DRYING OFF METHODS, PARITY AND STAGE OF LACTATION INFLUENCES ON MILK PRODUCTION, MILK COMPOSITION AND SOME BLOOD PLASMA PARAMETERS IN HOLSTEIN FRIESIAN COWS

R.A. Abou-Saleh, A. S. M. Soliman, M. R. El-Mahdy and T. M. M. Hassan[*]

Department of Animal Production, Faculty of Agriculture, Benha University, Egypt
[*]*Corresponding author:* tamer.mohamed@fagr.bu.edu.eg

SUMMARY

The aim of this study was to investigate influence of drying off methods, parity number and stage of lactation on milk production, composition and some blood plasma parameters by using 27 Holstein-Friesian cows which divided into three groups (each group contained 9 cows). First group was dried by suddenly stop milking method, second group dried by irregular milking method and third group dried by the incomplete milking method in different parities. Total milk production of the next lactation was recorded and also average daily milk yield during ten months of lactation. Milk and blood samples were taken from all cows every 100 days during the lactation season to analyze some milk composition and blood plasma parameters. Results showed that drying off cows by the incomplete milking method before calving gained higher milk production, better milk composition and blood plasma parameters than other drying off methods but not significantly. Fourth or more parity cows gained higher milk production, milk composition and blood parameters than other parties. Cows at the third stage of lactation (last 100 days) had the highest milk composition and blood plasma proteins (total protein albumin and globulin). In conclusion, incomplete, irregular and sudden stop milking can safely be recommended as a method for drying off cows producing at least up to 20, 11-20 and >10 kg daily, respectively without negative results in quantity and quality of milk as well as blood plasma parameters. It could be recommend that using sudden stop method for low lactating cows (less than 10 kg milk/day) and irregular and incomplete methods for both medium and high lactating cows (11-20 kg and more than 20 kg milk/day, respectively).

Keywords: Drying off methods, Holstein Friesian, Milk, Blood parameters

INTRODUCTION

The dry period is a crucial phase in the lactation season of a dairy cow. Dairy managers aim to dry off pregnant cows to achieve a dry period of appropriate length to maximize productivity in the next lactation season (Dingwell *et al.,* 2001). A dry period of sixty days has been routinely recommended. In recent years, growing interest has developed toward shorter dry period as a management strategy which could be more appropriate for today's high producing dairy cows (Santschi *et al.,* 2011) and is well known to maximize milk production in the next lactation season (Van Knegsel *et al.,* 2014). Shortening the dry period has been proposed as a management strategy to improve the energy balance of dairy cows in early lactation stage. Cows with a short dry period produced 1.4 kg/day less milk than cows with a conventional dry period (60 days), with average milk yield loss of 4.5% in the next lactation season. When the dry period was omitted, cow produced 5.9 Kg/day less milk yield than cows with a conventional dry period, with an average milk yield loss of 19.1% (Steeneveld *et al*., 2014). The primary factors to be considered in a comparison of drying methods for cows are the effects upon the cow, the time required to drying up the cow and the quantity and quality of milk yielded in subsequent lactations (Wayne *et al.,* 1933). However, optimal dry period length may vary depending on parity number, herd size, and level of milk production, among other factors (Atachi *et al.,* 2013). It is known that milk production is affected by factors such as parity number, stage of lactation and the dry period of cows. The same factors might have some effects also on milk composition and blood parameters in lactating cows (Cozzi *et al.,* 2011 and Kuhn *et al.,* 2007).

The aim of this study was to investigate the effect of drying off methods and parity on the daily and total milk yield, its composition as well as blood plasma parameters and the effect of different stages of lactation on the milk composition as well as blood plasma parameters of imported Holstein Friesian cows in the Nile delta of Egypt.

MATERIALS AND METHODS

The experimental work of this study was carried out at El-Tonsy (International Company for Animal Wealth) dairy cattle farm in Abou-Rawash, Giza, Egypt, from July 2014 to June 2015 under the supervision of Animal production department staff, Faculty of Agriculture, Benha University.

Management of experimental animals:

In this study 27 Holstein-Frisian cows of the herd allowed to feed on Egyptian clover (*Trifolium alexandriunm*), corn silage and rice straw during autumn and winter months. However, in spring and summer

Methods of drying off cows:

27 Holstein-Frisian cows were divided into three groups (each group containing 9 cows), first group dried by suddenly stop method, second group dried by irregular milking method and third group was dried by incomplete milking method in different parities which can be illustrated as following:

1. Sudden stop milking drying off method: feeding cows low production concentrate mixture before week of sudden stop milking method till drying.
2. Irregular milking drying off method: at the final week of lactation, cows are milked once per day to decline milk production till drying.
3. Incomplete milking drying off method: at the final week of lactation, cows milked incompletely to decline milk production till drying.

After the final milking, cow's teat was injected by antimicrobial (dry cow therapy) and wax material to protect the udder from invading bacteria during the dry period in all different drying studied methods. All used previous methods were, according to Wayne *et al.* (1933).

Milk yield:

The experiment was designed to study the effect of both drying off methods (sudden stop, irregular and incomplete milking) and parity number (second, third and fourth or more parity) on experimental cows (N = 27) average daily and total milk yield. Total milk yield was calculated by summing up of cows daily milk yield during 10 months of lactation.

Milk sampling and analysis:

Milk samples were taken from all experimental cows (N=27) every 100 days during lactation to estimate the effect of lactation stage (100, 200 and 300 days of lactation) on milk composition. Milk samples were stored at 5º C for subsequent analysis of milk composition (total solids, fat, solids not fat, protein, lactose and ash %) according to IDF (1991a), IDF (1991b), IDF (1993) and AOAC (1995).

Blood sampling and analysis:

Blood samples were collected individually every 100 days from all experimental cows (N=27) during lactation to estimate the effect of lactation stage (100, 200 and 300 days of lactation) on some blood plasma parameters, by addition of EDTA into dry clean tubes. The blood plasma was obtained by centrifuging the blood samples soon after collection at 3000 rpm for 15 minutes. Blood plasma was transferred into vials and stored in deep freezer at -20 ◦C for subsequent specific chemical analysis. Total protein, albumin, globulin, A/G ratio, triglyceride, total cholesterol, calcium, potassium and magnesium concentration were determined according to Henry (1964), Doums *et al.* (1971), Frings *et al.* (1972) and American Association for Clinical Chemistry (1977). The concentration of total globulin in each sample was obtained by subtracting albumin concentration from the total protein concentration and albumin globulin (A/G) ratio was calculated by total albumin by total globulin.

Table 1. Feed ingredients and chemical composition of the experimental diets

Item	Early dry period cows	Close up period cows[1]	Mediate and low production[2]	Fresh and high production[3]
Ingredients%:				
Corn grain dent yellow	43.5	43.4	47.6	42
Wheat bran	26.7	19.5	21.5	18.3
Soybean meal 44%	25.8	25	20.5	28.1
Limestone ground	2	2.3	1.2	1.17
Molasses cane	-	3	6.5	3.6
Protected fat	-	0.6	-	3.5
Sodium chloride	0.9	0.275	0.7	0.6
Vitamins AD3E	0.175	0.2	0.15	0.15
Sodium bicarbonate	-	-	1.22	1.5
Magnesium oxide	-	-	0.25	0.45
Micro minerals (Zn-Cu-Selenium)	-	0.1	-	0.05
Di-calcium phosphate	0.225	0.35	-	0.2
Antitoxins	0.35	0.12	0.075	0.075
Dried yeasts	-	0.009	-	0.003
Minerals	0.35	0.4	0.3	0.3
Acid buffer	-	0.54	-	-
Calcium chloride	-	1.4	-	-
Magnesium sulfate	-	2.8	-	-
Total	100	100	100	100
Chemical composition%:				
Dry matter	92	90	90	92
Crude protein	18.6	17.4	16.2	18.5
Crude fiber	4	3	3.5	3
Nitrogen free extract	73	70.7	76.2	73.6
Ether extract	0.4	0.7	0.3	0.5
Ash	4	8.5	3.8	4.4

[1] before 21days of calving, [2] below 25 Kg milk production cows, [3] over 25 Kg milk production cows.

Statistical analysis:

Statistical analysis was carried out by using the least squares procedure for analyzing the data with unequal subclass number described by SAS (2004). The Statistical models used as follows:

$Y_{ijk} = \mu + M_i + P_j + (MP)_{ij} + b_1(\times_{1ijk} - \overline{\times}_1) + b_2(\times_{2ijk} - \overline{\times}_2) + b_3(\times_{3ijk} - \overline{\times}_3) + b_4(\times_{4ijk} - \overline{\times}_4) + e_{ijk}$ (Model 1)

sWhere: Y_{ijkl} = the observation of l cow average daily and total milk yield; μ = the overall mean of all observations; M_i = the fixed effect due to I^{th} drying method (i=1, 2, 3 where 1= sudden stop method, 2= irregular milking method and 3= incomplete milking method); P_j = the fixed effect due to the jth Parity number (j=1, 2, 3 where 1= second, 2= third and 3= fourth or more parity); $(MP)_{ij}$ = the fixed effect of the interaction between drying method and parity number; b_1 = Linear regression coefficient of average daily and total milk yield on dry period length; b_2 = Linear regression coefficient of average daily and total milk yield on cow weight at dry period; b_3 = Linear regression coefficient of average daily and total milk yield on cow weight at calving; b_4 = Linear regression coefficient of average daily and total milk yield on cow weight after 50 days of lactation; e_{ijk} = random error associated with the individual observation and assumed to be (N, IND) and $(0, \sigma^2_e)$.

$Y_{ijkl} = \mu + M_i + P_j + S_k + (MP)_{ij} + (MS)_{ik} + (PS)_{jk} + (MPS)_{ijk} + e_{ijkl}$

(Model2)

Where: Y_{ijkl} = the observation of l cow milk composition and blood parameters; μ = the overall mean of all observations; M_i = the fixed effect due to I^{th} drying method (i=1, 2, 3 where 1= sudden stop method, 2= irregular milking method and 3= incomplete milking method); P_j = the fixed effect due to the jth Parity number (j=1, 2, 3 where 1= second, 2= third and 3= fourth or more parity); S_k = the fixed effect due to the kth stage of lactation (k=1, 2, 3 where 1=1st stage, 2= 2nd stage and 3=3th stage of lactation); $(MP)_{ij}$ = the fixed effect of the interaction between drying method and parity number; $(MS)_{ik}$ = the fixed effect of the interaction between drying method and stage of lactation; $(PS)_{jk}$ = the fixed effect of the interaction between parity number and stage of lactation; $(MPS)_{ijk}$ = the fixed effect of the interaction among drying method, parity number and stage of lactation; e_{ijk} = random error associated with the individual observation and assumed to be (N, IND) and $(0, \sigma^2_e)$.

Tests of significance for differences between means were carried out according to Duncan (1955).

Estimating the curve parameters of milk yield:

In this work, the shape of the milk curve of Holstein cows was studied using the gamma type function (Wood, 1967) which was described as sufficiently good for modeling extended lactations (Abdel-Salam *et al.,* 2011). The following gamma-type function was used for describing the lactation curve of all parameters:

$$Y_n = a n^b e^{-cn}$$

Where: Y_n is the daily milk yield (kg) in the nth day of lactation, **a** is the initial yield, **b** describing the rate of milk yield increase up to the peak during the ascending phase, **c** describes the rate of milk yield decrease during the descending phase and **e** is the base of natural logarithms. The constants **a, b** and **c** were calculated by using a general linear model (GLM) procedure of SAS software (SAS, 2004).

RESULTS AND DISCUSSION

Milk production of cows:
Drying off methods effect on milk production:

Cows dried by incomplete milking method had a higher daily and total milk yield (10889.85 kg) than that dried by irregular (10187.45 kg) or sudden stop (9786.01 kg) milking methods as shown in Table (2) and Figure (1). The differences between means of experimental cow's milk yield, due to drying methods effect, were not significant except at daily milk yield at 2nd month of lactation (P<0.05). In this respect, Wayne *et al.* (1933) using three methods of drying off Holstein cows, found that complete cessation of milking can safely be recommended as a method for drying off cows producing at least up to 8.8 kg daily; cows can be dried off in less time by this method than by either of the other two methods considered and they did not record any significant difference in the quantity of milk in the lactations following the drying up of cows by the three methods used (incomplete milking, intermittent milking and complete cessation). Zadeh and Mohit (2013) found that Holstein cows that had the lowest dry period (0-10days) produced the lowest milk yield (5472.4 kg/305 days), however, cows that had the medium dry period (51-70 days) produced the highest milk yield (7518.9 kg/305 days), while, cows had the highest dry period (71>130 days) produced the medium milk yield (6846.4 kg/305 days) with significant differences (P<0.05). Van Knegsel *et al.* (2014) showed that in Holstein-Friesian cow; milk yield was 13.8 , 7.7 and 0.1 kg/days, for dry period 0, 30 and60 days, respectively; the study indicated that a reduced dry period (30 or 0 days), compared with a conventional dry period of 60 days, reduced the production of milk (P<0.05). Useni *et al.* (2014) found that dry period less than 60 days reduced milk yield, while an extended dry period (more than 121 days) may result in over conditioned dry cows and therefore be costly to the dairy farmer even although milk yield is higher in the next lactation.

Regression coefficients of the equation of Wood lactation curve showed that different drying off methods had a different (P < 0.05) a, b and c parameters (Table 3). Incomplete, followed by irregular and then sudden stop milking begin lactation season with higher (P< 0.05) milk production (Figure 1). However, incomplete milking obtained a higher (P < 0.05) rate of increased milk production with less persistence of milk yield and

more c value compared to both of irregular and sudden stop milking, which almost had the same b and c values.

Table 2. Least-squares means and standard errors of experimental cow's average daily and total milk yield during 10 months of lactation

Classification	N	ADMY1	ADMY2	ADMY3	ADMY4	ADMY5	ADMY6	ADMY7	ADMY8	ADMY9	ADMY10	TMY
Drying off methods												
Sudden stop milking	9	26.58± 1.76	32.18[ab]± 1.39	33.86± 1.78	32.34± 1.41	31.14± 1.88	29.39± 2.10	30.10± 2.50	30.39± 2.40	28.71± 2.25	29.42± 2.16	9786.01±518.06
Irregular milking	9	24.50± 1.78	29.28[b]± 1.41	32.92± 1.80	32.58± 1.43	33.33± 1.91	33.98± 2.13	33.40± 2.54	32.88± 2.43	30.05± 2.29	28.12± 2.19	10187.45±525.52
Incomplete milking	9	27.18± 1.62	34.97[a]± 1.28	35.51± 1.63	35.82± 1.30	35.22± 1.73	34.20± 1.94	34.18± 2.30	31.47± 2.21	29.20± 2.07	28.28± 1.99	10889.85±476.73
Parity number:												
Second	9	21.66± 4.83	33.57±3.82	29.88± 4.89	28.65± 3.89	26.28± 5.17	26.56± 5.79	27.45± 6.88	26.90± 6.60	27.64± 6.20	28.83± 5.94	8336.90±1423.11
Third	9	27.30± 2.07	33.38±1.63	35.21± 2.09	33.41± 1.66	32.28± 2.22	32.03± 2.48	32.39± 2.95	30.82± 2.83	29.40± 2.66	30.20± 2.55	9725.25±610.77
Fourth or more	9	29.31± 6.13	29.47±4.84	37.21± 6.20	38.68± 4.93	41.11± 6.56	38.98± 7.34	37.84± 8.72	37.02± 8.36	30.92± 7.86	26.79± 7.53	12801.16±1804.52

[a, b] Means within any classification, followed by different letters are significantly different (p<0.05).
ADMY1-10= Average daily milk yield from 1st to 10th month of lactation.
TMY= Total milk yield during 10 months of lactation.
N= number of experimental cows

Table 3. Regression coefficient of the equation of wood lactation curve by drying off methods and parity number

Item	a (kg)	b	c
Drying off methods:			
Sudden stop milking	23.36[b]	0.02	-0.02
Irregular milking	27.54[a]	0.41	-0.11
Incomplete milking	27.55[a]	0.58	-0.07
Parity number:			
Second	24.45[b]	0.28	-0.12
Third	25.46[b]	0.32	-0.18
Fourth or more	28.47[a]	0.41	-0.13

Means within a column with different letters differ (P<0.05); *a* is the associated parameters with the initial milk production; *b* is the associated parameter with the rise in milk production to peak lactation; *c* is the associated parameter with the decrease
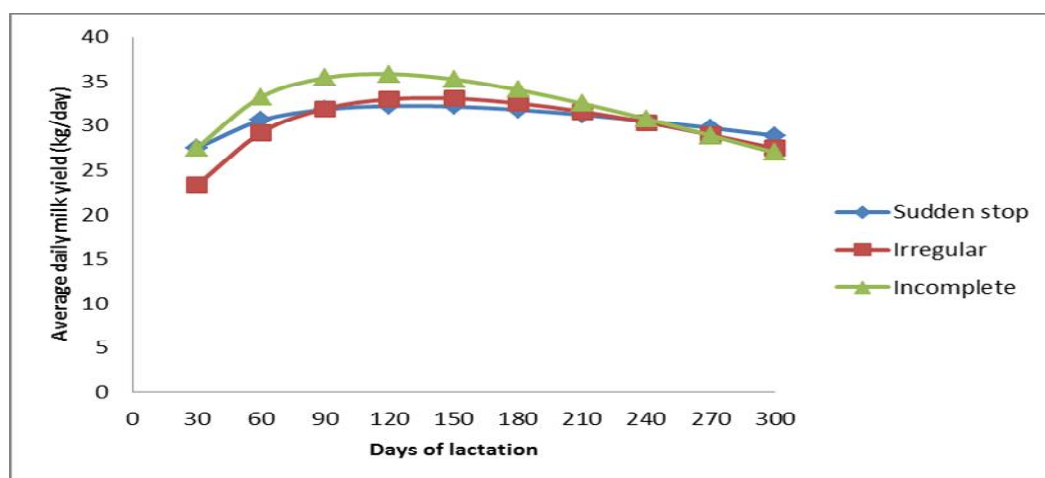in milk production from peak to the end of lactation.

Figure 1. Drying off methods effect on average daily milk production during 300 days of lactation.

Parity number effect on milk production:

It could be seen in Table 2 that fourth or more parity cows showed the highest milk production level (12801.16 Kg) than other parities. The differences between means of cow's milk yield (kg), due to parity effect, were non-significant. These results agree with those of Watter *et al.* (2008) who found that daily milk yield was 42.3 and 44.8 kg, for Holstein cows at second and third or more parity, respectively, the same authors reported that differences between means of daily milk yield due to parity effect were not significant. Also, Santschi *et al.* (2011) reported that total milk yield of Holstein cows was 8580 and 10495 kg, for cows at first and second or more parity, respectively, and the differences between means of

total milk production due to parity effect were not significant. Mellado *et al.* (2014) using Holstein cows, reported that there were no differences between means of total milk yield due to parity number effect at first and second lactation (12707 versus 12306 kg).

Parity number had affected ($P< 0.05$) each of a, b and c. Cows with higher parity number had higher a, b and c values than those with lower parity number. However, lactating cows with second parity have a lower initial production and rate of increase, than other parities (Table 3 and Figure 2). These results are in agreement with the finding of Yilmaz *et al.*, (2011).
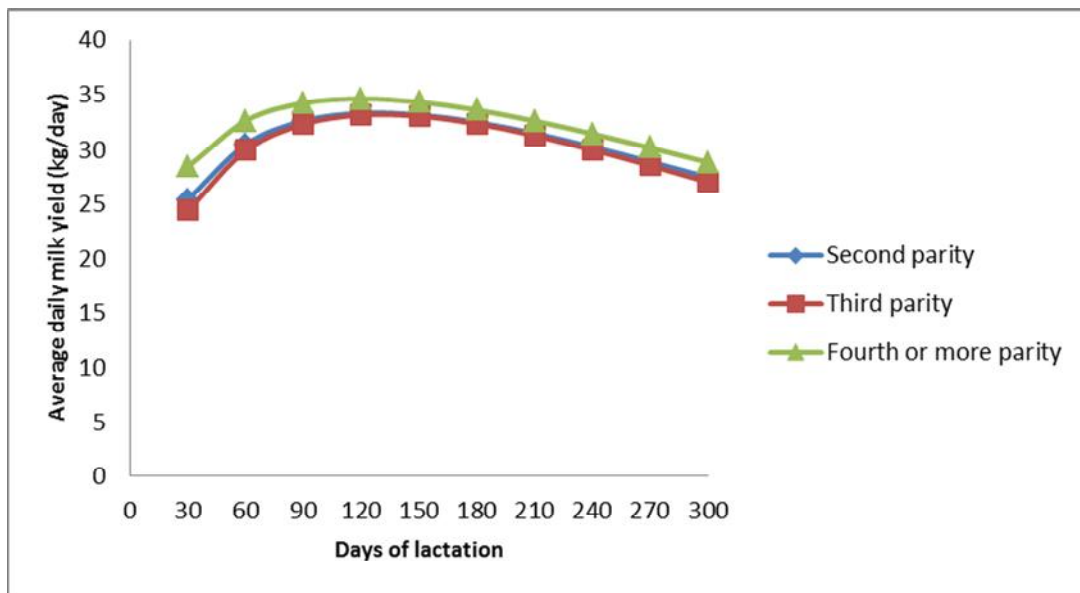

Figure 2. Parity number effect on average daily milk production during 300 days of lactation

The differences among means of experimental cow's average daily and total milk yield, due to the interaction between drying off methods and parity, were not significant.

Significance of linear regression of milk yield on studied factors:

The linear regression coefficients of experimental cow's milk yield on each of dry period length, cow's weight at dry period, cow's weight at calving and cow's weight after 50 days of lactation were not significant except for regression coefficient of daily milk yield at fourth month of lactation on cows weight at calving ($P<0.05$) and regression coefficients of daily milk yield at the third, fourth and fifth month of lactation on cows weight after 50 days of lactation ($P<0.05$ and $P<0.01$).

Milk composition of cows:
  Drying off methods effect on milk composition:
Cows that were dried off by the incomplete milking method had the highest milk composition of total solids, fat, solids not fat, protein and lactose% than other drying off methods (irregular milking and

sudden stop milking methods, respectively) as shown in Table (4) and Figure (3). The differences between means of cow's milk composition, due to drying off methods effect, were highly significant ($P<0.001$) for all milk composition except for ash percentage.

Results obtained in the current study agree with those of Weglarzy (2009) who estimated that Holstein cow's milk fat percentage was 4.14, 4.20, 3.78 and 4.06%, milk protein percent was 3.26, 3.28, 3.20 and 3.20%, for cows with <30, 31-60, 61-90 and >90 days dry period, respectively. The same author stated that differences in milk protein production between groups were statistically significant ($P<0.01$) and fat production in group <30 days dry period was lower by 6.06%, in group >90 days dry period lower by 5.37% in group 31-60 days dry period lower by 1.01%, protein production in group<30 days dry period was lower by 14.12%, while, in group >90 days dry period and 31-60 days dry period lower by 12.84 and 9.78%, respectively TOO LONG. Also, Pytlewski *et al.* (2009) found that the length of the dry period has a highly significant effect on yields of fat and protein content in Polish Holstein Friesian and Jersey cows. In addition, Santschi *et al.* (2011)

reported that milk composition of Holstein cows was : fat percentage 3.86 and 3.92%; protein percentage 3.31 and 3.40%; lactose percentage 4.56 and 4.54%, in cows at conventional dry period 60 days and short dry period 35 days, respectively. The same authors stated that there were no differences between means of milk composition due to dry period length, except for the protein percent (P<0.001). On the other hand, Wayne *et al.* (1933) did not record any significant difference in the quality of milk in the lactations following the drying up of cows by the three methods used (incomplete milking, intermittent milking and complete cessation).

Table 4. Least-squares means and standard errors for cow's milk composition

Classification	N	Total solids%	Fat%	Solids not fat%	Protein%	Lactose%	Ash%
Drying off methods:							
Sudden stop milking	54	11.73[c]±0.076	3.25[c]±0.034	8.48[c]±0.046	3.09[b]±0.031	4.58[b]±0.025	0.800±0.01
Irregular milking	54	12.08[b]±0.076	3.37[b]±0.034	8.70[b]±0.046	3.16[b]±0.031	4.74[a]±0.025	0.806±0.01
Incomplete milking	54	12.51[a]±0.076	3.57[a]±0.034	8.94[a]±0.046	3.29[a]±0.031	4.80[a]±0.025	0.831±0.01
Parity number:							
Second	54	11.70[c]±0.076	3.22[c]±0.034	8.47[c]±0.046	2.97[c]±0.031	4.69±0.025	0.801±0.01
Third	54	12.16[b]±0.076	3.42[b]±0.034	8.74[b]±0.046	3.20[b]±0.031	4.73±0.025	0.798±0.01
Fourth or more	54	12.47[a]±0.076	3.55[a]±0.034	8.92[a]±0.046	3.37[a]±0.031	4.71±0.025	0.837±0.01
Stage of lactation:							
First	54	11.56[c]±0.08	3.19[c]±0.04	8.36[c]±0.05	3.05[c]±0.05	4.56[c]±0.02	0.73[c]±0.01
Second	54	12.26[b]±0.08	3.45[b]±0.04	8.88[b]±0.05	3.21[b]±0.05	4.75[b]±0.02	0.82[b]±0.01
Third	54	12.55[a]±0.09	3.56[a]±0.04	9.98[a]±0.05	3.28[a]±0.05	4.81[a]±0.02	0.87[a]±0.01

[a, b, c] Means within any classification, followed by different letters are significantly different (p<0.05).
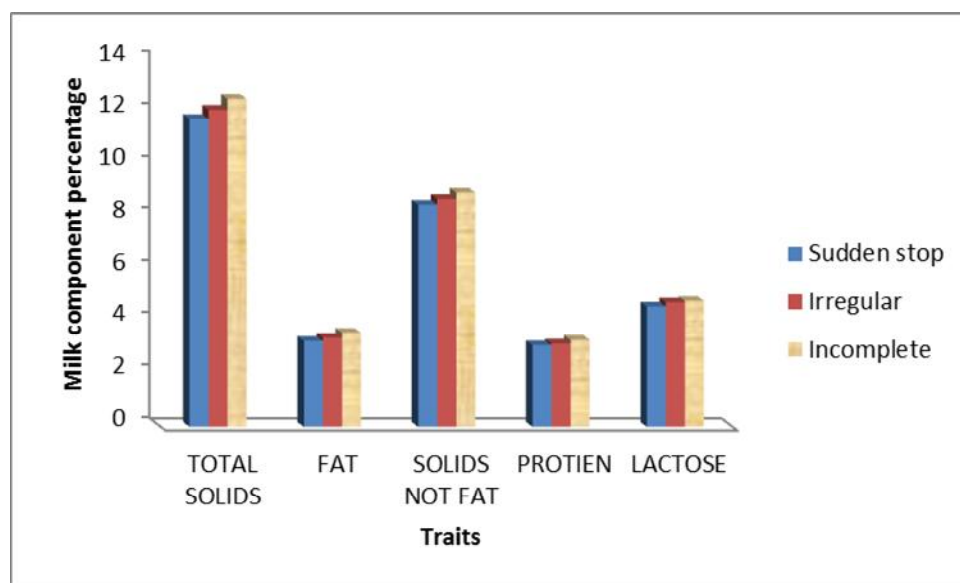N= number of milk samples.

Figure 3. Effect of drying off method on milk composition

Parity number effect on milk composition:
Fourth or more parity cows had higher milk composition of total solids, fat, solids not fat and protein% compared with the second and third parties, respectively as shows in Table (4) and Figure (4). The differences between means of milk composition, due to the parity effect, were highly significant (P<0.001) for studied milk composition except for lactose and ash percentages.

The present results disagree with the finding of Santschi *et al.* (2011) who showed that Holstein cow's milk fat was 3.86 and 3.88%; protein was 3.31 and 3.31%; lactose was 4.56 and 4.45%, for cows at second and third or more parity, respectively. The same authors reported that no significant differences between means of milk component, due to the parity number of cows and Steeneveld *et al.* (2014) who found that no significant differences between means of milk composition (fat and protein%) due to parity of Holstein cows. Also, Van Knegsel *et al.* (2014) noticed that Holstein Friesian cow's milk protein and fat percentage doesn't affect by the parity number of cows except for lactose percentage (P<0.05).

Cows at third stage of lactation (last 100 days of lactation) had higher values of milk composition (total solids, fat, solids not fat, protein, lactose and ash%) than cows at other stages of lactation (first 200 days of lactation) as shown in Table (4) and Figure (5). The differences between means of milk composition, due to stage of lactation effect, were

highly significant (P<0.001). Similar results recorded by Soleimani *et al.* (2010) who found that Holstein cow's milk proteins, lactose and solids not fat% were affected by the week of lactation (P<0.001) but, milk fat% wasn't affected by the week of lactation and Steeneveld *et al.* (2014) who recorded that stage of lactation affected fat and protein% of Dutch dairy cows milk (P<0.05). On the contrary, Safa *et al.* (2013) observed that Holstein cow's milk protein, lactose and solids not fat % weren't affected by the week of lactation while, milk fat% affected by the week of lactation (P=0.0002).
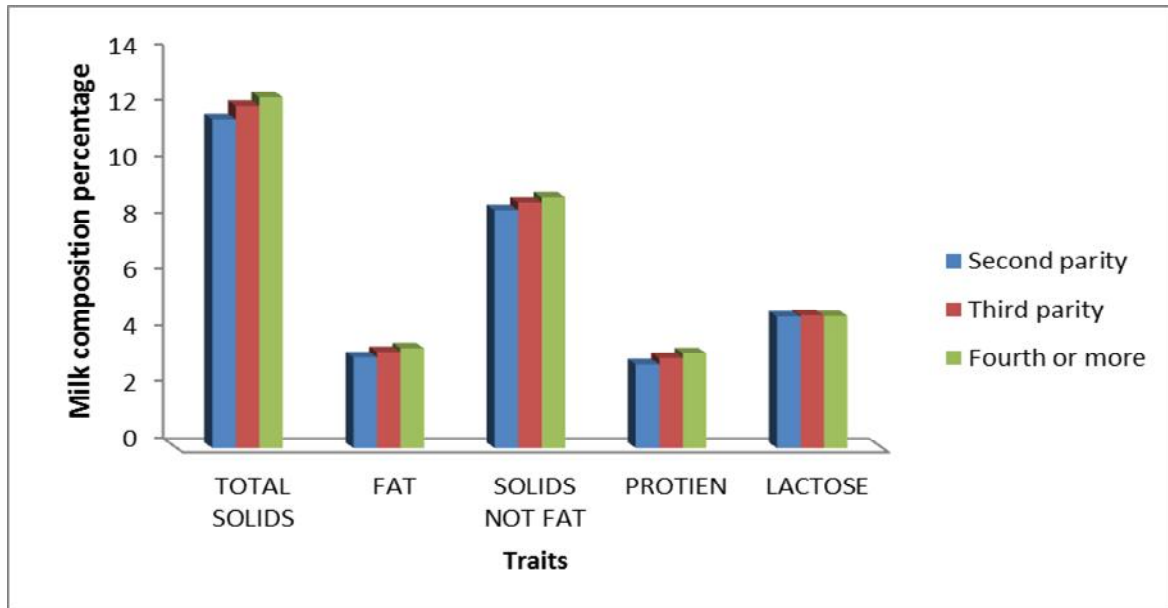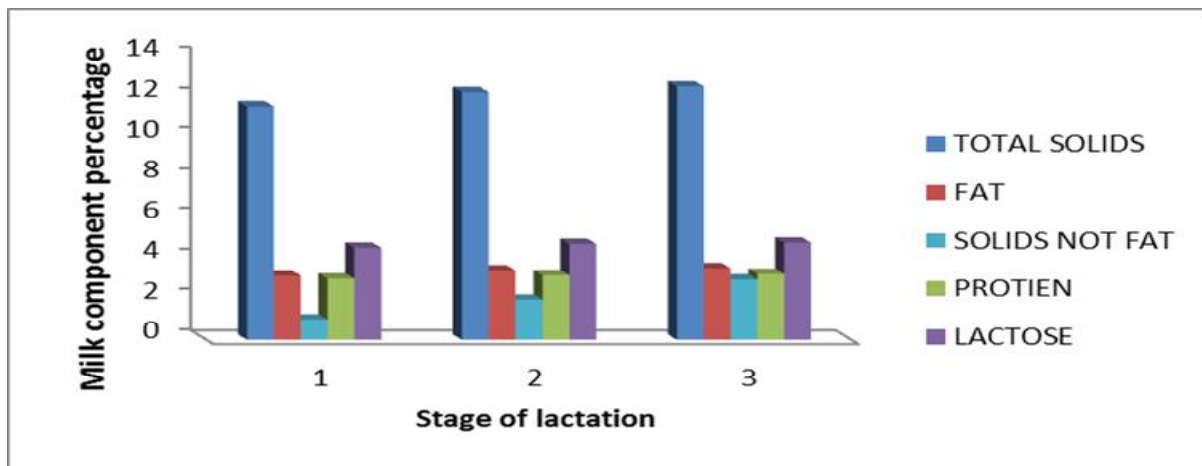

Figure 4. Effect of parity on milk composition(%)

Figure 5. Effect of stage of lactation on milk composition (%)

Stage of lactation effect on milk composition:

The differences among means of milk composition, due to the interaction among drying off methods, parity and stage of lactation, were not significant.

Blood plasma parameters of cows:
Drying off methods effect on blood plasma parameters:

Means of cow's blood plasma parameters (total protein, albumin, globulin, A/G ratio, triglyceride, total cholesterol, calcium, Potassium and magnesium) were almost the same value. The differences between means of blood plasma parameters, due to drying off methods effect, were

not significant as presented in Table 5 and Figure 6. Results obtained almost agree with those of Andersen *et al.* (2005) who showed that there were no overall effects of treatments (dry period of 60 days versus continuous lactation) on the blood plasma level of calcium (P=0.44). Also, Yamashina *et al.* (2012) observed that Holstein cow's blood plasma total protein and calcium were not affected by cows dry period length; total protein was 8.02 and 7.72 g/dl; calcium was 9.5 and 9.5 mg/dl, for cows dried at short (40 days) and traditional (60 days) length, respectively.

Table 5. Least-squares means and standard errors (LSM±SE) of cows blood plasma parameters

Classification	N	Total Protein	Albumin	Globulin	A/G ratio	Triglyceride	Cholesterol	Calcium	Potassium	Magnesium
Drying off methods:										
Sudden stop milking	54	66.02± 0.299	31.80± 0.159	34.22± 0.146	0.929± 0.001	28.70± 0.127	157.88± 1.85	8.83± 0.033	5.84± 0.035	2.47± 0.032
Irregular milking	54	66.38± 0.299	31.93± 0.159	34.43± 0.146	0.927± 0.001	28.80± 0.127	154.51± 1.85	8.83± 0.033	5.80± 0.035	2.50± 0.032
Incomplete milking	54	66.30± 0.299	31.94± 0.159	34.39± 0.146	0.928± 0.001	28.67± 0.127	158.25± 1.85	8.89± 0.033	5.83± 0.035	2.57± 0.032
Parity number:										
Second	54	65.75± 0.299	31.63± 0.159	34.12± 0.146	0.926± 0.001	28.52± 0.127	152.59[b]± 1.85	8.82± 0.033	5.75[b]± 0.035	2.42[b]± 0.032
Third	54	66.48± 0.299	32.02± 0.159	34.47± 0.146	0.928± 0.001	28.87± 0.127	157.37[ab]± 1.85	8.85± 0.033	5.83[ab]± 0.035	2.53[a]± 0.032
Fourth or more	54	66.46± 0.299	32.03± 0.159	34.45± 0.146	0.929± 0.001	28.78± 0.127	160.68[a]± 1.85	8.88± 0.033	5.88[a]± 0.035	2.59[a]± 0.032
Stage of lactation:										
First	54	65.59[c]± 0.41	31.62[c]± 0.22	33.96[c]± 0.19	0.93± 0.002	28.54± 0.17	157.98± 2.64	8.86± 0.047	5.85± 0.051	2.49± 0.046
Second	54	66.04[b]± 0.41	31.73[b]± .22	34.29[b]± 0.19	0.92± 0.002	28.88± 0.17	155.87± 2.64	8.87± 0.047	5.84± 0.051	2.50± 0.046
Third	54	67.13[a]± 0.42	32.35[c]± 0.22	34.81[a]± 0.20	0.93± 0.002	28.78± 0.18	156.40± 2.74	8.80± 0.049	5.76± 0.053	2.51± 0.048

[a, b, c] Means within any classification, followed by different letters are significantly different (p<0.05).

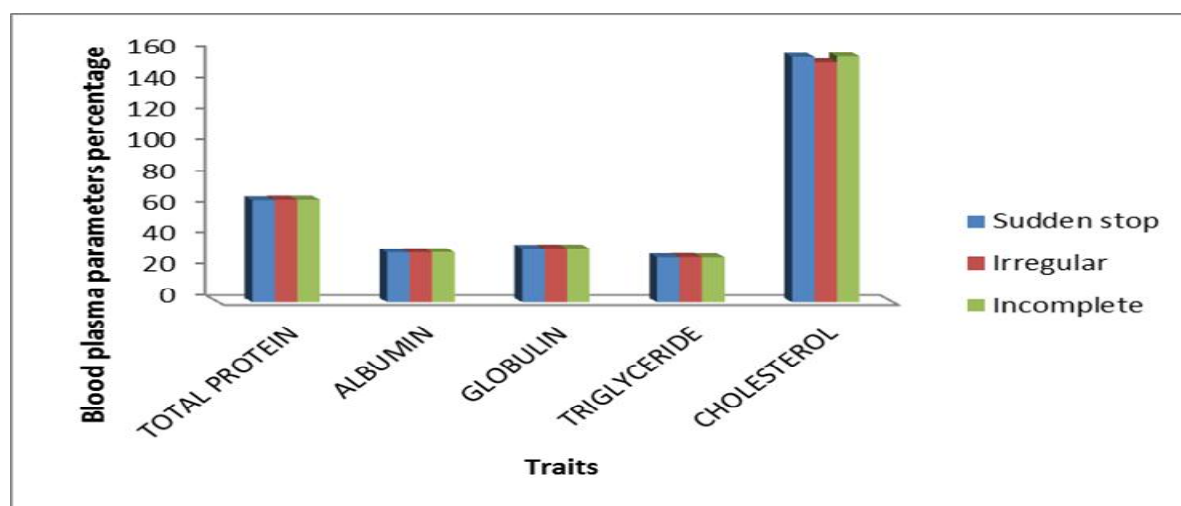N= number of blood samples

Figure 6. Effect of drying off methods on blood plasma parameters

Effect of parity on blood plasma parameters:

Fourth or more parity cows had the highest means of cholesterol, potassium and magnesium in cows blood plasma while, second parity cows had the lowest means of cholesterol, potassium and magnesium in cows blood plasma. There were no differences between means of blood plasma parameters (total protein, globulin, albumin, A/G ratio, triglyceride and albumin), due to parity effect except for cholesterol, potassium and magnesium means which were significant (P<0.01) as showed in Table 5 and Figure 7. The opposite results were obtained by, Cozzi *et al*. (2011) who found that serum total protein and globulin of Holstein dairy cows were 80 and 43 g/L, for first parity cows, while it were 83 and 45 g/L, for second or more parity cows, respectively; there was no significant effect of parity on blood serum total protein and globulin of cows. On the contrary, Brscic *et al*. (2015) using Holstein cows, found that blood serum total protein and globulins were 77.1 and 40.9 g/L, for first parity cows, while, it was 81.3 and 44.3 g/L, for first and second or more parity cows, respectively, and differences between means of cows blood serum total protein and globulins due to parity effect were significant (P<0.05).
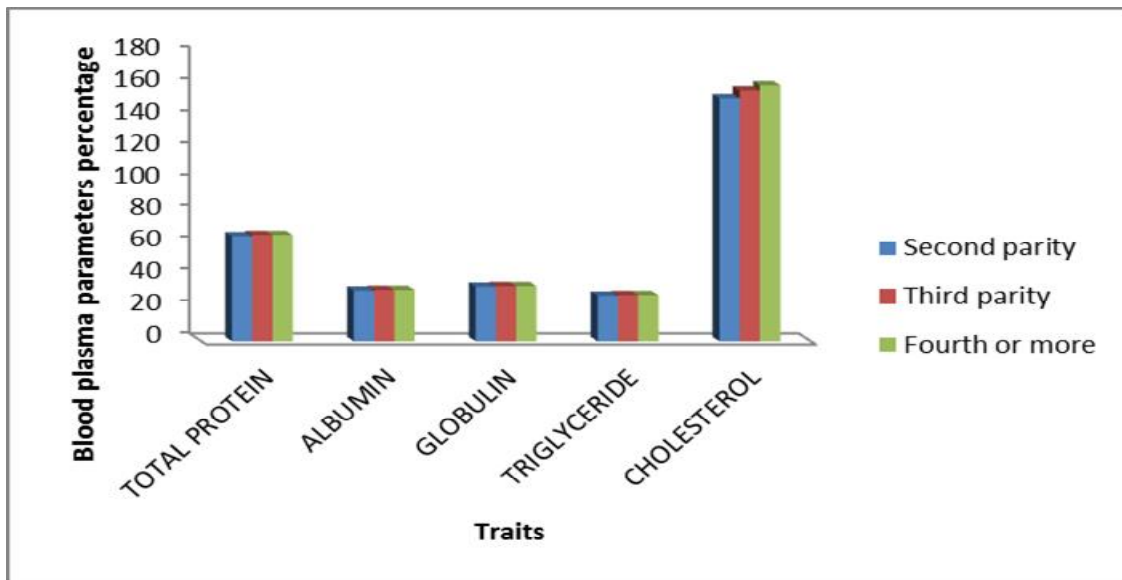
Figure 7. Effect of parity on some blood plasma parameters

Stage of lactation effect on blood plasma parameters:

Cows in the last lactation stage (last 100 days of lactation) had higher values of cow's blood plasma protein, globulin and albumin than cows in other lactation stages and cows in the first lactation stage (first 100 days of lactation) had the lower values as shown in Table 5 and Figure 8. The differences between means of blood plasma total protein, globulin and albumin, due to stage of lactation effect, were significant ($P<0.05$ and $P<0.01$) but, for other cows blood plasma parameters were not significant. Similar results obtained by Cozzi *et al*. (2011) who recorded that blood serum cholesterol of Holstein dairy cows was 4.9 and 5.9 mmol/L, for cows at early and medium stage of lactation, respectively; there were no differences between means of cows blood serum cholesterol due to stage of lactation effect and Brscic *et al*. (2015) using Holstein cows, stated that blood serum total protein was 77.7, 78.4 and 74.8g/L; globulin was 41.1, 42.0 and 38.7g/L, for cows at 10-20, 21-40 and 41-60 days of lactation, respectively, differences between means of cows blood serum total protein and globulin due lactation stage effect were significant ($P<0.05$). Also, Yamashina *et al*. (2012) indicated that blood plasma total protein and albumin of Holstein cows were affected by stage of lactation postpartum ($P<0.01$), total protein was 7.59, 8.25 and 8.81 g/dl, albumin was 3.47, 3.64 and 3.79 g/dl, for cows at 1, 3 and 10 weeks postpartum, respectively.
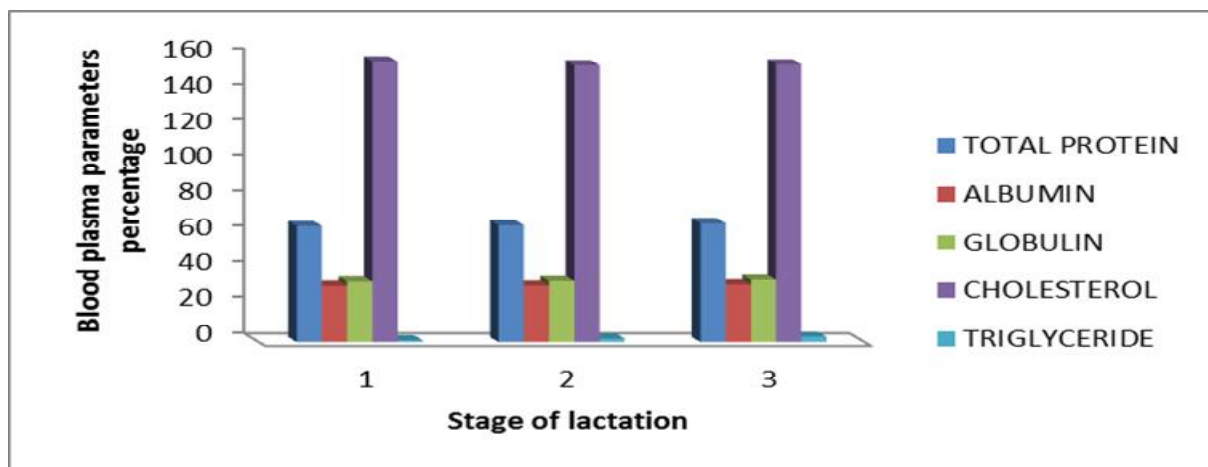

Figure 8. Effect of stage of lactation on some blood plasma parameters.

The differences among means of blood plasma parameters, due to the interaction among drying off methods, parity and stage of lactation, were not significant.

CONCLUSION

As a conclusion, incomplete, irregular and sudden stop milking can safely be recommended as a method for drying off cows producing at least up to 20, 11-20 and >10 kg daily, respectively without negative results in quantity and quality of milk as well as blood plasma parameters.

RECOMMENDATIONS

It could be recommend that using sudden stop method for low lactating cows (less than 10 kg milk/day) and irregular and incomplete methods for both medium and high lactating cows (11-20 kg and more than 20 kg milk/day, respectively).

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تأثير طرق التجفيف وترتيب الولادة ومرحلة الإدرار على انتاج اللبن ومكوناته وبعض تقديرات بلازما الدم فى أبقار الهولشتاين فريزيان

رجب عبد الحميد على أبو صالح ، أحمد سليمان محمود سليمان ، محمود رياض المهدى ، تامر مسعد محمد حسن

قسم الانتاج الحيوانى، كلية الزراعة بمشتهر، جامعة بنها، جمهورية مصر العربية

الهدف من الدراسة بحث تأثير طرق التجفيف وترتيب الولادة ومرحلة الادرار على انتاج اللبن ومكوناته وبعض تقديرات بلازما الدم للأبقار باستخدام عدد ٢٧ بقرة هولشتاين فريزيان مقسمة الى ثلاثة مجموعات (كل مجموعة تحتوى على ٩ أبقار)، تم تجفيف المجموعة الاولى بطريقة الايقاف المفاجىء للحلب ، المجموعة الثانية بطريقة الحلب الغير منتظم ، المجموعة الثالثة بطريقة الحلب الغير كامل وكانت الابقار فى كل مجموعة تحتوى على ترتيب ولادات مختلفة. تم تقدير انتاج اللبن خلال موسم الادرار التالى قسمت على ١٠ أشهر تم تقدير خلالها الانتاج اليومى والكلى وأخذت عينات من اللبن والدم من كل ابقار التجربة كل ١٠٠ يوم لتحليل مكونات اللبن وبعض تقديرات بلازما الدم. أعطت الابقار التى تم تجفيفها بطريقة الحلب الغير كامل انتاج لبن يومى وكلى أعلى من التى تم تجفيفها بالطرق الأخرى. كانت الاختلافات بين متوسطات انتاج اللبن وبعض تقديرات بلازما الدم للأبقار التى ترجع لتأثير طريقة التجفيف غير معنوية فيما عدا انتاج اللبن اليومى خلال الشهر الثانى من الادرار عند مستوى ٠.٠٥ بينما الاختلافات بين متوسطات مكونات اللبن للأبقار والتى ترجع لتأثير طريقة التجفيف عالية المعنوية عند مستوى ٠.٠٠١ لكل مكونات اللبن ماعدا نسبة الرماد. طريقة تجفيف الأبقار لم تؤثر معنويا على أى من تقديرات الدم. الابقار التى تلد الولادة الثانية كانت تعطى مكونات لبن (ماعدا اللاكتوز والرماد) وكذلك تقديرات الدم (الكوليسترول والبوتاسيوم والماغنسيوم) أعلى عن باقى الابقار الأخرى. الأبقار فى المرحلة المتأخرة من الادرار (أخر ١٠٠ يوم) كانت تعطى مكونات لبن وبروتينات الدم أعلى من الأبقار فى مراحل الأدرار الأخرى. نستنتج من ذلك ان هذه الدراسة ساهمت فى تغيير طرق التجفيف الخاطئه ومنعت خساره اقتصاديه وماديه فى احدى مزارع الالبان الكبرى بجمهورية مصر العربيه بمنطقة الدلتا وكذلك تقليل عملية الفرز الصحى للأبقار. نوصى مزارع الألبان بتطبيق طرق ألتجفيف الثلاثه :طريقة التجفيف الفجائى للأبقار المنخفضه فى الانتاج (أقل من ١٠ كجم لبن/يوم) وطريقة الحلب الغير منتظم للأبقار المتوسطه فى الانتاج (من ١١- ٢٠ كجم لبن) وطريقة الحلب الغير كامل للأبقار العاليه فى الانتاج (الاكثر من ٢٠ كجم لبن).

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