SOYBEAN AND SUNFLOWER MEAL IN CALF STARTERS FOR BUFFALO CALVES

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SUMMARY

Twenty-four newly born male and female buffalo calves were used to study the effects of amount of milk consumed during suckling period and protein source in calf starters through suckling and post weaning time on their productive performance. Animals were divided into four similar groups (6 animals each). In the first experimental period (suckling period), calves of the first and second groups (G1 & G2) were fed buffalo's milk (437 liter/105 days) beside experimental calf starters that differ in protein sources (soybean meal, SBM, for G1, or sunflower meal, SFM, for G2) and were weaned at 105 d old. The third and fourth groups were fed buffalo's milk (360 liters/90 days) in addition to calf starter with SBM (G3) or SFM (G4) until weaning at 90 days of age. Good quality hay was offered ad libitum for all groups from the second week of age. During the second experimental period (from weaning till 9 mo. old) calves were fed on the starter previously offered in the first period in addition to berseem hay and rice straw. While in the third experimental period (up to 15 mo. old) the experimental calves were fed on one ration consisted of commercial concentrate feed mixture plus rice straw and berseem hay.

The results during the suckling period showed that calves weaned at 90 day (G3 and G4) consumed significantly ($P<0.05$) less daily DM than those weaned at 105 days (G1 and, G2). However, no effect due to protein source on DMI and daily gains was recorded. Moreover, SFM calves were less ($P<0.05$) efficient in feed conversion than SBM calves. The results indicated, also, that the cost of one-kg LBG for calves weaned earlier (G3, G4) was 19% less ($P<0.05$) than that weaned at 105 day (G1, and G2,). The results of the second experimental period revealed that time of weaning had no effect on daily feed intake and feed efficiency values. However, there was a significant effect on growth rates. In the same time, there was a significant effect due to source of protein in calf starter when fed pre and post weaning on feed intake and growth rates, while no effect ($P>0.05$) on DM : gain ratio was detected.

The results of the third experimental period indicated that there was no significant effect to prior treatment on daily intakes of DM, TDN and DCP. While age at weaning significantly ($P<0.05$) affected on growth rates and feed efficiency However, no effect ($P>0.05$) due to the source of protein, previously fed during the first and second experimental periods, on the growth rates or efficiency either expressed as DMI, TDNI or DCPI per kg gain. Economical evaluation showed that weaning time at suckling period had only the significant ($P<0.05$) effect on the parameters measured.

Key words: buffalo calves performance, soybean meal, sunflower meal, calf starter economical efficiency.

INTRODUCTION

In most conventional rearing programs for dairy replacement heifers, producers wean calves between 6 to 8 wk of age. Early weaning program is an attractive alternative to reduce feed cost and labor requirements. Many producers are reluctant to adopt such a program because of low feed consumption at weaning, which may be reflected in a reduced growth post weaning. Some researchers stress the importance of achieving high consumption of calf starter before early weaning. It is well established that consumption of dry feeds and subsequent ruminal fermentation stimulate rumen development in the neonatal calf. In order to increase intake of solid feeds, some farmers use a pre-starter diet or add milk replacer with plant ingredients to a complete starter diet. However, these feeds are usually nearly as expensive as liquid feeding. Also it has not been shown clearly that early consumption of starter is critical to post-weaning performance, Luchini et al (1991).

Therefore, the objective of this study was to investigate the effect of weaning age using soybean and sunflower meals as main protein sources in calf starters, on the productive performance of buffalo calves up to 15 mo of age.

MATERIALS AND METHODS

Twenty-four newly born male and female buffalo calves were used in this study. They were removed from their dams (3-4 day-old) after having the colostrum. Experimental calves were randomly divided into four similar groups ((3 males + 3 females, each). During the first experimental period (suckling period; from 4 days to weaning), animals of the first and second groups (G1&G2) were artificially fed on buffalo milk according to farm station allowances (10 % of their live weight daily during the first 2 months then, 2 liters twice a day till weaning). Total milk consumed was 437 liter/105 days. Calves were fed either soybean meal (G1, SBM) or sunflower meal (G2, SFM) calf starters . Calves of the third and the fourth groups were also, artificially fed buffalo's milk (2 liters twice a day until weaning) in addition to either calf starter with SBM (G3) or SFM (G4). Calves of G1 and G2 were weaned at 105 d of age, while those of G3 and G4 were weaned at 90 d old regardless of their final live body weight. Calf starter and good quality hay were offered ad libitum for all calves from the second week of age.

The second experimental period, (from weaning, up to 9 months old), calves of each group were fed on the starters previously offered during the first period as a concentrate feed in addition to berseem hay and rice straw as roughages. At the third experimental period (from 9 to 15 months old), all the experimental calf groups were fed on a commercial concentrate feed mixture (CFM) beside berseem hay and rice straw. All experimental calves were fed during the second and the third feed period according to allowances of El-Ashry (1980), as shown in Table (1). Feed ingredients and chemical composition of the experimental rations are presented in Tables (2) and (3).

Feed residuals, if any were recorded and the amounts consumed were calculated daily for each group. Fresh water was offered freely all the day. The concentrate portion of the ration was offered twice daily at 08.00 and 16.00 hr while the roughage part was offered ad libitum. Fasting weight of the animals was recorded biweekly. Samples of feedstuffs and milk were taken and subjected to chemical analysis for DM,

Table (1) Feed allowances of buffalo calves from weaning to 18 mo age.

Age, month	Weight, kg	Daily gain, g	SE, kg	DP, g
3-4 month	100-120	600-650	1.98	395
4-5 month	121-140	600-650	2.28	455
5-6 month	141-160	600-650	2.7	540
6-9 month	161-215	500-600	2.77	550
9-12 month	216-270	500-600	2.88	630
12-15 month	271-326	500-600	3.12	650
15-18 month	346-375	500-600	3.48	810

Table (2): The ingredients (%) of experimental starters and concentrate feed mixture used pre and post weaning periods.

Ingredients	Starters		CFM
	SBM	SFM	
Ground maize	35	34	22
Undecorticated cotton seed meal	-	-	35
Soybean meal	12	-	-
Sun flower meal	-	21	-
Rice bran	15	7	4
Wheat bran	35	35	33
Limestone powder	2	2	2
Sodium chloride	1	1	1
Molasses	-	-	3

Table (3): Chemical composition (as fed basis, the calculated nutritive value and the prices (LE/ton) of whole milk, and feedstuffs used in the experiment.

Item	Chemical composition,%						nutritive value,%			Price,
	DM	CP	EE	CF	NFE	Ash	SE*	TDN*	DCP*	LE/ton
Buffalo's milk	17.1	4.0	6.9	00	5.4	0.8	24.2	23.4	3.8	1500
SBM starter	88.2	14.7	4.6	5.8	57.0	6.1	65.8	74.8	11.0	611
SFM starter	88.3	15.4	3.5	10.1	53.5	5.8	61.1	71.5	11.7	683
Berseem hay	89.4	12.1	1.0	29.1	35.1	1.21	35.2	48.0	9.0	383
CFM	91.5	17.4	3.1	11.2	54.2	5.6	49.7	63.3	11.6	627
Rice straw	91.9	3.0	1.6	31.3	39.1	16.9	21.7	40.0	0.0	62

CFM: Concentrate feed mixture.

*** Calculated according to Abou-Raya (1967).**

OM, CP, CF, Ash, EE according to A.O.A.C., (1990). While NFE values were calculated by difference.

The data were analyzed according to Statistical Analysis System, (SAS) User's Guide, (1985). Separation among means was carried out by using Duncan multiple test, (1955). The statistical model used was due to two-way classifications with interaction.

RESULTS AND DISCUSSION

Calf performance during the first experimental period (suckling period):

Data of Table (4) show that calves weaned at 90 day (G3 and G4) consumed significantly (P<0.05) less dry matter (DM) than those weaned at 105 days (G1 and, G2). This due mainly to differences in duration of suckling days. In contrast, there was no effect (P>0.05) to protein source on dry matter intake (DMI), although the SFM calves consumed slightly more DMI (1677 g/head/d) than SBM calves (1645 g/head/d),. Consequently, values of TDN and digestible protein (DCP) intake took the same trend. The same results were reported by Myers et al (1999) who found that the early-weaned calves, consumed less daily DM compared those weaned at an average of 115 days of age.

Values of daily TDNI are in hormony with those reported by Hilal (1985) for buffalo calves raised artificially, which ranged between 1.44 to 1.72 kg TDNI/h/d.

Concerning the effect of protein source, there was no effect (P>0.05) on TDNI and DCP intakes although the SFM calves consumed less (P>0.05) TDNI (1497 g/d) than those received SBM (1513 g/d). These results disagrees with Morrill (1992) and Anderson et al (1987) who noted that weaning time had no effect on the DCP intake.

Experimental SBM calves, consumed insignificantly less DCP (245 g/d) than those received SFM starter (253 g/d). On the other hand, Stake *et al* (1973) found significant effect on DMI due to the source of protein when compared SFM with rapeseed meal. However, Signorietti *et al* (1997), reported that source of protein had no effect on daily intake of dairy calves fed different types of starters.

The results showed that there was no significant effect (P>0.05) due to inclusion of soya or sunflower meals in calf starter on daily gains (Table, 4). It may due to that calves depend on milk proteins in these ages rather than starter proteins. Average daily gain (ADG) for different experimental groups were, 573, 524, 552 and 569 g for G1, G2, G3 and, G4, respectively. These values are less than those obtained by Hilal (1985) and El-Ashry *et al* (1988). They found that daily gain for buffalo calves raised on milk replecers plus starter ranged between 593 to 793 g/d. In the same time, the present results are higher than those obtained by El-Basiony (1983) and Youssef (1992) for buffalo calves raised artificially and gained 540 g/d.

Results of feed efficiency (Table 4) show that the early weaned calves (G3 and G4) were efficiently better than the later weaned calves (G1 and G2)in utilizing DM and DCP intakes. Similar results were obtained by Khory *et al* (1967) on buffalo calves and Myers *et al* (1999) who reported that calves weaned early were more efficient than calves weaned late.

Moreover, SFM calves were less (P<0.05) efficient than SBM calves. It may be due to differences in CF content in the starters (Table 3; 5.8 vs 10.1% for SBM and SFM respectively) where the rumen was not developed enough to utilize the fiber efficiently. In addition

Table 4: Productive performance of buffalo calves previously fed SBM or SFM starters and were weaned either at 90 or 105 of age during the first experimental period.

Mean	G1	G2	G3	G4	Weaning age		Protein source	
					90 d	105 d	SBM	SFM
Daily DM intake, g	1874[a]	1936[a]	1416[b]	1418[b]	1417[b]	1905[a]	1645	1677
Daily TDN intake, g	1675[a]	1704[a]	1319[b]	1323[b]	1321[b]	1690[a]	1497	1513
Daily DCP intake, g	274[a]	285[a]	217[b]	221[b]	219[a]	279.5[b]	245	253
Weight changes								
Initial weight, kg	33.0	34.2	38.0	32.0	35	33.6	35.5	33.1
Final weight, kg	93.2	89.2	87.7	83.2	91.2	85.5	90.5	86.2
Weight gain, kg	60.2	55.0	49.7	51.2	56.2	51.9	55.0	53.1
ADG, g	573	524	552	569	624	532	564	545
Feed efficiency:								
DMI kg / kg gain	3.27[b]	3.69[a]	2.56[c]	2.49[c]	2.49[a]	3.448[b]	2.92	3.05
TDNI kg / kg gain	2.92[b]	3.25[a]	2.39[c]	2.33[c]	2.32[a]	3.09[b]	2.66	2.75
DCPI g /kg gain	478[b]	544[a]	393[c]	333[c]	384[a]	509[b]	436	459
Feed cost of 1 kg LBW, L.E	8.43[b]	9.39[a]	7.49[c]	7.09[c]	7.3[a]	8.91[b]	7.96	8.24

a,b and c : Means within the same raw with different superscripts differ (P<0.05)

calves fed SFM starter showed higher intake and less weight gain.

The economical efficiency expressed as feed cost LE / kg LBW gain were, 8.43, 9.39, 7.49 and 7.09 for G1, G2, G3 and, G4 respectively (Table 4). The cost of one-kg gain for early weaned calves (G3, G4) were 19% less (P<0.05) than those weaned at 105 days (G1, and G2,). That is because the less consumption of milk as an expensive feed and the non-significant differences in daily gains among all calves groups.

Calf performance during the second experimental period:

Mean DMI (Table 5) were highest (P<0.05) for G1 compared to the other groups. In the same time, there was no significant difference among G2, G3 and G4. The values of daily DMI presented herein are within the range reported by El-Basiony (1994) being 5.25 - 6.24 kg for weaned buffalo calves up to 15 mo old. On the other hand, calves weaned at 90 days (G3 and G4) consumed significantly less DM (5787 g/d) than those weaned at 105 days (G1 and G2, 6035 g/d). This may be due to the differences in initial live weights in this period, which were lower for G3 and G4. Moreover, Anderson et al (1987) and Myers *et al* (1999) reported that early weaning did not affect significantly daily DM intake post weaning, Calves fed SFM starter consumed less (P<0.05) DMI (5741 g/d) than those received SBM starter (6081 g/d; Table 5), because SBM is more palatable and acceptable by calves. These results agree with those obtained by Stake *et al* (1973), who found significant effect on DMI due to the source of protein when compared between SFM and rapeseed meal.

Data of TDN intake (Table 5) indicated that calves previously weaned at 90 days (G3 and G4) consumed less (P<0.05) TDN 3422 g/d than those weaned at 105 days (G1 and G2; 3511 g/d). Regardless the LBW, there are significant differences in starter intake due to differences in TDN content of different starters (Table 3). Source of protein may affect TDNI i.e., the calves received SFM starter consumed significantly less TDNI (3334 g/d) than those received SBM starter (3599 g/d).

The average daily DCP intakes for the different experimental groups (Table 5) were 475, 470, 461 and 469 g/head for G1 G2 G3 and G4 respectively. These values are less than those obtained by El-Basiony (1994) for buffalo calves, who reported values ranged between 587 to 592 kg DCPI / day.

Daily intake values of DCP took the same trend of DMI mentioned above. Calves, which were weaned at 90 days (G3, G4) consumed less (P<0.05) amount (465 g/d) of DCP than those weaned at 105 days (473 g/d). Data of growth rates (Table 5) showed that average daily gains were, 812, 742, 761 and 711 g for G1, G2, G3 and, G4, respectively. Differences were significant. Moreover, calves weaned at 90 day (G3, G4) had lower (P<0.05) ADG (736-g/ d) than those weaned at 105 day (G1 and, G2, 777 g/d). It may be attributed to the weaning weight which was higher in late weaned calves. Moreover, SBM calves had higher (P<0.05) ADG (787 g/d) than SFM calves (727 g/d). Also it should be noted that the groups received SBM starter showed slightly higher intakes than those received SFM starter and this may be the reason of increasing weight gain. The present results agree with Fiems *et al* (1986) and Grabovens *et al* (1993) on Friesian calves. They stressed on the importance of source of protein in growing calves and its effect on ADG. Moreover, in study on Friesian calves, El-din Aet *et al.* (1991) found that the soybean group had higher weight gain than the other protein sources groups. Contrary, Nishino *et al* (1986) and

Table (5): Productive performance of buffalo calves fed SBM or SFM starters and were weaned either at 90 or 105 days of age during the second experimental period.

Mean	G1	G2	G3	G4	Weaning age		Protein source	
					90 d	105 d	SBM	SFM
Daily DM intake, g	6342[a]	5729[b]	5820[b]	5753[b]	5787[b]	6035[a]	6081[a]	5741[b]
Daily TDN intake, g	3689[a]	3332[b]	3508[a]	3335[b]	3422[b]	3511[a]	3599[a]	3334[b]
Daily DCP intake, g	475[a]	470[a]	461[b]	469[a]	465[b]	473[a]	468	470
Weight changes								
Initial weight, kg	93.2	89.2	87.7	83.2	85.45	81.25	90.45	86.2
Final weight, kg	227.2	211.6	225.4	211.5	218.45	219.4	226.3	211.55
Weight gain, kg	134	122.4	137.7	128.3	133	128.2	140.85	125.35
ADG, g	812[a]	742b[c]	761[bc]	711[c]	777	736	787	727
Feed efficiency:								
DMI kg / kg gain	7.81	7.72	7.64	8.09	7.87	7.76	7.73	7.91
TDNI kg / kg gain	4.54[a]	4.49	4.61	4.69	4.65	4.62	4.57	4.59
DCPI g /kg gain	584[b]	633[a]	606[ab]	660[a]	633[b]	609[a]	595[b]	646a
Feed cost of 1 kg LBW, L.E	3.53[b]	4.02[a]	3.69[b]	4.19[a]	3.94	3.78	3.61[b]	4.12[a]

a, and b: Means within the same raw with different superscripts differ (P<0.05)

Pichler (1990) fed calves 3-6 month old on different protein sources and reported that the source of protein had no effect on ADG.

Data of the feed efficiency (Table 5) show that there was no effect to either weaning time or protein source on DM : gain ratio. Values of TDN efficiency took almost the same trend of DM efficiency,

The amounts of DCP needed to produce one-kilogram gain were ranged between 584 to 660 g. Differences were significant ($P<0.05$). Also, there was a significant effect to either weaning time or protein source on DCP efficiency. This may due to variation in protein content of SBM and SFM.

The mean economical efficiency, (LE/kg LBW gain, Table 5) indicate that least expensive was that of G1 followed by G3, G2 and G4. Differences were significant ($P>0.05$). The feed cost of 1 kg gain for the early weaned groups were slightly ($P>0.05$) higher (3.94 LE/kg gain) than those weaned at 105 days (3.78 LE/kg gain) by a difference of about 4 %. The feed cost of 1 kg gain for SFM groups were significantly higher (4.12 LE/kg gain) than those fed on SBM starter (3.61 LE/kg gain) by a difference of about 14 %. The least cost feed group was G1, which received SBM starter and weaned at 105 days.

Calf performance during the third experimental period

The main objective of this period is to investigate effect of the previously raising treatment (suckling period with different calf starters and time of weaning) on growth performance of the buffalo calves from 9 to 15 months of age.

It is clear from Table (6) that there was no significant effect due to prior treatment on daily intakes of DM, TDN and DCP.

On the other hand, calves of G4 (fed on SFM and weaned at 90 d old) had the highest ($P<0.05$) ADG value (609 g) than the other groups. At the same time, no significant differences were detected among the other groups (571, 552 and 533 g for. G1, G3 and G2 respectively). The total gain and final body weights of the four groups are within the same range that reported by El-Koussy (1976) and El-Basiony, et al (2001) on buffalo calves at the same age. Calves weaned at 90 days (G3 and G4) had higher ($P<0.05$) ADG than those weaned at 105 days (G1 and, G2). However, no significant effect ($P>0.05$) due to the source of protein, previously fed during the first and second experimental periods. Similar observation was recorded by Yoon and Stern (1995) .

Data of Table (6) indicated that amount of DM intake required to produce one-kilogram live body weight gain was significantly less (14.01kg) for calves previously weaned at 90 days by about 5.9 % than those weaned at 105 days (14.85 kg). Similar observation was detected for TDN and DCP efficieny.

In contrast, no effect ($P>0.05$) due to the source of protein, previously fed on feed efficiency. Nutrients needed to produce one kg weight gain, during the third experimental period reported herein were very close to those reported by El-Ashry (1968), and some what higher than those reported by El-Basiony, (1994) and El-Basiony *et al.*(2001) working with buffalo calves.

Economical efficiency values (Table 6) indicate that the feeding cost / kg gain was significantly less (6.42 LE / kg gain) for early weaned calves groups (G3 and G4) than those of late weaned groups (6.42 Vs 6.76 LE / kg gain, respectively). The cost of one-kilogram gain is higher by about 5.3 % for late weaned groups.

Table (6): Productive performance of buffalo calves groups previously weaned at different ages and raised on either SBM or SFM starters during the third period, (9-15 mo old).

Mean	G1	G2	G3	G4	Weaning age		Protein source	
					90 d	105 d	SBM	SFM
Daily DM intake, g	8228	8134	8482	8180	8126	8197	8140	8123
Daily TDN intake, g	4368	4312	4260	4370	4320	4340	4314	4356
Daily DCP intake, g	645	636	627	650	639	641	635	646
Weight changes								
Initial weight, kg	227.2	211.6	225.4	211.5	218.5	219.4	226.3	211.6
Final weight, kg	330	308	325	321	323	318.8	327.4	314.4
Weight gain, kg	102.8	96.4	99.6	109.7	104.5	99.4	101.1	102.85
ADG, g	571^{b}	533^{b}	552^{b}	609^{a}	580.5^{a}	552^{b}	561.5	571
Feed efficiency:								
DMI kg / kg gain	14.41	15.26	14.58	13.43	14.01^{b}	14.85^{a}	14.5	14.34
TDNI kg / kg gain	7.65	8.09	7.72	7.17	7.45^{b}	7.87^{a}	7.69	7.63
DCPI g /kg gain	1129	1194	1135	1068	1101^{b}	1162^{a}	1132	1131
Feed cost of 1 kg LBW, L.E	6.57	6.95	6.61	6.22	6.42^{b}	6.76^{a}	6.59	6.56

a,b and c : Means within the same raw with different superscripts differ (P<0.05)

Table (7): Productive performance of buffalo calves fed SBM or SFM starters and were weaned either at 90 or 105 days of age during the entire period (15 mo).

Mean	G1	G2	G3	G4	Weaning age		Protein source	
					90 d	105 d	SBM	SFM
Daily DM intake, kg	6.05	5.81	5.98	5.86	5.85	5.94	5.94	5.81
Initial weight, kg	33.0	34.2	38.0	32.0	35.0	33.6	35.5	33.1
Final weight, kg	330	308	325	321	323	319	327	314
Total weight gain, kg	297	273.8	287	289	288	285.4	291.5	280.9
ADG (g)	660 ^{a}	608^{c}	638^{b}	642^{b}	640	634	648	624
Mean DMI, kg/kg gain	9.16^{c}	9.56^{a}	9.37^{b}	9.13^{c}	9.14 ^{b}	9.37^{a}	9.17 ^{b}	9.31^{a}
Feed costs: LE / kg LBW gain	558c	6.12^{a}	5.34^{c}	5.78^{b}	5.43 ^{b}	5.85 ^{a}	5.53 ^{b}	5.81^{a}

a,b and c : Means within the same raw with different superscripts differ (P<0.05)

Calf performance during the entire experimental period:

The comparisons of daily dry matter intakes of different experimental groups (Table 7) during the entire experimental period indicate that no significant differences were found among different experimental groups in mean daily DM intake.

Although, there were significant differences ($P<0.05$) among the four groups in live body weight gain, there was no effect due to either weaning age or to source of protein fed till 9 mo age. Value of ADG for G1 was the highest (660 g/d) while that of G2 was the lowest (608 g/d). In addition, the results of feed efficiency (Table 7) indicate that calves of G1 and G4 consumed, significantly, the lowest (9.16 and 9.13 kg;) values of DM to produce one kg gain. At the same time, those of G2 were least efficient. It is of interest to mention that effect of protein source on feed efficiency detected only during suckling period.

Economical evaluation showed that cost of one kg LBW gain was significantly affected by weaning age and starter protein source. The cost was higher by 7.7 % for calves, which were weaned at 105 d than those at 90 d and by about 5 % for calves fed on SBM than those on SFM.

Generally, it could be observed that no significant difference between SBM and SFM when used either in calf starter or as concentrate feed for weaned buffalo calves on calf performance. However, it may affect feed cost according to its prices. On the other hand, weaning buffalo calves at 90 d had a positive effect on feed and economical efficiency through out the entire experimental period, specially from 9 to 15 mo of age.

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استخدام كسب الصويا وكسب عباد الشمس في بادئ العجول الجاموسي

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تم استخدام ٢٤ عجل وعجلة جاموسي عمر ٣ - ٤ يوم لدراسة تأثير مصدر البروتين خلال مرحلة الرضاعة والعمر عند الفطام على الأداء الأنتاجي لهذه العجول. قسمت العجول عشوائيا إلى أربعة مجموعات غذائية (٣ عجول و ٣ عجلات بكل مجموعة). قسمت التجربة إلى ثلاث فترات تجريبية. الفترة الأولى: وهى فترة الرضاعة حيث غذيت الحيوانات فيها كما يلى: المجموعة الأولى غذيت على لبن جاموسى وبادئ يحتوى على كسب الصويا كمصدر بروتينى، وفطمت العجول على عمر ١٠٥ يوم. المجموعة الثانية غذيت على لبن جاموسى وبادئ به كسب عباد الشمس كمصدر بروتينى وفطمت العجول على عمر ١٠٥ يوم. المجموعة الثالثة غذيت على لبن جاموسى وبادئ يحتوى على كسب الصويا كمصدر بروتينى، وفطمت العجول على عمر ٩٠ يوم. المجموعة الرابعة غذيت على لبن جاموسى وبادئ به كسب عباد الشمس كمصدر بروتينى وفطمت العجول على عمر ٩٠ يوم. كما قدم دريس البرسيم عالي الجودة للمجموعات الأربعة بحرية بداية من الأسبوع الثاني من العمر.

الفترة التجريبية الثانية، وفيها غذيت حيوانات كل مجموعة بعد الفطام على البادئ السابق التغذية عليه كعلف مركز بالإضافى إلى الدريس وقش الأرز حتى عمر ٩ أشهر.

الفترة التجريبية الثالثة والتى استمرت حتى عمر ١٥ شهر حيث غذيت جميع عجول التجربة على عليقة موحدة تتكون من مخلوط تجارى من العلف المركز بالإضافة إلى الدريس و قش الأرز. .

أوضحت نتائج الفترة التجريبية الأولى أن العجول المفطومة عند عمر ٩٠ يوم(المجموعات٣و٤) استهلكت مادة جافة يوميا اقل معنويا من تلك المفطومة على ١٠٥ يوم (المجموعات١و٢). ولم يظهر لمصدر البروتين تأثير معنوى على المأكول اليومى وإن كان له تأثيراً معنويا على كفاءة التحويل الغذائية حيث أظهرت الحيوانات المغذاة على بادئ كسب الصويا ذو كفاءة تحويلية أفضل من تلك المغذاة على بادئ كسب عباد الشمس. أتضح أيضا أن مقدار النمو للعجول المفطومة على٩٠ يوم أقل تكلفة اقتصاديا معنويا من تلك المفطومة على ١٠٥ يوم.

و أظهرت تجارب المرحلة الثانية أنه لا تأثير لوقت الفطام على المأكول و الكفاءة الغذائية رغم وجود تأثير معنوى على معدلات النمو و فى نفس الوقت يوجد تأثير معنوى لمصدر البروتين على مقدار المأكول اليومى و معدلات النمو بينما لم يظهر تأثير على الكفاءة الغذائية. و أتضح من نتائج المرحلة الثالثة أنه لا تأثير معنوى للمعاملات الغذائية السابقة من حيث مصدر البروتين أو فترة الرضاعة على المأكول اليومى بينما وقت الفطام يؤثر معنويا على معدلات النمو و الكفاءة الغذائية و مع هذا لا يوجد تأثير لمصدر البروتين السابق التغذية عليه على معدلات النمو و الكفاءة الغذائية.

اظهر التقييم الأقتصادى أن وقت الفطام ذو تأثير معنوى على الكفاءة الاقتصادية بينما ليس لمصدر البروتين تأثيراً واضحا.