ونشاط تخمرات الكرش، كمية الغذاء المأكول، وزن الجسم، الزيادة الكلية والزيادة اليومية فى الوزن، معدل التحويل الغذائي والكفاءة الاقتصادية.