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EFFECT OF FEEDING LEVEL REGIMES ON: 3- PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF PREGNANT BUFFALO HEIFERS AT FIRST SEASON MILK

Mona E. Farag[1] , S. A. Ebrahim[2] and A. A. Gabr[2]

[1]Department of Animal Nutrition, Animal Production Research Institute, Dokk, Giza, Egypt.

[2]Department of Buffalo Breeding, Animal Production Research Institute , Dokk, Giza, Egypt.

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SUMMARY

This objective of this experiment was to study the effect of plane nutrition with reference to the compensatory growth as well as productive and reproductive performance of buffalo heifers. Eighteen growing buffalo heifers averaged 156 days and 110 kg body weight were allotted randomly into three similar groups of six each at the beginning of the first part of experiment as published Shahin *et al*., (2016). The live body weight at the beginning of the second part of experimental period (at first service) was 347.83, 339.33 and 349.0 kg and age of 517.25, 571.69 and 594.66 days for groups R1, R2 and R3, respectively, as published (Mona *et al*., 2016). The live body weight at the beginning of the third part of experimental period (present one) of the experiment (at 3 mo of gestation) was 408, 398.4 and 399.9 kg and age of 624, 676 and 693 days for groups R1, R2 and R3, respectively. All nutritional allowance of all groups were calculated according to the standard of Kearl, (1982) where group R1 fed 100% of their allowances up to the end of the experiment (control), R2: fed 80% of their allowances until heifers grow up to 300 kg, and then switched on 100% up to the end of the experiment, while R3 fed 80% of the allowances over the whole experimental period that extended up to 105d lactation season. Results indicated that nonsignificant differences among dietary treatments were found respectively all nutrient digestibilities and feeding values (TDN and DCP). Despite CF digestibility was somewhat higher with 80% treatment (R3) than the others (R1 and R2). Also, digestibility of DM, CP and EE were slightly improved with R2 compared to those of the other treatments. Regarding growth performance, results showed that weights at 3, 6 and 9 months of gestation as well as just before calving were almost similar among dietary treatments. However, heifers fed R2 recorded significant higher total gain and daily gain at most growth phases in comparison with the other two feeding regimes (R1 and R3). Feed conversion ratio was better with heifers fed R3 followed by those fed R2, while those on R1 had the poorest values. The BSC at all measuring times were higher significantly with R1 than those of R2 and R3 treatments and as well as the values of R2 were significant higher than those of R3. Calf birth weight were not influenced by dietary treatments or BSC at calving, however R2 (feed restriction at 80%) had the highest calf birth weight. Also, heifers fed R2 recorded significant lower time required for closure of the cervix, position of the uterus and uterine horns symmetry city and the lowest values of the NS/C after the 2^{nd} service (1.33) compared with the other treatments. Milk yield was significant higher with R2 (restricted feed group) than that of the other treatments (R1 and R3), while milk composition (fat, protein, lactose, TS, SNF and ash) were not significant. It could be concluded that feeding growing buffalo heifers at 80% of feeding allowances according Kearl (1982) up to 300 kg live body weight and the fed on 100 of allowance along the successive stages (puberty and gestation and up to 105-d lactation season) were more suitable for productive and reproductive performance of heifers.

Keywords: *feeding levels, buffalo heifers, productive and reproductive performance.*

INTRODUCTION

Buffaloes are considered the principal milk yielding animals in Egypt, they are contributing about 60% of total milk production (Agriculture Economy Research Institute, 1997). Its productive and reproductive performance depends on the availability of feed especially at critical stages of their productive cycle such as growth, pregnancy and lactation (Hassan, 1982). Likewise some other factors could be affected on milk secretion of cows such as breed, stage of lactation, disease, management and nutrition (Armstrong, 1968). Nutrition has an important role in the productive and reproductive performance of buffalo heifers. Energy and protein are the major nutrients required by animal and its inadequate intake has a detrimental impact on the performance of dairy cattle. Nutrition can directly influence the uterine environment through energy and protein intake (Perry *et al.*, 2007).

As feed can account for up to 75% of the total costs of milk production (NRC, 2000 and Finneran *et al*., 2010). So any means, by which these costs can be reduced, without compromising animal performance, would be of benefit to the industry. Compensatory growth, a physiological process whereby an animal has the potential, after a period of restricted feeding, to undergo enhanced growth and efficiency upon realimentation (Hornick *et al*., 2000), and it is considering as one of potential approach used worldwide to reduce the costs associated with animals production. Exploitation of Compensatory growth is an important component of many animals production systems, particularly in pastoral systems where animals may have greater potential to cost effectively express the trait as pasture becomes plentiful again following restricted availability during the other months (Drouillard *et al*., 1991and Ashfield *et al*., 2014). The exploitation of this biological phenomenon can be facilitates the redistribution of feed supply from a time when feed is scarce and expensive to when it is more plentiful while still maintaining overall production targets through enhanced performance on less expensive feedstuff (Keane and Drennan, 1994).

However, reports in the literature on the mechanisms controlling the expression of compensatory growth are ambiguous and remain to be unfully elucidated. Optimal reproductive performance in animals is often limited by prolonged postpartum an estrous intervals. The stress of calving and the combined effects of growth and first lactation impose nutritional requirements that are often not fulfilled when fed cow. Thus, inadequate nutrients intake before (Bellows *et al*., 1982) or after calving (Grimard *et al*., 1995) has greater detrimental effects on postpartum reproduction in primiparous than in mature cows. Suckling (Williams, 1990 and Stagg *et al*., 1998) and nutrition (Selk *et al*., 1988 and Randel, 1990) are major regulators of the duration of the postpartum an estrous interval. Restricted nutrient intake prepartum results in thin cows at calving, a prolonged postpartum an estrous interval, and fewer cows in estrus during the breeding season. On the other hand, effects of nutrition on reproduction may be more pronounced in thin cows than in cows with adequate BCS (Richards *et al*., 1986 and Spitzer *et al*., 1995). The main limiting factor for milk yield potential of cows is the number of milk synthesizing cells in the mammary glands (Knight and Wilde, 1994). The objective of this study was to examine the effect of a typical period of feed restriction on feed efficiency, live weight, productive and reproductive performance of buffalo heifers.

MATERIALS AND METHODS

Treatments and management

This study was conducted at El-Gemmiza Agricultural Research Station, Animal Production Research Institute, Agriculture Research Center, Ministry of Agriculture, Egypt. Eighteen growing buffalo heifers averaged 156 days and 110 kg live body weight were allotted randomly into three similar groups of six each at the beginning of the first part of experiment as published by Shahin *et al*. (2016). The mean live body weight at the beginning of the second part of experimental period (at first service) was 347.83, 339.33 and 349.0 kg and age of 517.25, 571.69 and 594.66 days for groups R1, R2 and R3, respectively, as published by Mona *et al*., (2016). The mean live body weight at the beginning of the third part of experimental period (at the third month of gestation) was 407.96, 398.37 and 399.91 kg and age of 624.0, 675.67 and 693.42 days for groups R1, R2 and R3, respectively. All nutritional allowance of all groups was calculated according to the standard of Kearl, (1982) and the experimental period was extended over the first 105 days of the lactation season. A comparative feeding trial using randomized complete block design in which over three parts of experiment, the control group (R1) was fed on 100% of the allowances up to the end of the experimental period. Group (R2) was fed on 80% of the allowances till heifers grow up to 300 kg live body weight and then received 100% of the allowances till the end of the experimental period, while R3 was fed on 80% of the allowances along the whole experimental period.

Daily feed allowance heifers were adjusted biweekly based on pregnancy stage, post-calving, change of body weight and milk yield. All heifer groups were fed on ration formulated from 50% concentrate feed mixture (CFM) and 50% roughage in which roughage portion consisted of 25% corn silage (CS), 10% berseem hay (BH) and 15% rice straw (RS) until the end of the experiment. Minerals blocks and fresh water were available freely through the day time. Daily feed intake was individually recorded, while fasting live body weight of each heifer was recorded at the start of the experiment before morning feeding and then biweekly until the study was completed. The CFM was offered twice daily before check for oestrous at 7 a.m and 4 p.m. While the roughage was offered at 8 a.m and 5 p.m. All heifers were kept under semi-open sheds, and individually feeding system was applied. Mammary development of heifers was measured twice monthly according to Sejrsen and Purup (1997).

Body weights of heifers were recorded at different stages of pregnancy, postpartum and lactation stages. The born calves were left with their dams during the first days of live to receive the required colostrums amounts. The calves were suckled individually on their dam milk at the rate of 10% of their body weight and given in two meals for six week. After that, the milk allowance was reduced gradually until weaning. Calves starter and berseem hay were available in front of the calves from the third week of suckling period until weaning time at fifteenth week of age.

Sampling and analysis

Daily intake of CFM, CS, BH and RS were recorded throughout the experiment. Representative samples of CFM, CS, BH and RS feed refusals and feces were analyzed according to the A.O.A.C. (1995). Chemical analysis of different feedstuffs and calculated composition of the experimental rations are presented in Table (1).

The digestibility trials were conducted at just before calving-60 days (before expectation of calving) by using all heifers in each group. Fecal grape samples were taken from heifers at three successive days and composted for each animal to determine total tract apparent nutrients digestibility using silica (McDonald *et al*., 1995) as an internal marker. The data were analyzed according to statistical analysis system, (SAS) User's Guide, (1998). Differences among means were carried out by using Duncan multiple range test, (Duncan, 1955). The primiparous buffaloes were examined clinically and pattern of embryonic loss from days 28 to 95 of gestation.

Table (1): Chemical composition of the different feedstuffs and calculated composition of experimental rations (% DM basis).

Item	DM	CP	EE	CF	NFE	Ash
CFM	88.38	16.96	3. 11	12.26	61.16	6.51
CS	35.84	7.23	2.16	22.71	54.49	13.41
BH	87.71	12.52	1.24	27.51	46.06	12.67
R S	88.59	2.51	1.04	37.66	39.56	19.23
* Ration (TMR)	75.20	11.92	2.38	20.21	54.74	10.76

**Ration : Total mixed rations consists of 50% (CFM) : 50% roughage (25% CS, 10% BH and 15% RS).*

RESULTS AND DISCUSSION

Nutrients Digestibility

Data of digestion coefficient and feeding values of dietary treatments are presented in Table 2. Results indicated that nonsignificant differences among dietary treatments were observed respecting all nutrients digestibility and feeding values as TDN and DCP. Despite CF digestibility was somewhat higher with 80% treatment than the other two feeding allowances. While, digestibility of DM, CP, EE % and feeding value as DCP were slightly improved for animals fed R2 than those fed R1 or R3.

In perspective the extent of rumenal digestion mainly depends on microbial activity and particle out flow rate. The present results are in harmony with those obtained by Mostafa *et al*. (2004) who indicated that the restricted feeding regime by 85% of the ad-lib. standard did not increase the digestibility of dray matter and its nutrients but the vice versa was occurred. Many investigators reported similar findings (Etman (1985) , Ahamed *et al*., 2003 and Shahin *et al*., 2004) in which as increasing the feeding level, digestibility of all nutrients were markedly increased with the exception of CF digestibility. While, Steingass *et al*. (1994) found that the nutrient digestibility decreased linearly with the increase of feeding level. Moreover, Etman *et al*. (2007) found that digestibility of DM and its nutrients did not affected significantly by feeding heifers on 2.5 or 3% of ther body weight, or according NRC (1975) standards.

Table (2): Effect of feeding levels on feed intake and nutrients digestibility and feeding values with growing replacement buffalo heifers.

Item	R1 100%	R2 100%	R3 80%
Digestibility coefficient %			
DM	67.34±2.16	68.66±3.21	66.76±2.81
CP	66.28±4.49	66.93±2.03	65.54±4.83
CF	54.91±6.93	55.49±4.81	57.60±3.21
EE	73.67±4.32	74.29±2.21	71.45±5.83
NFE	76.88±5.53	76.09±3.11	75.86±3.74
Feeding values %			
TDN	64.43	65.32	65.20
DCP	8.30	8.48	8.20

Growth performance:

Results of heifer's growth performance are shown in Table (3). Data showed that weights at (months of gestation-3, 6, 9 and Just before calving) were almost similar for heifers fed on different experimental regimes. However, animals fed R2 recorded significantly the higher mean total gain and daily gain at most growth phases in comparison with the other two feeding regimes, while the lowest ones were recorded for R3 regime. This might be due to the improved in nutrients digestibility and feeding values during this period and also due to the compensatory growth effect, which being in reflection of precedent restriction feeding phase (80% of feeding allowance). These results were in agreement with those reported by Keogh *et al*. (2015) who recorded an increase in growth rate at *ad libitum* feeding period for bulls after a restriction feeding period. Also these results are comparable to those reported by Shahin (2007) who found body weight at conception and 6- month of gestation are almost similar among heifers fed the different feeding allowances (2, 2.5 or 3% of their body weight in comparison with NRC one, 1996) . However, he added that the 3%- feeding allowance gave the highest growth performance over the whole experimental period (from the first service up to just before calving). The feed conversion expressed as the amount intake of DMI, TDN and DCP required per KG gain (Table 3) showed that the heifers fed R3 had better fed conversion for DMI, TDN and DCP, followed by R2. Heifers fed R1 showed the poorest feed conversion values. These results are in agreement with those reported by Keogh *et al*.(2015), who found that feed conversion ratio was better for bulls that fed on *ad libitum* (during realimentation) that being subsequently to restricted- feeding phase. Presumably, the improvement in feed efficiency by restricting level of feed intake or allowances compared with ad-lib feeding may be attributed to: 1) reduced physical activity leading to reduce maintenance requirements, 2) increasing diet digestibility with decreasing intake and 3) reduced feed wastage (Mostafa *et al*. (2004). Collectively, a lot of results in the literature indicated that over feeding should be avoided in late gestation and a high – energy- density diet is desirable in early lactation in order to obtain a more favorable metabolic profile.

Table (3): Growth performance during prepartum of buffalo heifers fed different experimental rations.

Item	Experimental rations		
	R1	R2	R3
Live body weight, kg			
Month of gestation-3	407.96 ±18.50	398.37 ±17.56	399.91±21.52
Month of gestation-6	464.84±21.85	458.42±22.58	453.42±22.19
Month of gestation-9	523.17±23.15	521.46±26.09	508.08±21.90
Just before calving	541.23±26.33	539.92±26.80	526.63±23.50
Total gain, kg			
Month of gestation-3 to6	56.88[b]	60.05[a]	53.51[c]
Month of gestation-6 to 9	59.33[b]	63.04[a]	54.66[c]
gestation-9 to Just before calving	17.06[b]	18.46[a]	18.55[a]
gestation-3 to Just before calving	133.27[b]	141.55[a]	126.72[c]
Daily gain, kg			
Month of gestation-3 to6	0.632[b]	0.667[a]	0.595[c]
Month of gestation-6 to 9	0.659[b]	0.700[a]	0.607[c]
gestation-9 to Just before calving	0.711	0.71	0.675
gestation-3 to Just before calving	0.653[b]	0.687[a]	0.611[c]
Feed conversion:			
Kg DM / kg gain	15.70[a]	14.92[b]	13.42[c]
Kg TDN / kg gain	10.26[a]	9.75[b]	8.76[c]
Kg CP / kg gain	1.30[a]	1.26[b]	1.10[b]

a, b and c: Means in the same row with different superscripts are significant (P< 0.05).
Live body weight changes and feed conversion

Table (4): Live body weight changes and feed conversion during postpartum of buffalo heifers fed different experimental rations.

Item	Experimental rations		
	R1	R2	R3
Weight changes, kg			
Just before calving	541.23±26.33	539.92±26.80	526.63±23.50
Just after calving	476.96 ±21.50	473.59 ±20.13	461.50±24.60
days after calving-30	471.53±22.52	468.58±22.58	455.00±20.18
days after calving-105	514.51±21.83	502.33±23.15	490.88±21.85
Body weight changes , kg			
Just before to after calving	- 64.33	- 66.33	- 65.13
days after calving-30	- 5.43[b]	- 5.01[c]	- 6.5[a]
days after calving-105	+ 42.98[a]	+ 33.75[c]	+ 35.88[b]
Just after calving to days after calving-105	+ 37.55[a]	+ 28.74[b]	+ 29.38[b]
Feed conversion:			
Kg DM / adjusted FCM ,kg	2.17[a]	2.02[b]	1.89[c]
Kg TDN / adjusted FCM ,kg	1.43[a]	1.32[b]	1.24[c]
Kg CP / adjusted FCM ,kg	0.181[a]	0.172[b]	0.155[c]

a, b and c: Means in the same row with different superscripts are significant (P< 0.05).

Data of live body weight and live body weight changes during just before calving, just after calving, days after calving-30 (early lactation) and days after calving-105 (peak lactation) are summarized in Table 4. Animals received both R1 or R2 appeared to show higher live body weight compared with R3, with no significant differences among them in respect of all weighting times (just pre and after calving and 30 and 90 days after calving). Concerning, live body weight changes values at just before to after calving, it could be observed that almost similar for heifers fed different experimental dietary treatments. While the live body weight changes values at days after calving-30 to just after calving showed that animals fed R3 recorded significant higher loss their body weights than those on other treatments. This might be due to the different level of DMI. Also, the heifers fed R1 had significant (P< 0.05) gained weight at 105-d after calving more than that of R2 and R3 treatments being 42.98, 33.75 and 35.88 kg, respectively. Concerning, the feed conversion expressed as the amount intake of DMI, TDN and DCP required per kg FCM (Table 4) heifers fed R1 had significant the poorest feed conversion for DMI, TDN and DCP, followed by R2, while those fed R3 showed the favorable feed conversion values.

Generally, results in Table (3 or 4) showed that heifers received 80% of their allowances till grow up to 300 kg live weight and then received 100% of allowances till the end of the experiment (R2), was positively (P<0.05) affected of growth compared with heifers received 80% of their allowances over the whole experimental period (R3). These results are in agreement with those achieved by Ali *et al*. (2014) and Shahin *et al*. (2016) who reported that heifers fed on high energy and protein levels had significantly higher total body weight gain and daily gain than those had low energy and protein levels. Also, Keogh *et al*.(2015), revealed that feed conversion ratio was better when restricted feedinf period for bulls was done before they were switched into *ad libitum* feeding phase (realimention periods). On the other hand, decreased feeding costs, increased feed intake and feed efficiency as well as genetic background have been implicated as the key mechanisms underpinning the compensatory growth phenomenon (Hornick *et al*., 2000; Sanz Sampelayo *et al*., 2003 and Joemat *et al*., 2004). However, ambiguity still remains between authors on the optimum duration and severity of restricted feeding due to the influence of confounding factors between studies including differences in animal genotype, gender, maturity of the animal and age as well as diet type in addition to the length and severity of the restricted feeding regime used (Ryan *et al*., 1993; Yambayamba *et al*., 1996 and Sahlu *et al*., 1999). The extent or success of a compensatory growth response may be expressed using a"compensatory index." Generally, the CG index lies between 50 and 100% recovery (Hornick *et al*., 2000). The compensatory growth index may be confounded by a number of factors including the age of the animal, the diet type offered during restriction and realimentation, and potentially most importantly, the length and severity of the restricted feeding regime (Horton and Holmes, 1978; Coleman and Evans, 1986). Additionally, an increase in feed efficiency resulting from feed restriction and subsequent compensatory growth has been noted in a number of studies (Yambayamba *et al*., 1996 and Ritacco *et al*., 1997); however, other studies have provided conflicting results (Coleman and Evans, 1986; Sainz *et al*., 1995; Hornick *et al*., 1998 and Vasconcelos *et al*., 2009). These contrary findings may be due, using different degrees of nutritional restriction as well as the variance in the quality of the realimentation diet as earlier stated by (Tolla *et al*., 2002). On the other hand, effects on body reserves must be monitored because over- conditioned cows have lows intakes both before and after calving compared with cows with normal condition (Holter *et al*., 1990). In relation to the present results, Deuhurst *et al*. (2000) demonstrated that despite large differences in dry cows diets, there was litter residual effect on DMI and milk production beyond the first month of lactation, indicating the animals ability to compensate for poor dry cow management if provide with a high quality lactation diet.

Body condition score

Data presented in Table (5) showed that animals received R1 appeared to be significant higher BSC (P< 0.05) at all stages of gestation third, sixth and ninth month of gestation, Just before calving, as also as 30 and 105 after calving than that of other treatments. Also, BSC corresponding values of R2 were significant higher than those of R3, the lowest one. These results may be due to increase in DMI with R1 rations. Concerning the changes in BSC, data in Table (5) showed that heifers received R3 recorded significant (P< 0.05) lower values at month of gestation-3 to Just before calving, Just before calving to 30-d after calving, Just before calving to 105 d after calving and month of gestation-3 to 105- d after calving compared with other treatments. The two high feeding levels (R1 or R2) over the 105-d the after parturition increased BCS and improved BW of animals compared with those had a low level intake (R3). Excessively due to the compensatory growth phenomena heifers on R2 had relatively good BSC values. High-energy diets fed after calving (Perry *et al*., 1991 and Stagg *et al*., 1995) or before puberty (Yelich *et al*., 1995) increase fat deposition in mature cows and growing heifers. Primiparous beef cows fed a high-energy diet postpartum partitioned a greater proportion of net energy (consumed) to grow maternal tissue than cows on moderate-energy diets (Lalman *et al*., 2000).

Intake of nutrients of first-calf cows during gestation may (Corah *et al*., 1975; Bellows and Short, 1978 and Spitzer *et al*., 1995) or may not (Whittier *et a*l., 1988; Goehring *et al*., 1989 and Wiley *et al*., 1991) influence birth weight of calves. Calf birth weights of primiparous buffalo heifers with a BCS of 5 were significantly heavier (1.5 kg) than those from cows with a BCS of 4 (Spitzer *et al*., 1995). In the present experiment, calves from buffalo heifers fed (R1 or R2) with a BCS of 3.65 or 3.45 and calve birth weight were 37.83 or 39.61 kg, respectively, heavier at birth than those from heifers fed R3 with a BCS of 2.95 and calve birth weight was 35.75kg. Environmental and genetic factors were affect birth weight of calves (Holland and Odde, 1992) and also may influence the effect of nutrient intakes on birth weight. In addition, nutrient intakes during gestation must be drastically restricted to reduce calf birth weight because thin cows have enhanced placental growth, which may diminish some of the negative effects of reduced nutrient intake on fetal growth (Rasby *et al*., 1990). Definitely achieving the correct BSC at each production stage is particularly important, where body condition at calving has a major role in reproductive performance of suckle cows, since it regulates the duration of postpartum anoestrus (Selk *et al*., 1988).

Table (5): Body condition score (BSC) at during different experimental periods and changes in BSC of buffalo heifers fed different experimental rations.

Item	Experimental rations		
	R1	R2	R3
Calve birth weight ,kg	37.83 ±2.12	39.61± 3027	35.75± 3.11
Body condition score			
Month of gestation-3	$2.50^{\alpha} \pm 0.13$	$2.30^{b} \pm 0.12$	$2.05^{c} \pm 0.15$
Month of gestation-6	$2.75^{\alpha} \pm 0.18$	$2.55^{b} \pm 0.14$	$2.25^{c} \pm 0.18$
Month of gestation-9	$3.25^{\alpha} \pm 0.13$	$3.05^{b} \pm 0.13$	$2.65^{c} \pm 0.14$
Just before calving	$3.65^{\alpha} \pm 0.12$	$3.45^{b} \pm 0.1$	$2.95^{c} \pm 0.14$
days after calving-30	$3.35^{\alpha} \pm 0.15$	$3.10^{b} \pm 0.14$	$2.50^{c} \pm 0.17$
days after calving-105	$3.45^{\alpha} \pm 0.11$	$3.35^{b} \pm 0.13$	$2.70^{c} \pm 0.15$
Change in BCS			
Month of gestation-3 to Just before calving	1.15^{a}	1.15^{a}	0.90^{b}
Just before calving to days after calving-30	-0.30^{c}	-0.35^{b}	-0.45^{a}
Just before calving to days after calving-105	-0.20^{b}	-0.1^{c}	-0.25^{a}
Month of gestation-3 to days after calving-105	0.95^{b}	1.05^{a}	0.65^{c}

a, b and c: Means in the same row with different superscripts are significant (P< 0.05).

Reproductive performance:

The data presented in table (6) cleared that heifers fed R3 recorded significantly (P< 0.05) higher Placenta weight, followed by R2, while the lowest one was recorded for R1. This might be due to the different of body measurements, as a result of the differing levels of nutrition. These results are the contrary with those obtained by Bayoumi (1995) and El- Ashry *et al*. (2003) who reported that placenta weight and fetal membranes drops weight increased with increasing feeding level. Also, data showed that heifers fed R3 recorded significant (P< 0.05) higher time required for fetal membranes drop, Closure of the cervix, Position of the uterus and uterine horns symmetry compared with other treatments. This might be due to the different feed intake and nutrients digestibility. On the other hand, data (Table 6) showed that animals received R2 recorded significant (P< 0.05) lower vaccination fertility, while the highest one was recorded for R3. These results are in agreement with those reported by (Hornick *et al*., 2000; Sanz Sampelayo *et al*., 2003 and Joemat *et al*., 2004).

Table (6): Effect of treatments on fetal membranes drop and uterine involution of primiparous buffaloes during transition period.

Item	Experimental rations		
	R1	R2	R3
Placenta weight/kg	3.67^{b}±0.25	4.33^{a}±0.25	4.17^{a}±0.28
Fetal membranes drops/ hours	3.67^{c} ±0.67	4.00^{b} ±0.63	9.33^{a} ±0.71
Closure of the cervix/day	18.33^{b} ±0.67	15.50^{c} ±1.23	26.67^{a} ±1.50
Position of the uterus/day	27.33^{b} ±2.42	20.50^{c} ±1.95	40.00^{a} ±2.91
Uterine horns symmetry /day	41.67^{b} ±2.14	32.83^{c} ±2.76	48.33^{a} ±2.20
Vaccination fertility	124.67^{b} ±11.53	81.33^{c} ±15.98	149.50^{a} ±21.78

a, b and c: Means in the same row with different superscripts are significant (P< 0.05).

It is worthy to note that heifers on (R2) where 80% of their allowances was received till heifers grow up to 300 kg live body weight and then received 100% of the allowances till the end of the experimental period, reduced the time required for fetal membranes drops, closure of the cervix, position of uterus, uterine horns symmetry and this means as improvement in the reproductive performance of the wheels as well as providing 20% of the feed allowances could be save and this leads to an economic improvement in such feeding system.

Oestrous activity

Data in Table (7) clearly demonstrated that animals fed R2 recorded shorter ($P<0.05$) interval periods from Just after calving to the first service or to conception, followed by R1, while the longest interval period was recorded for R3 feeding regime. This might be due to the increase in nutrients digestibilities and compensatory growth, which in turn positively affected on uterus to be return to the normal state faster than the other dietary manipulation. These present findings are nearly similar to those obtained by Sanz Sampelayo *et al*., (2003) and Joemat *et al*., (2004).

Regarding oestrus cycle length, it could be noticed that the animals received R3 recorded longer periods ($P< 0.05$), followed by R1, while R2 recorded the shortest value. These results might be attributed to much longer by different levels of DMI and nutrients digestibility. These findings are nearly similar with those obtained by Prasad *et al*., (1995), Shahin, (2007) and Mona, (2016) who reported that heifers receiving low feeding level had significantly longer postpartum interval to oestrous than heifers given the high feeding levels. In general, several factors such as climate, temperature, photoperiod, nutrition have been shown to affect the length of oestrus cycle and the degree of heat expression.

In this respect, Niekerk *et al*., (1990), and Freetly and Cundiff (1998) reported that the level of feeding of heifers up to mating at 2 years has little effect on their reproductive performance. In other study with cows, results revealed that body condition was affected only on the time taken postpartum to the start of ovarian activity (26-d for high and 32-d for low body condition group (Wolfenson *et al*., 1988).

Conception and pregnancy rates:

Table (7): Oestrous and mating performance of growing buffalo heifers fed the experimental rations.

Item	Experimental rations		
	R1	R2	R3
Interval (day) from:			
Just after calving to first service	55.50^a	37.40^b	69.55^a
Just after calving to conception	98.35^B	79.22^c	137.12^a
Oestrous cycles length (day):	21.35^b	20.58^b	22.72^a
No. of conceived primiparous buffaloes after;			
1^{ST} service	3	4	2
2^{rd} service	3	2	3
3^{Srd} service	-	-	1
Ns/ C after the 2^{nd} service	1.5	1.33	2.0
Ns/ C after the 3^{rd} service	-	-	1.83
Cumulative conception rate % after:			
1^{ST} service	50	66.67	33.33
2^{rd} service	100	100	83.33
3^{Srd} service	-	-	100
No. of heifers to 3 months of preg.	6	6	6
Pregnancy rate (%)*	100	100	100
Pregnancy rate (%)**	100	100	100
No. of primiparous buffaloes embryonic loss	0	0	0
Embryonic loss (%)***	0	0	0

**On the basis of conceived animals* ** On the basis of total animals*

**** On the basis of conceived animals (No of buffalos conceived, not aborted and not calved)*

Results obtained in Table (7) cleared that CR of the 1^{st} and 2^{nd} service were superior for the animals fed R2 than those of other treatments, and all primiparous buffaloes received R1 or R2 were conceived after 2^{rd} service. While, all primiparous buffaloes received R3 was conceived after the 3^{rd} service. Also, the (NS/C) after the 2^{nd} service were the highest for animals fed R3 (2), followed by those in group R1 (1.5) and then R2 group that had the lowest values (1.33). While, the (NS/C) after the 3^{rd} service was recorded the highest values for R3 only. These results indicated that R2 had more beneficial effect on primiparous buffalo's reproductive performance compared with other treatments. This might be due to the increase in nutrients digestibility and compensatory growth, which that happened in this dietary treatment and led to the uterus return to normal faster. These present findings are nearly similar to those obtained by Sanz Sampelayo *et al*. (2003) and Joemat *et al*. (2004),

Also, data of pregnancy rate are shown in table (7). The pregnancy rate on the basis of number of conceived or total animals in each experimental group were similar in all treatments. Results showed that the embryonic loss (mortality) was not found for animals fed different plan of nutrition. Many investigators reported similar findings (Diskin *et al*., 2000, Silke *et al*., 2002 and Shahin *et al*., 2012). In relation to matter, Osoro and Wright (1992) decided that body condition at calving is often considered to have a major role in the reproduction of cows which possibly by regulation of the duration of anoestrus.

Milk yield and its composition

Data presented in Table (8) cleared that animals received R2 had significantly ($P< 0.05$) higher milk, 7% FCM, fat, protein, lactose, TS, SNF and ash expressed as daily yields, kg than those of the other dietary treatments (R1 or R3). While the milk composition (fat, protein, lactose, TS, SNF and ash) percentage did not significant affected by dietary treatments. This might be due to the increase in nutrients digestibility (Table 2) and also potentially due to the modulator effect of compensatory growth that induced with the restricted ration followed by realimentation. Consistently, Yambayamba and Price (1997) concluded that compensatory growth may modulate mammary growth, although the mechanism has not been elucidated. They were added that such feeding manipulation could subsequently result in higher potential for milk production. These results are in line with those obtained in dairy cattle by Park *et al*., (1989) who evaluate the development and differentiation of the mammary gland as induced by a specific stair-step nutrient regimen. Further, the animals in the compensating group produced 8 to 10% more milk than those in the control group. Similar results had been demonstrated in rates (Park *et al*., 1988). It is well established in dairy cattle (Stelwagen and Grieve, 1990) that high prepubertal plans of nutrition have adverse effects on mammary development. Petitclerc *et al.* (1984) found that a high level of feed intake by dairy heifers during the prepubertal stage increased mammary fat relative to parenchymal tissue and Sejrsen *et al*. (1982) reported that prepubertal dairy heifers fed to grow at 0.6 kg/day had 32% more parenchymal DNA had 64% less fat in the mammary gland than those fed to gain 1.2 kg/ day. Physiologically, it has been shown in ruminants that feed restriction followed by realimentation is associated with significant changes in the endocrine system, particularly the CIT-IGF-1 axis (Breier *et al.,* 1986). Moreover, Park *et al.* (1989) suggested that the changes in nutrient density may modulate hormone secretion and enzymatic activities.

Table (8): Effect of feeding levels on average milk yield, 7% FCM and milk composition in primiparous buffaloes during the 105 days of the first lactation season.

Item	Experimental rations		
	R1	R2	R3
Aver. milk yield , kg/d	$5.14^{b}\pm0.17$	$5.51^{a}\pm 0.23$	$4.79^{c}\pm 0.23$
7% FCM yield, kg/d	$5.11^{b}\pm0.22$	$5.51^{a}\pm0.23$	$4.71^{c}\pm0.25$
Milk composition			
Fat %	6.97 ± 0.25	7.02 ± 0.31	6.85 ± 0.22
Fat yield, kg	$0.36^{b} \pm0.07$	$0.39^{a}\pm0.05$	$0.33^{c}\pm0.04$
Protein %	4.19 ± 0.20	4.15 ± 0.23	4.16 ± 0.12
Protein yield , kg	$0.22^{\alpha}\pm0.03$	$0.23^{a}\pm0.07$	$0.20^{c} \pm0.02$
Lactose %	4.89 ± 0.26	4.85 ± 0.18	4.67 ± 0.24
Lactose yield , kg	$0.25^{b}\pm0.06$	$0.27^{\alpha}\pm0.05$	$0.23^{c}\pm0.04$
TS %	16.75 ± 0.48	16.76 ± 0.35	16.35 ± 0.32
TS yield , kg	$0.86^{b}\pm0.07$	$0.93^{a}\pm0.08$	$0.78^{c} \pm0.06$
SNF %	9.78 ± 0.89	9.74 ± 0.77	9.50 ± 0.69
SNF , kg	$0.51^{b}\pm0.08$	$0.54^{\alpha}\pm0.6$	$0.46^{c} \pm0.05$
Ash %	0.70 ± 0.05	0.71 ± 0.07	0.68 ± 0.04
Ash yield , kg	$0.04^{\alpha} \pm0.001$	$0.04^{\alpha} \pm0.001$	$0.03^{c} \pm0.001$

a, b and c: Means in the same row with different superscripts are significant ($P< 0.05$).

While, the lowest values was recorded for R3 ration. These results are in agreement with those obtained by McDonald *et al.* (1995); Ekinci and Brodcrick (1997) and El-Ashry *et al*. (2003) who reported that milk yield increased with energy and protein level (feeding level). Also, the results of 7% FCM yield are equivalent with their conformable milk yield. On the other hand, Verna *et al*. (1993)

showed that differences in daily milk , milk fat and milk protein percents , when 8 multiparous buffalos were fed ad libitum on diets containing energy 0.83 or 0.77 FUL/kg DM and 14 or 12% protein on a DM basis.

CONCLUSION

It could be concluded that feeding growing buffalo heifewrs at 80% of feeding allowances according Kearl (1982) up to 300 kg live body weight and the fed on 100 of allowance along the successive stages (puberty and gestation and up to 105-d lactation season) were more suitable for productive and reproductive performance of heifers.

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تأثير أنظمة مستوى التغذية على : 3- الأداء الإنتاجي والتناسلي لعجلات الجاموس العشار موسم أول

منى أحمد السيد فرج[1] ، صلاح السيد عطية[2] و عبد الفضيل عبد الحفيظ جبر[2]

[1] قسم بحوث تغذية الحيوان- معهد بحوث الإنتاج الحيواني – دقى- جيزة – مصر.
[2] قسم بحوث تربية الجاموس - معهد بحوث الإنتاج الحيواني – – دقى- جيزة - مصر.

تهدف هذه الدراسة معرفة تأثير استخدام ثلاثة مستويات غذائية مختلفة لعجلات الجاموس النامي حسب مقررات كيرل 1982 من المادة الجافة المأكولة و المركبات الغذائية المهضومة والبروتين المهضوم على الأداء الإنتاجي والتناسلي من 90 اليوم الأولى من الحمل حتى 105 أيام الاولى من الولادة. أستخدم في هذه الدراسة ثمانية عشر من لعجلات الجاموس الحوامل عند 90 اليوم الاولى من الحمل ووزعت تبعا للمعاملات الآتية حسب حسب الاحتياجات الغذائية لمقررات كيرل 1982 :

المعاملة الأولى : فيها تناولت العجلات غذاء يحتوى على 100% من الاحتياجات الغذائية واستمرت حتى نهاية التجربة (كنترول).

المعاملة الثانية : فيها تناولت العجلات غذاء يحتوى على 80% من الاحتياجات الغذائية حتى وزن العجلات إلى 300 كجم ثم يرتفع مستوى التغذية إلى 100% وتستمر حتى نهاية التجربة.

المعاملة الثالثة : فيها تناولت العجلات غذاء يحتوى على 80% من الاحتياجات الغذائية واستمرت حتى نهاية التجربة.

بمتوسط وزن وعمر (156 يوم و 110 كجم) في البحث الأول من التجربة التي استمرت حتى أول تلقيحة ثم بدأ البحث الثاني وكان عمر ووزن العجلات 517, 572, 595 يوم و 347.8, 339.3, 349.0 كجم على التوالي واستمرت التجربة من خلال البحث الثالث والاخير وكان عمر ووزن العجلات 624, 676 , 693 يوم و408 , 398.3 , 399.9 كجم على التوالى وأستمرت التجربة حتى 105 يوم الأولى من موسم إنتاج اللبن وكانت أهم النتائج:

- لاتوجد فروق معنوية بين المعاملات التجريبية فيما يخص جميع معاملات هضم العناصر الغذائية وايضا القيم الغذائية من المركبات المهضومة الكلية والبروتين الخام المهضوم ويتضح ايضا ان معاملات هضم الالياف اعلى الى حد ما فى المعاملة الثالثة بالمقارنة بالماعملات الاولى والثانية . وفيما يخص اداء النمو كالنت اوزان العجلات عند 3و 6و 9 شهوتر من الحمل وكذلك قبل الولادة فى الغالب متشابهة بين المعاملات الغذائية. بالرغم من ان عجلات المجموعة الثانية سجلت وزن مكتسب كلى ويومى اعلى معنويا من المجموعتان الاخرتيان فى معظم مراحل النمو للعجلات. والتحويل الغذائى كان الافضل مع مجموعة الثالثة يتبعها المجموعة الثانية بينما المجموعة الاولى كانت الاقل قيمة فى التحويل الغذائي. أما حالة الجسم عند جميع اوقات القياس كانت اعلى معنويا مع مجموعة الاولى مقارنة بالمجموعات الثانية والثالثة وايضا كانت حالة الجسم للمجموعة الثانية اعلى معنويا من المجموعة الثالثة. واضحت النتائج ان اوزان العجول المولودة لم تتاثر معنويا بالمعاملات الغذائية او حالة الجسم للعجلات عند الولادة وبالرغم من ان المعاملة الثانية (80% من الاحتياجات الغذائية فى مرحلة النو المبكرة) كانت الاعلى فى اوزان العجول المولودة. وايضا عجلات المجموعة الثانية سجلت اعلى اداء للقياسات التناسلية مقارنة بالمجموعات الاخرى وايضا كان انتاج اللبن اعلى معنويا للمجموعة الثانية مقارنة بالمجاميع الاخرى مع عدم وجود فروق معنوية فى نسب مكونات اللبن من الدهن والبروتين واللاكتوز والجوامد الكلية والرماد
- يمكن التوصية: بأنه يفضل عند وضع خطة لتنشأ عجلات الجاموس أن يقدم لها مستوى غذائي بمعدل 80% من مقررات كيرل 1982 حتى وزن 300 كجم ثم يرفع مستوى التغذية حتى 100% من مقررات كيرل حتى 105 يوم الأولى من موسم إنتاج اللبن و هذا يؤدى إلى تحسن معنوي في الأداء الإنتاجي والتناسلي كنظام تنشئة عجلات الجاموس.