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Effect of Parity on Biochemical and Hormonal Parameters and Milk Yield in Holstein Friesian Cows

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Abstract:

The experiment was conducted at Taj Al-Nahrain Research Station, north of Diwaniyah Governorate, by using 35 Holstein cows for the period between 1/3/2022 and 15/8/2022, to demonstrate the effect of the milking parity on some biochemical characteristics of Holstein Friesian cows, these cows were divided into three parity as follows: the first parity (11 cows), the second parity (15 cows), and the third parity (9 cows) based on the station's records. The cows were placed in semi-shaded pens with a length of 140 m and a width of 60 m for each pen, these pens were provided with freely filled water basins, after that, the physiological traits were analyzed in the Physiology Laboratory of the College of Agriculture, University of Basrah. The results indicated a significant increase in glucagon concentration for the first parity compared to the second and third parity, there were no significant differences in glucose, cholesterol, triglycerides, albumin, total protein, milk yield, leptin, oxytocin and prolactin.

Keywords: Biochemical blood parameters, Holstein Friesian, Hormones, Milk yield, Lactation parity.

Introduction:

Hormones play an important role in the serum directly in relation to the physiological state of cows (Kassim *et al.*, 2019a; Kassim *et al.*, 2019b). Likewise, with regard to milk production, most of the factors that affect milk production in cows are the parity, which was based on differences in nutrition, management or health (Huhtanen *et al.*, 2002; Kassim, 2017). The concentration of cholesterol and triglycerides in the cows in the second parity was 1.06, higher than in the cows in the fifth parity, which was 0.94 mmol/L. It was what reveals the increase in the amount of fat to provide energy to increase milk production in identical cows. The concentration of total protein and albumin in the serum was higher in dairy cows with parity 2, it decreased in valency 5 (62.5,

59.1, 57.2, 54.3) $\mu\text{mol/L}$ for valency from 2 to 6, respectively (Xuehui *et al.*, 2019). It was also found that there were differences in the percentage of glucose, as the coefficient of variation was 17.1%, More ammonia is metabolized to urea in the liver in the DIM stages, The total protein concentration decreased in the 150-179 DIM groups, plasma glucose concentrations during the 3 weeks before birth and 3 weeks after birth were affected by parity, PAR3 cows had higher concentrations of glucose in plasma compared to 0.03 P = (2 PAR) cows, plasma glucose concentrations during the 3 weeks after birth were affected by treatment (Khazanehei *et al.*, 2015).

Regarding minerals, the results showed that the upper values for phosphorus and potassium are two to three times higher than the reference values (Kassim *et al.*, 2020). Calcium levels were much higher in primiparous cows compared to multiparous cows (higher milk production, high calcium mobilization and osteoclast levels with high levels of parathyroid hormone, virgin cows tend to produce a smaller amount of colostrum and have a large number of bone cells, taking into account that the bone structure is still in the growth phase (Russel, 2007).

Proper management of cows during the transitional period is considered to maintain the health of the cows, their fertility, and milk production during each lactation period, also, preserving some mineral elements is one of the most difficult tasks that can be accomplished in herds of dairy cows, which is approximately 75% of diseases in cows, it usually occurs in the first month after birth in tropical regions, therefore, attention is paid to nutrition and providing rations, which contains useful mineral elements for the animal and the generally accepted nutritional guidelines during the transitional period and after birth, it is the first step in the management of postpartum diseases (Vallejo *et al.*, 2017). This study aims to determine the effect of the milking parity on some biochemical blood parameters of Holstein Friesian cows.

Materials and Methods

The experiment was conducted at Taj Al-Nahrain Research Station, north of Diwaniyah Governorate, by using 35 Holstein cows for the period between 1/3/2022 and 15/8/2022, to demonstrate the effect of the milking parity on some biochemical characteristics of Holstein Friesian cows, these cows were divided into three parity as follows: the first parity (11 cows), the second parity (15 cows), and the third parity (9 cows) based on the station's records. The cows were placed in semi-shaded pens with a length of 140 m and a width of 60 m for each pen, these pens were provided with freely filled water basins, after that, the physiological traits were analyzed in the Physiology Laboratory of the College of Agriculture, University of Basrah.

Results and discussion

Table (1) shows the effect of the lactation parity on the concentration of glucose, cholesterol and triglycerides in the blood serum of Holstein Friesian cows, there was no significant effect of the lactation parity on glucose concentration. The first parity gave the highest concentration of

glucose, which reached 57.00 mg/100 ml, followed by the third parity (56.09 mg/100 ml), the second parity gave the lowest concentration (55.11 mg/100 ml), it was also noted that the lactation parity did not significantly affect cholesterol concentration. The first milk production parity recorded the highest rates (76.74 mg/100 ml), followed by the third parity (76.60 mg/100 ml). The second parity recorded the lowest rates (76.11 mg/100 ml). The results also indicate that there is no significant effect of the lactation parity on the concentration of triglycerides. The first parity recorded the highest concentration (25.04 mg/100 ml), compared to the third parity (24.84 mg/100 ml). The second parity gave the lowest value (24.45 mg/100 ml).

Table (1) Effect of lactation parity on concentrations of some blood parameters (glucose, cholesterol, and triglycerides) (mean± standard error).

Lactation parity	Cow no.	Glucose (mg/ 100 ml)	Cholesterol (mg/ 100 ml)	Triglycerides (mg/ 100 ml)
First	11	0.52±57.00	3.07±76.74	0.63±25.04
Second	15	0.52±55.11	2.31±76.11	0.52±24.45
Third	9	0.77±56.09	2.82±76.60	0.77±24.84
Sig.		NS	NS	NS

N.S: no significant differences between the means.

Table (2) shows the effect of the lactation parity on the concentration of albumin, total protein and urea in the blood serum of Holstein Friesian cows. The results indicate that there are no significant differences between the lactation parities in the concentration of albumin in the blood serum of Holstein Friesian cows, the third parity of milk production gave the highest rates of albumin concentration (3.85 gm/100 ml blood serum), followed by the second parity (3.80 gm/100 ml blood serum), while the first parity gave the lowest rates (3.75 gm/ml blood serum).

The same table indicates that the lactation parity has no significant effect on total protein concentration, the second parity recorded the highest concentration of 5.43 gm/100 ml blood serum, followed by the third parity (5.34 gm/100 ml blood serum). The first parity gave the lowest values (5.30 gm/100 ml blood serum), there was no significant effect of the milking parity on the urea concentration in the blood serum of Holstein Friesian cows, the first lactation parity recorded the highest concentration of 17.45 mg/100 ml blood serum, then comes the third parity after that, with a concentration of 16.52 mg/100 ml blood serum, the second parity recorded the lowest rates (16.28 mg/100 ml blood serum).

Table (2) Effect of lactation parity on concentrations of some blood parameters (albumin, total protein, and urea) (mean± standard error).

Lactation parity	Cow no.	Albumin (gm/ ml)	Total protein (gm/ ml)	Urea (mg/ ml)
First	11	0.13±3.75	0.13±5.30	0.67±17.45
Second	15	0.05±3.80	0.10±5.43	0.27±16.28
Third	9	0.07±3.85	0.15±5.34	0.54±16.52
Sig.		NS	NS	NS

N.S: no significant differences between the means.

Table (3) illustrates the effect of calving parity on milk production and the concentrations of certain hormones in the blood of Holstein Friesian cows. The results indicate that calving parity had no significant effect on average milk yield, despite numerical variations among parities. The first parity recorded the highest mean milk production (289.41 kg), followed closely by the second parity (289.27 kg), whereas the third parity showed the lowest value (276.04 kg).

The lower milk yield observed in the third calving parity may be attributed to the younger age of cows, whose reproductive endocrine system (hypothalamic–pituitary–ovarian axis) is still underdeveloped. Consequently, the secretion of reproductive hormones may be insufficient, which can disrupt estrous cycles and delay successful conception. This may prolong lactation duration and delay the onset of the dry period. These findings are not consistent with those reported by Chenyambuga and Mselek (2009), who stated that milk production increases with age due to increased body weight and the full development of secretory tissue in the mammary gland in later parities.

Regarding leptin concentration, the results showed no significant effect of calving parity, although numerical differences were observed. The highest leptin level was recorded in the second parity (21.37 ng/mL), followed by the third parity (21.30 ng/mL), while the lowest value was observed in the first parity (20.95 ng/mL). These findings are consistent with Xuelhui et al. (2019), who reported stable leptin concentrations within the physiological range across different lactation stages in Holstein cows (from the second to the sixth parity). They attributed this stability to consistent feeding and management conditions, which prevented any marked parityal influence on endocrine activity.

A significant effect ($P<0.05$) of calving parity was observed on glucagon concentration.

The first parity recorded the highest value (36.06 pg/mL), which was significantly higher than the second parity (26.66 pg/mL), while the third parity showed the lowest concentration (19.58 pg/mL). This variation may be related to lower feed intake in younger cows compared with older animals, due to competition for feed and social dominance within the herd. Consequently, increased hunger stress in younger cows may have elevated circulating glucagon levels. These results are not in agreement with Xuelhui et al. (2019), who reported different findings in Holstein dairy cows in China.

In contrast, oxytocin and prolactin concentrations were not significantly affected by calving parity, despite slight numerical increases in the third parity compared with the first and second parities. Oxytocin levels were 115.03, 112.03, and 116.60 pg/mL for the first, second, and third parties, respectively. Similarly, prolactin concentrations were 352.15, 343.94, and 335.07 pg/mL across the three parities, respectively. The relatively higher hormone levels observed in the third parity may help explain the increased milk yield compared with the first and second parities, as milk production is closely associated with the secretion of lactation-related hormones (Al-Rishdy et al., 2019).

Table (3) Effect of lactation parity on concentrations of some milk yield and concentration of hormones (mean± standard error).

Lactation parity	Number of cows	Milk yield	Leptin (ng/ml)	Glucagon (pg/ml)	Oxytocin (pg/ml)	Prolactin (pg/ml)
First	11	289.41±13.12	20.95 ± 0.77	36.06 ± 1.22 a	115.03 ± 2.35	352.19 ± 6.10
Second	15	289.27 ± 5.75	21.30 ± 0.82	26.06 ± 1.22 b	112.03 ± 2.05	343.94 ± 5.75
Third	9	267.04 ± 9.24	21.37 ± 0.57	19.58± 19.58 c	116.60 ± 2.27	335.07± 6.37
Sig.		NS	NS	*	NS	NS

Different letters within one column indicate the presence of significant differences below the 0.05 probability level. N.S: no significant differences between the means.

N.S: no significant differences between the means.

Conclusions

The results of the present study indicated that milking parity had a significant effect only on glucagon concentration, where cows in the first parity recorded higher values compared with those in the second and third parties. No significant effects of milking parity were observed on blood glucose, cholesterol, triglycerides, albumin, total protein, milk yield, leptin, oxytocin, or prolactin concentrations. The findings suggest that most of the biochemical and hormonal parameters remained relatively stable across different milking parities under the same management and environmental conditions. It can be concluded that milking parity had limited influence on the metabolic and productive performance of Holstein Friesian cows, except for its effect on glucagon levels.

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