

# Influences of Prefresh and Early Fresh Body Condition Score Changes on Some Holstein Dairy Performance Traits

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## Abstract

*This study was performed to investigate the effect of body condition change from the prefresh to early fresh periods on the subsequent milk production performance in Holstein dairy cows. For this purpose, 89 Holstein cows in a private high yielding dairy enterprise (average milk yield 8000 kg/season) were included in this study. Body condition score (BCS) was evaluated at the prefresh period (260–270 day) post last insemination, as well as one month postpartum. Evaluations of BCS were performed via, two evaluators on a scale of 1–5 points and the average BCS value for each cow was detected. BCS loss was estimated via, subtract of postpartum BCS value from the prefresh one. Data of the daily, initial, 305-day, and actual milk yield were collected and recorded. The results of this study revealed that, fatty cows during their prefresh phase (BCS 4.5–5.0 points) had high dairy performance, as these cows depicted the highest values of daily milk yield (37.58 kg), initial milk yield (43.38 kg), 305-day milk yield (11461.00 kg) and actual milk yield (12229.38 kg). Moreover, the cows with a postpartum BCS of 3.5–4.0 points recorded the highest significant daily milk yield (37.93 kg), 305-day milk yield (11566.67 kg), initial milk yield (49.00 kg) and actual milk yield (14945.00 kg). The cow losing from (–0.5)–(–1.0) point BCS has the highest significant daily and 305-day milk yield. In conclusion, BCS significantly influenced the milk performance traits of Holstein cows both at prefresh and postpartum period. For higher performance, the cows should be with somewhat heavy BCS at prefresh and with medium BCS postpartum. The dairy Holstein cows could loss about 0.5–0.75 BCS unit during their early fresh phase with efficient milk production. Further research is needed to prove this presumption.*

**Keywords:** *body condition score, Holstein, prefresh, postpartum, milk yield*

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## INTRODUCTION

Body condition score (BCS) is an easy, inexpensive, and subjective method to evaluate the body tissue reserves of lactating cows, independent of frame size and body weight (BW). During early fresh period, mobilization of body reserve for milk production becomes greater which induces the negative energy balance. It was proved that the negative energy balance has great impacts on dairy cattle performance [1].

The insufficient and unbalanced nutrition have the ability to bring the cow in severe negative

energy balance which has a negative impact on reproduction [2–4] and health [5, 6]. Depending on feed records, determining such energy in the field conditions is difficult. BCS is an evaluation tool of the amount of fat reserve on the body mobilized during the early period of lactation and replenished in the middle or at the end of lactation.

BCS helps to formulate effective feeding programs that cover all the nutritional requirements of dairy cattle [7]. Anonymous reported that BCS is commonly used to develop a sound feeding program in dairy

cattle enterprises due to its robust and quicker result and easy applicability [8]. Some previous publications have studied the effects of BCS during the calving, dry period and different periods of lactation on milk yield [9–11], and milk components [12]; however, others reported that BCS had no effect on the yield and health performances [3, 13, 14].

Certain complications such as decreased milk yield, high incidence of metabolic diseases, delayed postpartum estrus of emaciated cows, may take place due to lack of usable reserves in the early period of lactation. Furthermore, difficult birth, high incidence of metabolic diseases and reduction in milk yield of over-conditioned cows could occur due to a reluctance to consume dry food [15–17]. To avoid such complications of emaciation or obesity, the cows should have a BCS of at least 3.5 out of 5 at calving period [2]. Our concurrent work investigated the impact of BCS changes during prefresh and fresh stages on Holstein cows performance to detect how many BCS unites could be lost during early fresh period without any effect upon their dairy performance?

## MATERIALS & METHOD

This study was conducted in a private high yielding Holstein dairy enterprise (average milk yield 8000 kg /season). The dairy farm was located 80 Km away from Cairo in Giza province, Egypt. The trial was conducted from December 2013 to June 2014 with 89 Holstein cows. The dairy Holstein females were well managed according to the standards of Holstein breed. The Holstein cows were artificially inseminated using the same bull semen. Dairy cow BCS were evaluated during 260–270 day post last insemination, as well as 30 days postpartum. BCS evaluations were performed via, two evaluators on a scale of 1–5 points, where the cows were award a condition score on the scale 1 (very poor) to 5 (grossly fat) according to Ferguson *et al.* [16].

Average condition score scale was calculated as mean value between the two different evaluators. Cattle were managed not to increase nor decrease their BCS till parturition. BCS was evaluated twice, as the first time was done at prefresh stage (260–270 day of last insemination), while the second time at one

month postpartum (early fresh stage). BCS loss was estimated via, subtraction of postpartum BCS value from the prefresh one. As complete scoring of dairy cows was done, the cows were grouped into six main BCS groups according to their BCS value. The prefresh BCS groups were 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, and 6<sup>th</sup> for BCS values of >2.5, 2.5–3.0, 3.0–3.5, 3.5–4.0, 4.0–4.5, 4.5–5.0, respectively. Dairy cows with BCS value below 2.5 were culled as a part of farm culling policy. BCS was recorded again at 30-day postpartum in order to detect its effect on milk production. Also, dairy cows were grouped into five groups according to their postpartum BCS value, as 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> for the BCS value of >2.5, 2.5–3.0, 3.0–3.5, 3.5–4.0, 4.0–4.5, respectively.

Cows were again regrouped at postpartum into five groups according to the rate of BCS point loss on the same scale defined before, as 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> for the rate of decrease of BCS points of <(-0.25), (-0.25)–(-0.50), (-0.50)–(-0.75), (-0.75)–(-1.0), and gained (+0.25) points, respectively to determine its effect on milk production performance. The daily, 305-day, actual, and initial milk yield were recorded for the dairy Holstein females, so as to determine the effect of prepartum, postpartum and postpartum BCS loss on the dairy performance of high yielding Holstein cows.

## Statistical Analysis

Data were analyzed using SAS statistical analysis system package SAS (2008). One way ANOVA was performed using the following model:

$$Y_{ij} = \mu + B_i + e_{ij}$$

Where,  $Y_{ij}$  = any observed value;  $\mu$  = overall mean;  $B_i$  = the fixed effect of BCS;  $e_{ij}$  = random deviation due to unexplained source. Differences among means were compared statistically using Duncan's multiple range tests [18].

## RESULTS

### Effect of Prepartum BCS on Holstein Cows Dairy Performance

Concerning to the effect of prepartum BCS on Holstein cows dairy performance (Table 1), it was clearly indicated that dairy Holstein performance possessed significant differences

among different prepartum BCS groups, as cows with BCS of (4.5–5.0 points) sustained the highest values of daily milk yield (37.58 kg), initial milk yield (43.38 kg), 305-day milk yield (11461.00 kg), and actual milk yield (12229.38 kg). However, the lowest values of daily and 305-day milk yield were recorded for cows with BCS of (2.5–<3.0 points), and those with BCS of (<2.5 points), for initial milk yield and actual milk yield. Indeed, cows with BCS ranging from 3.0 to <4.5 points

showed a somewhat similar performance for daily and 305-day milk yield. Cows with BCS of (3.0–<3.5 points) have higher significant daily and 305-day milk yield as compared to those with BCS of (<2.5 points) and (2.5–<3.0 points); however, higher significant actual milk yield and initial milk yield were recorded when compared with those of BCS ranging from (<2.5–<3.0) and those with BCS of (3.5–<4.0).

**Table 1: Effect of Prepartum BCS on Holstein Cows Dairy Performance.**

Prepartum BCS groups	BCS points	N	%	Milk production traits			
				Daily milk yield	Initial milk yield	305-day milk yield	Actual milk yield
				Mean ± Se	Mean ± Se	Mean ± Se	Mean ± Se
1	<2.5	5	5.61	26.15±3.78 <sup>cd</sup>	20.80±4.41 <sup>e</sup>	7976.00±153.71 <sup>cd</sup>	6344.00±344.77 <sup>e</sup>
2	2.5–<3.0	13	14.60	25.33±0.73 <sup>d</sup>	22.31±1.31 <sup>de</sup>	7721.54±221.54 <sup>d</sup>	6803.85±398.85 <sup>de</sup>
3	3.0–<3.5	42	47.19	31.25±0.53 <sup>bc</sup>	37.74±0.89 <sup>ab</sup>	9531.28±161.94 <sup>bc</sup>	11511.79±270.01 <sup>ab</sup>
4	3.5–<4.0	18	20.22	30.70±1.41 <sup>bc</sup>	27.94±2.25 <sup>cde</sup>	9364.44±330.11 <sup>bcd</sup>	8523.06±386.21 <sup>cde</sup>
5	4.0–<4.5	6	6.74	33.07±2.97 <sup>ab</sup>	35.00±2.65 <sup>abc</sup>	10086.67±306.83 <sup>ab</sup>	10675.00±306.95 <sup>abc</sup>
6	4.5–5.0	5	5.61	37.58±1.44 <sup>a</sup>	43.38±4.26 <sup>a</sup>	11461.00±438.14 <sup>a</sup>	12229.38±299.05 <sup>a</sup>
P-value							

Means within the same column shearing different letters are significant at  $P<0.05$ .  
 BCS = body condition score

### Effect of Postpartum BCS on Holstein Cows Dairy Performance

Holstein dairy performance possessed significant difference among different postpartum BCS groups (Table 2). Cows with BCS of (3.5–<4.0 points) recorded the highest significant daily milk yield (37.93 kg), initial milk yield (49.00 kg), 305-day milk yield (11566.67 kg), and actual milk yield (14945.00 kg) as compared to other ones. The

lowest value of daily and 305-day milk yield was recorded as 29.75 kg and 8989.44 kg, respectively in the cows with BCS of (2.5–<3.0 points); while the lowest actual milk yield (8845.00 kg) was obtained from cows with BCS of (4.0–4.5 points). The lowest initial milk yield (30.50 kg) has been observed in cows of <2.5 BCS.

**Table 2: Effect of Postpartum BCS on Holstein Cows Dairy Performance.**

Postpartum BCS groups	BCS points	N	%	Milk production traits			
				Daily milk yield	Initial milk yield	305-day milk yield	Actual milk yield
				Mean ± Se	Mean ± Se	Mean ± Se	Mean ± Se
1	<2.5	4	4.49	32.76±0.43 <sup>ab</sup>	30.50±2.50 <sup>b</sup>	9990.00±130.00 <sup>ab</sup>	9302.50±262.50 <sup>b</sup>
2	2.5–<3.0	36	40.44	29.75±0.99 <sup>b</sup>	32.61±1.96 <sup>b</sup>	8989.44±101.67 <sup>b</sup>	9955.97±196.17 <sup>b</sup>
3	3.0–<3.5	40	44.94	29.88±0.65 <sup>b</sup>	30.88±1.11 <sup>b</sup>	9113.25±197.55 <sup>b</sup>	9416.88±139.63 <sup>b</sup>
4	3.5–<4.0	6	6.74	37.93±1.59 <sup>a</sup>	49.00±3.09 <sup>a</sup>	11566.67±213.33 <sup>a</sup>	14945.00±295.69 <sup>a</sup>
5	4.0–4.5	3	3.37	34.36±3.31 <sup>ab</sup>	29.00±2.01 <sup>b</sup>	10479.33±198.33 <sup>ab</sup>	8845.00±210.13 <sup>b</sup>
P-value							

Means within the same column shearing different letters are significant at  $P<0.05$ .  
 BCS = body condition score

### Effects of Condition Score Loss and/or Gain on Holstein Cows Dairy Performance

The effect of loss and/or gain in BCS of Holstein cows on some milk production traits are presented in Table 3. Cows with BCS loss from (-0.5) to (-1.0) points has the highest significant daily and 305-day milk yield, while

those with BCS loss of (-0.25)–(-1.0) points has the highest significant actual milk yield and initial milk yield. Cows with BCS gain (+0.25 points) and BCS loss (<-0.25 points) showed inferior performance for all milk production traits studied.

**Table 3:** Effects of Condition Score Loss and/or Gain on Holstein Cows Dairy Performance.

BCS loss groups	BCS loss points	N	%	Milk production traits			
				Daily milk yield	Initial milk yield	305-day milk yield	Actual milk yield
				Mean ± Se	Mean ± Se	Mean ± Se	Mean ± Se
1	< -0.25	12	13.48	24.60±1.27 <sup>b</sup>	21.14±1.98 <sup>b</sup>	7500.00±145.14 <sup>b</sup>	6405.74±178.27 <sup>b</sup>
2	(-0.25)–(<-0.5)	4	4.49	24.69±2.85 <sup>b</sup>	32.28±2.96 <sup>a</sup>	7530.00±253.42 <sup>b</sup>	9760.18±242.15 <sup>a</sup>
3	(-0.5)–(<-0.75)	44	49.43	31.88±0.26 <sup>a</sup>	33.93±1.14 <sup>a</sup>	9654.32±91.68 <sup>a</sup>	10357.05±346.60 <sup>a</sup>
4	(-0.75)–(-1.0)	27	30.33	33.24±1.26 <sup>a</sup>	37.74±2.08 <sup>a</sup>	10138.44±385.62 <sup>a</sup>	11510.93±333.78 <sup>a</sup>
5	+0.25	2	2.24	16.89±3.01 <sup>c</sup>	10.00±4.52 <sup>c</sup>	5150.00±149.25 <sup>c</sup>	3050.14±365.18 <sup>c</sup>
P-value							

Means within the same column shearing different letters are significant at  $P < 0.05$ .

BCS = body condition score

## DISCUSSION

### Effect of Prepartum BCS on Holstein Cows Dairy Performance

In fact, cows with moderate BCS produced significantly higher actual milk yield and initial milk yield as compared to those with lower BCS and those with BCS of 3.5–<4.0 points. These results were reinforced by the finding of Samarütel *et al.* [14] who reported that, thin cows at calving could not reach their genetic milk yield potentials due to absence of body reserves that would support elevation of milk production at the beginning of lactation.

Two presumptions were suggested regarding this positive relation between sufficient body reserves at calving and higher milk yield—first is the positive impact of high BCS on the number of mammary cells during the calving period; the second is the reduction in the stress on the digestive system to decompose the foods [2]. In contrast, the results recorded by Bayram *et al.* [19] found that cows with low condition score at calving have higher significant ( $P < 0.01$ ) actual milk yield and 305-day daily milk yield than those with moderate condition score, as well as BCS at calving did not have an effect on peak daily milk yield.

Bouska *et al.* [20] reported that cows with low body reserves achieved the highest milk yield among all body condition classes ( $\leq 3.5$ ,  $4.0$ ,  $\geq$

4.5) during the drying off period. In addition, cows with high condition score during the calving period consumed less feed, so they suffered from a higher negative energy balance, and subsequently produced less milk than other cows. Increasing BCS resulted in reduced dry food intake, as review by Broster and Broster [21]. Some previous researchers reported that BCS at calving did not have an effect on milk yield [3, 9, 10, 22]. These disparate results about the effect of BCS on milk yield may attribute to the use of different scoring systems and classifications, different mathematical models and different factors such as the breed, milk yield and raising techniques, as published by Bayram *et al.* [19].

Some previous studies observed no effect of BCS at calving on peak daily milk yield and days to attain peak milk yield [9, 19, 23, 24]. However, others found a positive effect on the peak daily milk yield [2, 15]. Harmonious results were reported by Gergovska *et al.* [25] who found that cows from both the breeds (Holstein and Brown Swiss) with higher BCS ( $\geq 3.5$  points) at calving have the highest milk yield for 305-day lactation. Banuvalli *et al.* [26] concluded that significant and positive associations between BCS at calving and milk production have been observed in crossbred Holstein cows.

### **Effect of Postpartum BCS on Holstein Cows Dairy Performance**

Indeed, cows with BCS of 3.5–4.0 points showed superiority for milk production traits which need greater proof because of small number of animal in this group which is reflected by higher standard error. These results agreed with those obtained by Jilek *et al.* [3] who reported that cows with low body reserve within the month after calving had a great impact on daily milk yield ( $P < 0.01$ ) during the first five months of lactation. This could be explained as cows with genetically high milk yield potential are more inclined to mobilize their bodies' fat reserves to milk and these cows had lower BCS at the first month of lactation but had higher milk yield. Concurrently, Samarütel *et al.* [14] recorded that cows with low BCS produced more daily milk yields in the first two months of lactation.

Contradictory results were obtained by Bayram *et al.* [19] who reported that condition score obtained in the first month of lactation has no effect on milk production traits with the exception of peak daily milk yield ( $P < 0.05$ ), but they found that cows with BCS in the first month of lactation had a significant more milk yield (2.4 kg) at the peak point than those with moderate BCS ( $P < 0.01$ ) which agreed with the present results as daily and 305-day milk yield of moderate cows was lower than those of thin body condition ( $< 2.5$  points).

The insufficient reserves in emaciated cows and/or the insufficient dry food intake in obese cows may be expected to decrease peak daily milk yield or extend milk period. Yamazaki *et al.* [27] reported weak and negative phenotypic associations between peak and 305-day milk yield and BCS in early stage of lactation (0–30 days in milk).

The present results agreed with those of Gergovska *et al.* [28] who found that BCS at calving had a significant effect on the 305-day milk yield, test-day milk yield and peak lactation production. Cows with a BCS of 3.5–4.0 points at calving had sufficient body reserves in the early lactation, which allowed them to reach higher peak milk yield, and higher 305-days milk yield as compared to cows with BCS of 3.0 points or lower at

calving. At BCS of 2.0–2.5 points at calving, Holstein-Friesian cows had lower milk yield than those of cows with high BCS (3.5–4.0 points). Also, Samarütel *et al.* [14] recorded that during the first two months of lactation, the heavy cows had the highest milk yield.

### **Effects of Condition Score Loss and/or Gain on Holstein Cows Dairy Performance**

From the outgoing results it was clearly found that, the higher the loss in the BCS the higher the milk production performance. The outgoing result was going barrel with previous publications [2, 17, 24] who reported higher milk yields in cows with high BCS losses.

Positive genetic correlations have been indicated between BCS loss and milk yield characteristics [17]. However, some studies reported a nonsignificant effect of the change in the condition score on reproduction and milk yield traits. Bayram *et al.* [19] found that 17.7% of the cows showed condition gain, while 25.1% showed no change and 57.1% showed condition loss ranging between 0.01 and 0.90 units.

Normally, dairy cows during their postpartum suffer from negative energy balance, so they mobilized their body reserves for milk production at the beginning of lactation. The degree of loss of body reserves depends on a number of factors, such as degree of body condition at calving, nutrition after calving, level of milk production, etc. Cows selected for high milk yield were found to suffer more from negative energy balance, thereby greater loss of body condition after calving as compared to the ones with average milk yield [29].

Koenen *et al.* [30] found that the average loss of BCS after calving is greater in the Holstein (1.2 points) as compared to Red and White cows (1.0 point) that difference is attributable to different productivity (1000 kg higher in the Holstein than Red and White cows). Also, there is a positive correlation between loss of BCS and milk yield [31]. About 30 days after calving, cows have lost an average of 0.49 points of BCS, the lean ones have lost 0.25 points, while those with medium body condition cows have lost 0.48 points; those

with good body condition have lost 0.60 points. The foregoing results proved that, the highest percent of cows 49.43% (44) showed condition loss ranged between 0.5 and 0.75 units. Gergovska *et al.* [25] recorded that cows from both the breeds (Holstein and Brown Swiss) with higher BCS ( $\geq 3.5$  points) at calving, with greater loss of BCS after calving ( $\geq 2.5$  points) have the highest milk yield for 305-day lactation which go barrel with the present results. Banuvalli *et al.* [26] found that cows having high BCS at calving had lost more condition and produced more daily milk yield, when compared to cows with low body condition.

### CONCLUSION

BCS significantly influenced the dairy performance of Holstein cows both at prefresh and postpartum period. The higher dairy performance of Holstein dairy cows was usually accompanied with somewhat heavy BCS at a prefresh and with medium BCS postpartum, but this needs further research to prove this presumption because of small number of animals including in this paper. Furthermore, the higher the loss in the body condition unites during fresh period the higher was the dairy performance.

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