PRODUCTIVE AND REPRODUCTIVE EFFICIENCIES OF BUFFALO HEIFERS UNDER DIFFERENT FEEDING SYSTEMS.

BY

Abu El-Hamd M. A. *; A. F. Mehrez*; E. E. Ragheb* and Gabr, Sh. A. **

***Animal Production Research Institute, Agricultural Research Center, Dokki, Giza.**

**** Animal Production Department, Faculty of Agriculture, Tanta University.**

ABSTRACT

A total of 120 buffalo heifers was used in this trial. Animals were divided into three LBW categories, 40 in each. Category I: low weight (90-130 kg); category II: medium weight (140-170 kg) and category III: high weight (180-200 kg). Within each category, animals were divided into two sub groups, control and treated, 20 animals each. Heifers in the control subgroups were fed 2.5-7.25 kg CFM, 1 kg hay and 1-4 kg rice straw, while those in the treated ones were fed 1.5 –2.0 kg protein supplement, 2.25-4.75 kg corn and 1-2.5 kg rice straw. The experimental feeding period lasted 9 months. Digestibility trials were carried out. At puberty as well as at conception blood samples were taken age and LBW were recorded. Results revealed that final weight was significantly ($P<0.05$) higher in treated than control heifers only in category II (296.5 vs. 320.1 kg). The highest total gain and average daily gain were recorded for treated heifers in category III, being 182.5 and 0.760 kg, respectively. Digestibility coefficient of DM was significantly ($P<0.5$) higher in treated than control heifers only in category II. Digestibility coefficient of CP was significantly ($P<0.05$) higher in treated than control heifers in all LBW categories. However, digestibility coefficient of CF was significantly ($P<0.05$) higher in treated than control heifers only in category III. In categories I and II, treated heifers showed significantly ($P<0.05$) higher concentration of total protein, albumin and globulin in their blood than control heifers. Significantly ($P<0.05$) higher albumin/globulin ratio was detected

in treated than control heifers in category II. Concentration of urea-N was significantly ($P<0.05$) higher in treated than control heifers in all LBW categories. Concentration of cholesterol, creatinine and activity of AST and ALT did not significantly differ in all LBW categories. Feed efficiency as kg DM, TDN and DCP/kg gain was significantly ($P<0.05$) better in treated than control heifers only in category II and in category I, treated heifers showed poorer feed efficiency as TDN and DCP and slightly better efficiency as DM. In category III, treated heifers showed significantly better-feed efficiency only as DM than the control group. At puberty and conception, the treated heifers exhibited significantly ($P<0.05$) earlier age and heavier weight than the controls in all LBW categories. They also showed marked improvement in conception rate (CR) and number of services per conception (NS/C) ($P<0.05$). The highest CR and the lowest NC/C values were recorded for treated heifers in category II (85% and 1.3 services, respectively). Age at 1st calving was significantly ($P<0.05$) lower in treated than control heifers in all categories, being the lowest in category II.

Based on the foregoing results regard to growth and reproductive performance of buffalo heifers, it was found that feeding buffalo heifers on whole corn plus protein supplement diet at all LBW categories showed marked improvement in reproductive efficiency of buffalo heifers at puberty, conception and calving, in particular at medium LBW category (140-170 kg) than feeding heifers CFM plus hay.

Keywords: *Productive, reproductive, buffalo, heifers and protein*

INTRODUCTION

Improving the reproduction of lactating cows is important to attain considerable increase in milk production. It can be achieved by starting their productive live as early as possible through early puberty, mating, conception and calving. Age at puberty is a major determinant of lifetime reproductive efficiency of buffalo cows.

Dietary energy level is the limited factor affecting average daily gain, age at puberty, first service and conception of buffalo heifers (Shahin, 2004 a&b and El-Ashry *et al.*, 2001) and ewe lambs (El-Gohary, 2004). Inadequate nutrition adversely affected

the pituitary function through the pattern of releasing and/or producing the pituitary gonadotrphins (Lamminy, 1969).

Age at puberty and consequently age at the 1st service and conception are inversely related to plane of nutrition. The effect of nutrition on sexual maturation seems to involve the LH pulse generating system located in the hypothalamus and signals reflecting metabolic status (Schillo, *et al.* 1992).

Selection for weaning weight or final weight did not have a detrimental effect on age at puberty in heifers (Wolfe *et al.* 1990). Marston *et al.* (1995) found significant effects of level of soybean supplementation and short-term concentrate feeding on age and weight at puberty of heifers weighting 215 kg. To determine the effect of post-weaning weight gain on subsequent reproductive performance, Buskirk *et al.* (1995) found that increasing post-weaning weight gain of lightweight heifers increased their reproductive performance.

In heifers fed to achieve either moderate (0.6 kg/d) or high ADG (1.0 kg/d) to determine body weight at puberty. High-gain diet heifers were younger, heavier and taller (all $P<0.01$) at puberty than Moderate-gain diet heifers (Hall *et al.*, 1995).

The present study aimed at comparing the effects of high-energy feeding system versus the traditional concentrated feed mixture on growth performance, feed efficiency, digestibility coefficients and blood parameters, as well as age and weight at puberty, 1st service and conception of buffalo heifers at different LBW categories.

MATERIALS AND METHODS

This work was carried out on " El Marg" farm of the Egyptian company for meat and milk production to study the growth and reproductive performance of buffalo heifers fed high energy containing ration, which consisted of whole corn, protein supplement and rice straw and compared it with the performance of heifers fattened on the traditional ration.

Animals:

A total of 120 buffalo heifers was divided into three weight categories (40 heifers each). Each LBW category was further

divided into two equal subgroups, namely control and high dietary supplemented protein and yellow corn (HDSPY) groups. Categories of LBW were light from 90 to 130 kg, medium from 140 to 170 kg and heavy from 180 to 200 kg.

Heifers in the control subgroup were fed the control ration, while those in the treatment group were fed the experimental ration as shown in table (1). Animals were fed twice daily at 8 a.m. and 4 p.m. They were kept under open sheds and had access of water all day.

Feeding system:

Chemical composition of different feedstuffs used in feeding the experimental heifers is presented in table (1). The experimental heifers were subjected to two feeding systems namely, high supplemented dietary protein and yellow corn (HSDPY) as describe by EL-Ashry (1984) and that commonly used by the Egyptian company for meat and milk production (Table 2).

The diets of the experimental groups were composed of whole corn, protein supplement and rice straw. The ration used for the control groups consisted of co-op concentrate feed mixture, hay and rice straw. The co-op feed mixture contained 28% undecortecated cottonseed cake, 37% wheat bran, 24% corn, 5 % rice bran, 3% cane molasses, 2% limestone and 1 % salt.

Table (1): Chemical composition (%) on DM basis of different foodstuffs used in feeding buffalo heifer heifers.

Item	DM	Nutrient % of DM							
		OM	CP	CF	EE	NFE	Ash	TDN	DCP
CFM	90.07	93.37	16.84	12.59	2.76	61.18	6.63	60.37	8.83
PS	90.01	93.44	28.47	7.34	7.24	49.60	7.35	66.17	22.73
YC	89.20	98.11	8.23	2.42	3.65	83.81	1.89	80.00	7.0
BH	84.50	88.50	11.50	33.82	0.75	42.59	11.34	48.00	9.0
RS	89.41	82.98	3.23	36.71	1.44	41.60	17.02	40.00	-

PS: Protein supplement. YC: Yellow corn BH: Berseem hay RS: Rice straw

Table (2): Average daily feed intake, TDN and DCP for the control and treated heifers at different weight intervals.

Live body weight (kg)	Control system									
	CFM			Berseem hay			Rice straw		Total	
	kg	TDN	DCP	kg	TDN	DCP	kg	TDN	TDN	DCP
90~130	2.50	1.51	0.22	1.0	0.48	0.09	1.0	0.40	2.39	0.31
130~180	2.50	1.50	0.22	1.5	0.72	0.14	3.0	1.20	3.43	0.36
181~225	4.25	2.57	0.37	1.5	0.72	0.14	4.0	1.60	4.89	0.51
226~270	4.25	2.57	0.37	1.5	0.72	0.14	4.0	1.60	4.89	0.51
271~315	4.75	2.87	0.42	1.0	0.48	0.09	4.0	1.60	4.95	0.51
316~360	5.50	3.32	0.47	1.0	0.48	0.09	4.0	1.60	5.40	0.56
361~405	6.25	3.77	0.55	1.0	0.48	0.09	4.0	1.60	5.85	0.64
406~450	7.25	4.38	0.64	1.0	0.48	0.09	4.0	1.60	6.46	0.73
Live body weight (kg)	HSDPY system									
	Protein supplement*			Yellow corn			Rice straw		Total	
	kg	TDN	DCP	kg	TDN	DCP	kg	TDN	TDN	DCP
90~130	1.50	0.99	0.34	2.25	1.80	0.16	1.0	0.40	3.19	0.50
131~180	1.75	1.16	0.40	2.50	2.00	0.18	1.5	0.60	3.76	0.58
181~225	2.00	1.32	0.45	2.75	2.20	0.19	2.0	0.80	4.32	0.64
226~270	1.50	0.99	0.34	3.50	2.80	0.24	2.5	1.00	4.79	0.58
271~315	1.50	0.99	0.34	4.00	3.20	0.28	2.5	1.00	5.19	0.62
316~360	1.75	1.16	0.40	4.25	3.40	0.30	2.5	1.00	5.56	0.70
361~405	1.75	1.16	0.40	4.50	3.60	0.32	2.5	1.00	5.76	0.72
406~450	2.00	1.32	0.45	4.75	3.80	0.33	2.5	1.00	6.12	0.78

*** Protein supplement contained decorticated cottonseed meal 40%, linseed meal 20%, wheat bran 22%, rice bean 15%, calcium carbonate 2 % and sodium chloride 1%.**

Digestibility trials:

At weaning age, digestion trials were conducted using individual metabolic cages and four heifers from both groups for each LBW category. Feces were individually collected daily for 5 days to determine digestibility coefficients of nutrients.

Blood sampling:

At puberty, blood samples were collected in clean heparinized test tubes via the jugular vein from 5 heifers/group immediately before feeding. Blood plasma was separated by centrifugation of the collected blood at 15 *g* for 10 min then, plasma was kept frozen at -20^0C until chemical analyses. Concentration of total protein, albumin, urea-N, total cholesterol and creatinine and activity of aspartate (AST) and alanine (ALT) aminotransferases in blood plasma were estimated using commercial kits produced by Diagnostic System Laboratories, Inc USA according to the references in Table (3). Plasma globulin was calculated by subtracting concentration of albumin from total proteins.

Table (3): References of kits used for biochemical analyses of heifers blood serum.

Blood parameter	Reference
Total protein	**Gornall *et al.* (1949)**
Albumin	**Weichselaum (1946)**
Urea-N	**Patton and Crouch (1977)**
Total cholesterol	**Watson (1960)**
Creatinine	**Henry (1965)**
ALT & AST	**Reitman and Frankal (1957)**

Experimental procedures:

Individual live body weights (LBW) were monthly recorded before morning feeding and total gain and average daily gain (ADG) were calculated. Chemical analysis of feeds and feces were determined according to A.O.A.C. (1984). Feed efficiencies in term of Kg DM, TDN and DCP per kg gain were performed at the end of the experiment according the result of the digestibility trials.

Detection of estrus was started at the 15^{th} months of age, using a vasectomized buffalo bull, which was introduced 3 times (8 a.m., 12 a.m. and 2 a.m.) to run with the heifers animals of each group to detect oestrous activity. The date of onset of the first oestrous behaviour was recorded for each animal and considered as

indicator for achieving puberty. In all groups, heifers reached puberty with LBW between 340->350 kg were naturally mated.

Age and live body weight of heifers at the first oestrus (puberty) and conception were recorded.

Statistical analysis:

Data were statistically analyzed using "T" test to compare the differences between the control and treated group within each LBW category.

RESULTS AND DISCUSSION

Growth performance:

Data in table 4 show total weight gain and average daily gain were significantly higher in HDSPY than control group in all LBW categories. The differences in this respect were recorded for HDSPY heifers in medium LBW category, being 26.8 kg and 99.0 g, respectively. The lowest corresponding values were obtained for treated heifers in low LBW category, being 16.6 kg and 61.0 g, respectively. However, HDSPY heifers in high LBW category showed moderate values, being 18.0 kg and 67.0 g, respectively.

Monthly LBW of buffalo heifer for all LBW categories during the experimental period are illustrated in figure (1).

Table (4): Effect of dietary treatment on LBW and gain of buffalo heifers in different LBW categories.

Item	Low weight		Medium weight		High weight	
	Control	Treated	Control	Treated	Control	Treated
Initial weight (kg)	120.1 ±5.6	118.5 ±6.2	147.6 ±5.4	144.3 ±6.2	182.5 ±9.3	174.4 ±8.5
Final weight (kg)	259.6 ±6.5	274.6 ±5.8	296.5 ±7.0b	320.1 $\pm6.4^{a}$	347 ±8.2	356.9 ±7.5
Total gain (kg)	139.5 $\pm4.1^{b}$	156.1 $\pm4.2^{a}$	149.0 $\pm7.0^{b}$	175.8 $\pm6.8^{a}$	164.5 $\pm4.7^{b}$	182.5 $\pm5.4^{a}$
Daily gain (kg)	0.581 $\pm0.01^{b}$	0.650 $\pm0.01^{a}$	0.621 $\pm0.01^{b}$	0.732 $\pm0.02^{a}$	0.685 $\pm0.02^{b}$	0.760 $\pm0.02^{a}$

a and b: Means having different superscripts within the same row for each LBW category are significantly ($P<0.05$) different.

The present range of average daily gain is in agreement with that early reported by El-Ashry *et al.* (1985) on male buffalo heifers subjected to similar feeding systems. However, the obtained values of live body weight gain (Table 4) is higher than that reported on Egyptian buffalo heifers by Ragab and Abdel-Salam (1962); El-Ashry *et al.* (2002 and 2004). On the other hand, averages daily gain of Murrah and Purnathadi buffalo heifers (Nawale *et al.*, 1997) and Pakistan buffalo calves (Akram *et al.*, 1962) were lower than that presented in the present study.

The differences in average daily gain of buffalo heifers may be related to differences in the initial body weight and/or the other managerial conditions.

The marked increases in average daily gain of the HDSPY than control heifers within each LBW category may be in relation to increasing dietary energy level (Shahin, 2004a) and dietary protein level (Abdel-Latif, 2005), which are higher in HDSPY than control in all LBW categories in our study.

Digestibility coefficients:

Digestibility coefficients of different nutrients in HDSPY compared to control heifers within each LBW category are shown in table (5). Digestibility coefficient of DM was significantly ($P<0.5$) higher in treated than control heifers of medium LBW category. While it did not differ significantly in low and high LBW categories.

Digestibility coefficient of CP was significantly ($P<0.05$) higher in treated than control heifers in all LBW categories. The same was true for CF but only in high LBW category. On the other hand, digestibility coefficients of EE and NFE insignificantly slightly improved in treated as compared to control heifers in all LBW categories (Table 5).

In general, heifers in low LBW category either control or treated showed a tendency of higher digestibility coefficients of all nutrients as compared to those in medium and high LBW categories.

The significant increase in CP digestibility coefficient of treated heifers in all LBW categories may be related to protein supplementation and in turn increasing dietary CP.

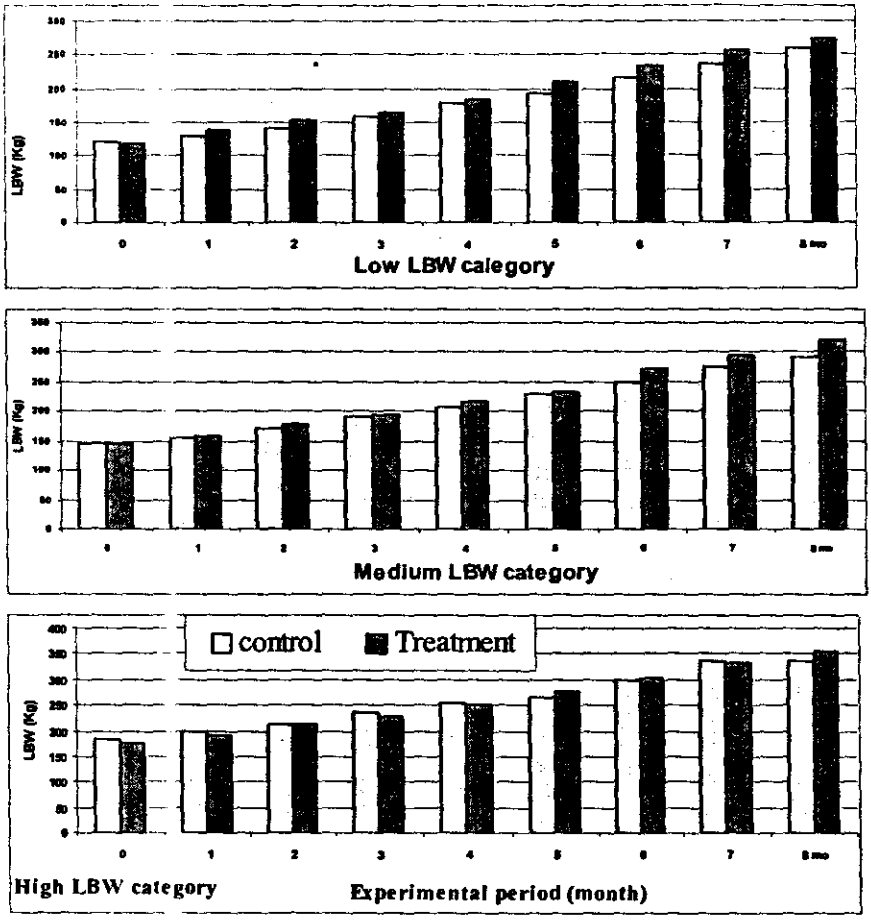

Figure (1) Monthly changes in LBW of treated and control buffalo heifers in different LBW categories.

It is of interest to note that digestibility of CP and CF showed marked decrease by increasing age in term of increasing LBW category. According to average daily feed intake (Table 2), increasing TDN and DCP intakes in HDSPY by increasing LBW,

had desirable effects on CF and CP digestibility coefficients of treated heifers, in particular at high LBW category.

Table (5): Average values of nutrient digestibility coefficients (%) of the treated and control group in all LBW categories.

Item	Low weight		Medium weight		High weight	
	Control	Treatment	Control	Treatment	Control	Treatment
DM	69.93	71.54	65.39^{b}	68.63^{a}	62.88	62.11
CP	70.55^{b}	74.87^{a}	64.23^{b}	66.20^{a}	61.90^{b}	64.24^{a}
CF	51.57	54.31	51.43	50.88	41.37^{b}	44.90^{a}
EE	73.49	74.23	65.84	67.11	71.59	72.77
NFE	70.04	73.62	75.25	77.41	68.13	70.01

a and b: Means having different superscripts within the same row for each LBW category are significantly (P<0.05) different.

The significant increase in digestion of the treated than the control group within each LBW category is in agreement with statement of Nelson (1969) and Ragheb (1985), who reported that the increase in dietary energy improved the digestibility of all nutrients except CF digestion by heifers.

Blood biochemical parameters:

Plasma biochemical parameters in blood of HDSPY and control groups of each LBW category are shown in table (6). In low and high LBW category, HDSPY heifers showed significantly (P<0.05) higher concentration of total protein, albumin and globulin than those in the control heifers. However, similar trends were found in heifers of medium LBW category, but the differences were significant (P<0.05) only for albumin concentration. Such trends were reflected in insignificant differences in albumin/globulin ratio between HDSPY and control heifers of low and high LBW category and significantly (P<0.05) higher albumin/globulin ratio in HDSPY than control heifers in medium LBW category.

The significant (P<0.05) increase in concentration of total protein and their fractions in low and high LBW category for

HDSPY than control heifers was mainly related to increasing dietary protein supplementation, in turn increasing in the DCP intake by HDSPY heifers.

Table (6): Effect of dietary treatment on biochemical and enzyme activity in blood plasma of buffalo heifers in different LBW categories

Item	Low weight		Medium weight		High weight	
	Control	Treated	Control	Treated	Control	Treated
Protein (g/dl)	5.32 ±0.2^{b}	6.23 ±0.2^{a}	7.22 ±0.2	7.58 ±0.3	7.90 ±0.2^{b}	8.65 ±0.2^{a}
Albumin (g/dl)	3.33 ±0.1b	3.91 ±0.1^{a}	3.92 ±0.1^{b}	4.48 ±0.1^{a}	4.15 ±0.1^{b}	4.60 ±0.1^{a}
Globulin (g/dl)	1.99 ±0.1b	2.32 ±0.1^{a}	3.30 ±0.1	3.11 ±0.1	3.75 ±0.1^{b}	4.05 ±0.1^{a}
AL/GL ratio	1.78 ±0.1	1.68 ±0.1	1.18 ±0.1^{b}	1.44 ±0.1^{a}	1.11 ±0.1	1.14 ±0.1
Urea-N (mg/dl)	45.11 ±1.8	50.25 ±2.2	49.05 ±2.5^{b}	58.50 ±2.1^{a}	36.87 ±2.2^{b}	41.05 ±2.1^{a}
Cholesterol (mg/dl)	63.18 ±2.2	60.92 ±2.1	69.00 ±1.8	65.85 ±2.3	73.33 ±1.9	70.24 ±2.1
Creatinine (mg/dl)	1.49 ±0.1	1.44 ±0.1	1.57 ±0.2	1.51 ±0.1	1.57 ±0.1	1.46 ±0.2
AST (IU/dl)	95.22 ±5.2	91.90 ±3.9	98.20 ±5.6	88.50 ±5.7	95.75 ±4.2	93.15 ±5.3
ALT (IU/dl)	43.23 ±3.2	46.32 ±2.8	53.10 ±4.1	47.20 ±4.1	41.81 ±2.6	44.92 ±2.5

A, B and C: Means having different superscripts within the same row are significantly different at (P<0.05).

Concentration of urea-N was significantly (P<0.05) higher in HDSPY than control heifers in all LBW categories. In the same line, there was a tendency of lower concentration of cholesterol and creatinine as well as lower activity of AST and higher activity of ALT in HDSPY than control groups in all LBW categories. The differences in this concept, however, were not significant.

The obtained values of blood biochemicals concentration and enzyme activity (Table 6) are within the physiological norms of buffalo heifers as reported by El-Ashry *et al.* (2004) and Farag (2004). Values of total protein are in agreement with those reported by Elwan (1991) and El-Baramony (1995) for growing buffalo heifers.

It could be concluded that HDSPY heifers in all LBW categories showed improved protein metabolism in term of increasing concentration of total protein and its fractions with insignificant changes in activity of AST and ALT in blood plasma. Also, fat and protein metabolism increased, which may indicate increasing feed efficiency of treated animals as compared to the control ones (Abdel-Khalek *et al.*, 2000).

Feed efficiency:

Feed efficiency expressed as kg DM, TDN and DCP/kg gain (Table 7) was significantly better in HDSPY than control heifers in medium LBW category. In low LBW category, HDSPY heifers showed poorer feed efficiency as TDN and DCP and slightly better efficiency as DM than the control heifers, but the differences were not significant. In low LBW category, HDSPY heifers showed only significantly better-feed efficiency as DM than the control group.

Table (7): Effect of dietary treatment on feed efficiency of buffalo heifers in different LBW categories.

Kg/kg gain	Low weight		Medium weight		High weight	
	Control	Treated	Control	Treated	Control	Treated
DM	13.70 ±0.4	13.15 ±0.3	13.77 ±0.3^{a}	11.68 ±0.3^{b}	12.48 ±0.3^{a}	11.25 ±0.2^{b}
TDN	6.29 ±0.2	6.69 ±0.2	7.00 ±0.3^{a}	5.94 ±0.2^{b}	6.35 ±0.2	5.73 ±0.3
DCP	0.714 ±0.02	0.737 ±0.02	0.771 ±0.03^{a}	0.654 ±0.03^{b}	0.699 ±0.02	0.630 ±0.03

a and b: Means having different superscripts within the same row for each LBW category are significantly (P<0.05) different.

Such results indicated the best feed efficiency as DM, TDN and DCP of treatment when heifers were in medium LBW category. Similar results were obtained by El-Ashry *et al.* (1985) on male buffalo heifers. The obtained feed efficiency as total DM of buffalo heifers in different groups is markedly higher than that reported by El-Baramony (1995) on Egyptian buffalo heifers (10.5 kg total DM/kg gain) and lower than that reported by El-Ashry *et al.* (2004), being 20.1 kg DM/kg gain. Furthermore, Shahin (2004a) found that increasing dietary energy level from 100 to 120% TDN improved feed efficiency of buffalo heifers as indicated in the present study.

Reproductive performance:

Age at puberty was significantly ($P<0.05$) younger in HDSPY than the control heifers in all LBW categories. But it was more pronounced in medium and high LBW categories than that in low LBW. The reduction in age at puberty between HDSPY than control heifers were 0.8, 1.1 and 1.0 months in low, medium and high LBW categories, respectively (Table 8).

The earlier pubertal age of HDSPY heifers was associated with the in significantly greater body weight gain as compared to the control heifers.

These results indicate earlier age and heavier LBW at puberty of the HDSPY than the control heifers in all LBW categories, with the greatest responses in heifers within medium LBW category.

In Egyptian buffalo heifers, mean age and weight at puberty were 19.5 months and 272.3 kg (El-Ashry *et al.*, 2004), 14.4 months and 301.8 kg (Shahin, 2004 a) and 17.6 months and 339 kg (Abdel-Lalif, 2005). Buskirk et al. (1995) found that increasing postweaning weight gain of heifers improved reproductive performance. Hall *et al.* (1994) found that heifers fed high energy level were younger ($P<0.001$) at puberty than the heifers fed moderate level.

Egyptian buffalo heifers, 215 days old and weighing 153 kg on the average, were subjected to 3 feeding levels (80, 100 and 120% of TDN allowances) reached puberty at 458.0, 433.3 and

424.9 days old and 307.4, 301.8 and 292.8 kg, respectively (Shahin, 2 004 a). Interval from puberty to conception was 123.3, 95.9 and 91.5 days, respectively.

Table (8): Effect of dietary treatment on reproductive traits of buffalo heifers in different LBW categories.

Item	Low weight		Medium weight		High weight	
	Control	Treat.	Control	Treat.	Control	Treat.
At puberty:						
Age (month)	16.9 ±0.2[a]	16.1 ±0.2[b]	16.6 ±0.2[a]	15.5 ±0.2[b]	16.4 ±0.2[a]	15.4 ±0.2[b]
LBW (kg)	316.5 ±14	324.5 ±05	317.8 ±12	332.7 ±13	321.4 ±14	323.4 ±12
At conception:						
Age (month)	19.1 ±0.2[a]	18.3 ±0.2[b]	18.6 ±0.1[a]	17.6 ±0.1[b]	18.5 ±0.1[a]	17.6 ±0.1[b]
LBW (kg)	361.6 ±12	369.5 ±11	371.2 ±24	383.6 ±15	370.2 ±16	381.6 ±15
Conception rate	70	77.5	75	85	70	85
NS/C	2.1 ±0.1[a]	1.7 ±0.1[b]	2.2 ±0.1[a]	1.3 ±0.1[b]	1.9 ±0.1[a]	1.4 ±0.1[b]
Age calving (month)	29.5 ±0.2[a]	28.7 ±0.2[b]	29.1 ±0.2[a]	28.1 ±0.2[b]	29.0 ±0.2[a]	28.1 ±0.2[b]

a and b: Means having different superscripts within the same row are significantly different at (P<0.05).
NS/C: Number of services per conception

There is a strong relationship between average daily gain and age at puberty of buffalo heifers (Shahin, 2004 a). He found that average daily gain of buffalo heifers attained the earliest puberty was significantly (P<0.01) higher (700 g/d) than those attained the moderate and latest puberty (657 and 515 g/d, respectively).

Nearly similar values of age and weight at conception were recently reported in Egyptian buffalo heifers (18.7 months and 359.8 kg) by Abdel-Latif (2005) and 25.1 months and 363.3 kg (El-Ashry *et al.*, 2004).

As affected by dietary energy level, Shahin (2004 b) found that buffalo heifers fed 120% TDN were significantly (P<0.05) heavier at conception than those fed 100 and 80% TDN levels, being 404.3, 390.5 and 379.8 kg, respectively. However, age at conception was significantly (P<0.05) earlier in buffalo heifers fed 120% TDN (563.1 days) and 100% TDN (568.8 days) than those fed 80% TDN level (625.1 days).

It is worthy noting that HDSPY heifers showed marked improvement in conception rate and number of services per conception (NS/C). Conception rate (CR) was almost higher in HSDP than control heifers. This reflected significantly (P<0.05) lower NS/C in treated than control heifers in all LBW categories. However, the highest CR and the lowest NC/C values were obtained for HDSPY heifers in medium LBW category (85% and 1.3 services, respectively).

In Egyptian buffalo heifers, number of services per conception ranged between 3.0 (El-Ashry *et al.*, 2004) and 1.33 (Abdel-Lalif (2005). As affected by dietary energy level, Marston *et al.* (1995) found that pregnancy rates were significantly lower for heifers fed soybean meal diet (67%) than for low, high, and dry lot feeding heifers (94, 94, and 86%, respectively). However, Lammoglia *et al.* (2000) reported that high-energy diet did not affect number of services per conception and final pregnancy percentage. Also, Buskirk *et al.* (1995) found no significant differences in pregnancy rate or first-service calving rate between heifer groups fed high or low energy levels.

Body condition (body weight) of the animal may affect its reproductive activity. Buffaloes in poor body condition possess postpartum quiescent ovaries and have extended periods of postpartum anoestrus (Jainudeen *et al.*, 1983). In Egyptian buffalo cows with a poor or high body condition score at calving, the interval from parturition to 1st ovulation averaged 62.9 and 47.2 d respectively. The interval to 1st oestrus was 75.0 and 73.8 d, DO was 95.3 and 81.5, and NS/C was 1.71 and 1.25 (all P<0.05). However, for cows with a poor or high body condition score at the time of service, the interval from parturition to 1st oestrus averaged

80.94 and 59.3 d, respectively. DO was 86.76 and 75.58, and NSC was 1.34 and 1.49, respectively. These differences between body condition groups were significant (Hegazy *et al.*, 1994).

Finally, age at 1st calving was significantly ($P<0.05$) lower in treated than control heifers in all LBW categories, being the lowest in medium LBW category.

Based on the foregoing results regard to reproductive performance of buffalo heifers, it was found that dietary treatment at all LBW categories showed marked improvement in reproductive efficiency of buffalo heifers at puberty and calving. Dietary treatment at medium LBW category showed the best results.

This may indicate that increasing average daily gain of buffalo heifers at medium LBW to moderate values (700-730 g/d) resulted in improving this reproductive performance.

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الكفاءة الإنتاجية والتناسلية لعجلات الجاموس تحت نظم غذائية مختلفة
محمد عوض محمد أبو الحمد*، علاء الدين فؤاد محرز*،السعيد السيد راغب* و شريف عبد الونيس جبر**
* معهد بحوث الإنتاج الحيواني، مركز البحوث الزراعية، وزارة الزراعة، مصر، ** قسم الإنتاج الحيواني، كليّة الزراعة، جامعة طنطا.

استخدم في هذه الدراسة ١٢٠ عجلة جاموسى. وقسمت إلي ثلاثة مستوياتِ حسب الوزن الحى ووضع في كل مستوى ٤٠ عجلة. وقسم كل مستوى إلي مجموعتين متماثلتين بكل مجموعة ٢٠ عجلة كالتالي:
المستوى الأول: وزن الجسم حي منخفض (٩٠-١٣٠ كجم).
المستوى االثانى: وزن الجسم حي متوسط (١٤٠-١٧٠ كجم).
المستوى الثالث: وزن الجسم حي عالي (١٨٠-٢٠٠ كجم).
وغذيت مجاميع الكنترول علي عليقة مركزة ودريس البرسيم وقش الأرز بينما غذيت مجاميع المعاملات علي ١,٥-٢ كجم بروتين مضاف و٢,٢٥ -٤,٧٥ كجم ذرة و١-٢,٥ كجم قش الأرز واستمرت الفترة التجريبية ٩ شهور. وقدر معامل الهضم وأخذت عينات دم وكذلك سجل العمر والوزن عند البلوغ والحمل والنتائج المتحصل عليها كالتالي:-
زاد وزن الجسم النهائي معنويا في المعاملة مقارنة بالكنترول في المستوى الثاني. وارتفع معامل الهضم معنوي في كل المعاملات مقارنة بالكنترول في كل المستويات، بالرغم من أن معامل هضم البروتين كان عالي المعنوية في المعاملة مقارنة بالكنترول في المستوى الثالث.
أظهرت العجلات في المستويين الأول والثالث ارتفاع معنوي في تركيز كل من البروتين الكلي و الألبيومين والجلوبيولين بالمقارنة بعجلات الكنترول، بينما أظهرت العجلات المعاملة في المستوى الثانى معنوية عالية في النسبة بين الألبيومين والجلوبيولين مقارنة بالكنترول. وارتفع تركيز اليوريا في العجلات المعاملة في كل المستويات مقارنة بالكنترول بينما تركيز الكولسيترول والكرياتينين وكذلك نشاط AST and ALT لم يتأثر معنوي في كل المستويات.
أظهر العجلات المعاملة في المستوى الثاني تحسن في الكفاءة الغذائية للمادة الجافة وTDN وDCP لكل كجم نمو بالنسبة للكنترول، بينما أظهرت العجلات المعاملة في المستوى الأول فقر في الكفاءة الغذائية

TDN وDCP لكل كجم نمو بينما تحسنت قليلا المادة الجافة بالنسبة للكنترول، أما العجلات المعاملة في المستوى الثالث تحسنت الكفاءة الغذائية للمادة الجافة لكل كجم نمو بالنسبة للكنترول.

أظهر العجلات المعاملة في كل المستويات معنوية في العمر والوزن عند البلوغ والحمل وكذلك تحسن معدل الإخصاب وانخفاض عدد التلقيحات اللازمة للحمل بالنسبة للكنترول، بينما أظهر العجلات المعاملة في المستوى الثاني ارتفاع معدل الحمل وانخفاض عدد التلقيحات اللازمة للحمل بالنسبة للكنترول (٨٥% و ١,٣ تلقيحة علي الترتيب). أما العمر عند أول ولادة فقد انخفض في العجلات العاملة في كل المستويات وكان أكثرهم انخفاض العجلات المعاملة في المستوى الثاني مقارنة بالكنترول.

ومن النتائج السابقة يتضح أن العجلات الجاموسى المغذاة علي حبوب الذرة قد تحسنت الكفاءة الإنتاجية وكذلك حسنت الكفاءة التناسلية في العجلات الجاموسى عند البلوغ والعمر عند أول ولادة وخصوصا العجلات المعاملة في المستوى الثاني.