EFFECT OF DAILY WEIGHT GAIN ON AGE AT FIRST CALVING AND SUBSEQUENT MILK YIELD OF HOLSTEIN HEIFERS IN EGYPT

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SUMMARY

A total number of 1152 complete lactation records for 576 Holstein cows were collected from two commercial farms (Copenhagen and Sami Asaad farm) during the period from year 2007 to 2010 to determine the effect of average daily weight gain (ADG) from birth to conception of Holstein heifers on their age at first calving (AFC) and subsequent milk yield. Heifers were divided into four groups (G^s) based on their ADG as 650 g/day, 775 g/day, 875 g/day and 950 g/day for G1, G2, G3 and G4, respectively. Heifers of G4 reached the AFC 5.3 month earlier (P<0.001) than those of G1. ADG had positive effect on productive traits of the first two lactations. Cows of G4 had a similar 305 days milk yield in the first lactation compared to G1 but, scored non-significant higher milk yield in the second one by 535 kg.

G4 had non-significant increase in milk yield / day of cow age till the end of the first lactation (MY1/DCA) compared with G1. Milk yield / day of cow age of G4 till the end of the second lactation (MY2/DCA) increased (P<0.01) by 12.7 % compared to G1.

Days open of G4 in the first lactation (DO1) was shorter (P<0.05) than that of G1 by 44 days. This trend extended to the second lactation, however, it was insignificant. The present results showed that productive and reproductive performance of the faster growing Holstein heifers is better than that of slower ones. The ADG of Holstein heifers during the period from birth to conception affected significantly AFC, DO1 and MY2/DCA. G4 calved for the first time 5.3 months earlier, produced 535 kg more milk and had shorter days open by 67 days till the end of second lactation compared with G1.

Keywords: average daily gain, age at first calving, 305-day milk yield, days open, Holstein, Egypt

INTRODUCTION

Rearing heifers to join milking herd at an appropriate age and body weight, is a fundamental to enable heifers to express full lifetime potentiality. Body weight at first insemination is based on age, nutritional level and health condition. Poor growth rate may postpone age at first calving (AFC) (Johnson et al., 2011). Cost of rearing replacement heifers could be reduced in case of high growth rate, which is reflected on early age at first calving (Hultgren et al., 2011). Reducing age at first calving would minimize cost of raising heifers, shorten generation interval and increase the expected number of lactations given during productive life (Ashmawy, 1985).

There are inconsistent results in the literature concerning the effect of pre-puberty ADG on the subsequent milk production of dairy heifers. High growth rate was reported to reduce age at first pregnancy (Capuco et al., 1995 and Sejrsen and Purup, 1997). Meanwhile other studies indicated that increasing ADG was linked to low milk production (Van Amburgh et al., 1998; Lammers et al., 1999; Abeni et al., 2000 and Radcliff et al., 2000) due to reducing mammary parenchymal development (Meyer et al., 2004). Pirlo et al. (1997) and Waldo et al. (1998) stated no association between ADG and milk production.

No results are available; under Egyptian conditions; concerning the effect of ADG before conception of Holstein heifers on the subsequent milk production. Therefore, this study was conducted to test the effect of pre-conception ADG on productive and reproductive performance of Holstein heifers in two commercial farms under intensive production system in Egypt.

MATERIALS AND METHODS

Sources of data

A total number of 1152 lactation records for 576 Holstein cows calved during the period from January 2007 to December 2010 were collected from two commercial farms in Egypt. The first farm is Alexandria Copenhagen Company for Milk and Meat Production (FARM1), located at El-Nubariya district, EL-Beheira governorate, 150 km northwest of Cairo. The second is Sami Asaad farm (FARM2), located at Abu Hammad district, Sharkia governorate, 100 km northeast of Cairo, 15 km east of Zagazig city.

Herd management

Management practices in both farms under study were almost the same. Cows were fed a total mixed ration (TMR) throughout the year. The TMR consisted of concentrates, corn silage and alfalfa hay. Egyptian clover (*Trifolium alexandrinum*) was offered during winter (Dec. – Feb.) and spring (March – May) and replaced by Egyptian clover hay during summer (June – Aug.) and autumn (Sep. – Nov.). Ambient temperature was moderate during winter and spring, while it was hot during summer and autumn. Rations

were offered twice a day according to NRC (2001) requirements. New born heifers were allowed to suckle their dams till the third day post-partum. Thereafter, they were fed artificially raw milk and milk replacer until weaning at about 90 kg body weight, in addition to the starter (22% crude protein), which was offered starting from the second week of age. Fresh water was made available all the time.

Heifers were weighed monthly to calculate ADG from birth to conception. It was calculated by dividing the total weight gain by the number of days of that period. Heifers were inseminated for the first time when reaching about 360 kg of body weight. Heat was detected visually and heifers that displayed estrous symptoms were inseminated by frozen semen of the best 100 total predicated index Holstein bulls in USA and Canada. Cows were machine milked daily at eight hours intervals starting at 06:00 am. Daily milk yield was recorded for each cow till the end of lactation. Cows were dried off about two months before the expected calving date or when milk yield dropped to less than 7 kg/day. Cows were vaccinated against various bacterial and viral diseases in due time and were de-wormed against external and internal parasites, twice yearly.

Studied traits

a. Age at first calving (AFC, mo) was defined as days from birth to first calving dividing by 30.5.

b. 305-day milk yield (305-dMY, kg) was calculated as the total milk production throughout the first 305 days for cows milking more than 305 days or through the drying off date if it occurred normally prior to 305 days in milk. The 305-day milk of cows of incomplete lactations due to selling, death or slaughtering, yield was estimated using the equation approved by the International Committee for Animal Recording (ICAR, 2000) as follows:

The 305-day milk yield $=[(TMY \times 405)/(100 + LP)]$.

c. Milk yield / day of cow age till the end of the first lactation (MY1/DCA, kg) was calculated by dividing the total milk yield produced throughout the first lactation by the number of days from birth till the end of the first lactation.

d. Milk yield / day of cow age till the end of the second lactation (MY2/DCA, kg) was calculated by dividing the total milk yield produced throughout the first two lactations by the number of days from birth till the end of the second lactation.

e. Days open (DO, day) was defined as days from calving until conception. It was calculated by subtracting the previous calving date from the subsequent conception date.

Statistical analyses

In order to determine effects of daily gain on milk production and reproductive traits, heifers were classified according to their average daily gain (ADG) into four groups (G) depending on the standard deviation distribution of ADG as indicated in Table (1).

Table 1. Distribution of Holstein heifers according to their average daily gain

Groups	NO.	ADG (gm)	Min. (gm)	Max. (gm)
G1	124	650	427	699
G2	300	775	700	849
G3	86	875	850	899
G4	66	950	900	1046
Overall	576	780	720	875

Data were analysed using XLSTAT (2014), using two statistical models as follows:

Model 1

$$Y_{ijklm} = \mu + A_i + F_j + S_k + Y_l + e_{ijklm}$$

Where,

Y_{ijklm}	=	an observation of age at first calving,
M	=	the overall mean,
A_i	=	effect of ith average daily gain, (i = 1, 2, 3, 4), where 1= G1 (650 g/day), 2= G2 (775 g/day), 3= G3 (875 g/day) and 4= G4 (950 g/day),
F_j	=	effect of jth farm, (j = 1, 2), where 1= FARM1 and 2= FARM2,
S_k	=	effect of the kth season of birth, (k = 1, 2, 3, 4), where 1= winter (Dec. – Feb.), 2= spring (March – May), 3= summer (June – Aug.) and 4= autumn (Sep. – Nov.),
Y_l	=	effect of lth year of birth, (l = 1, 2, 3, 4), where 1= 2004, 2= 2005, 3= 2006 and 4= 2007, and
e_{ijklm}	=	random error, assumed to be NID (0, $O^{2)}$).

Model 2

Model (2) was assumed to analyze the rest of traits and reads as follows:

$$Y_{ijklm} = \mu + A_i + F_j + S_k + Y_l + e_{ijklm}$$

Where,

Y_{ijklm}	=	an observation of productive or reproductive trait,
M	=	the overall mean,
A_i	=	effect of ith average daily gain, (as described above in mode1),
F_j	=	effect of jth farm, (j = 1, 2), (as described above in mode1),
S_k	=	effect of kth season of calving, (as described above in mode1),
Y_l	=	effect of lth year of calving, (l = 1, 2, 3, 4), where 1= 2007, 2= 2008, 3= 2009 and 4= 2010 in first calving and 1= 2008, 2= 2009, 3= 2010 and 4= 2011 in the second calving, and
e_{ijklm}	=	random error, assumed to be NID (0, $O^{2)}$.

All possible interactions were tested and were non-significant, therefore, the used models did not include these interactions.

RESULTS AND DISCUSSION

Age at first calving

The overall mean of AFC obtained in this study (25.7 ± 0.25 month, Table 2) was higher than the values obtained on Holstein heifers in Egypt by Mokhtar *et al.* (1993; 24.3 month) and Afifi *et al.* (2004; 23.7 month). However, Ashmawy (1985), Sadek *et al.* (1994) and Salem *et al.* (2006) reported higher estimates ranged between 27.1 and 32.0 months for AFC of Holstein heifers in Egypt.

Low age at first calving in a particular dairy cattle herd is a reflection of good management practices adoption. Standard management practices allow heifers to reach appropriate body weight for breeding and to give birth for their first calves in early age.

Cooke *et al.* (2013) concluded that the optimum productive and reproductive performance in UK Holstein- Friesian cows (over 5 years of life) were achieved with an AFC of 23 - 25 months, which is close to that reported in the present study. The authors indicated that cows were also more likely to achieve more than three lactations; which is a crucial for profitability. Improving reproductive efficiency of heifers is assumed to increase profitability through reducing rearing costs with no adverse effect on productivity after calving.

Effect of average daily gain

Holstein heifers of G4 calved for the first time at lower age (P < 0.001) compared to other groups (Table 2) by 5.3, 1.7 and 0.6 months of G1, G2 and G3, respectively. Pirlo *et al.* (2000) showed that reducing AFC of Holstein heifers had a positive effect on milk yield and running costs of the farm. The authors reported that the most profitable AFC was between 23 and 24 months.

Tozer and Heinrichs (2001) showed that reducing AFC of Holstein cows from 25 to 24 or 21 months decreased replacement cost by 4.3% or 18%, respectively. Meanwhile, Bayram *et al.* (2009) found that AFC of Holstein cows was not affected significantly by ADG.

Do *et al.* (2013) in a study on 276573 Korean Holsteins indicated that the most lifetime profitable AFC ranged between 22.5 and 23.5 months. The authors added that the lifetime profit declined by about $725 when AFC increased from 22.3 to 32.8 months.

Effect of farm

Farm has a significant effect on AFC (P < 0.001) with a privilege of FARM1 (Table 2). Galal *et al.* (1981) and Sadek *et al.* (1994) found non-significant effect of farm on AFC of Holstein cows in Egypt.

Effect of season of birth

Season of birth has no significant effect on AFC (Table 2). Similar conclusion was mentioned by El-Khashab (1993) and Sadek *et al.* (1994). On the contrary, Neiva *et al.* (1992) found that season of birth affected significantly AFC of Holstein cows, which attributed to climatic conditions and available feeding resources and/or due to the vitamin content in the rations between different seasons (El-Keraby and Aboul-Ela, 1982).

Effect of year of birth

Year of birth was found to affect (P < 0.001) AFC. Heifers born in 2006 and 2007 calved for the first time at younger ages compared to those born during 2004 and 2005 (Table 2). This result is in agreement with the results of Neiva *et al.* (1992); El-Khashab (1993); Mokhtar *et al.* (1993) and El-Sheikh (1995). However, Galal *et al.* (1981) and Gad (1995), who found no effect of year of birth on AFC.

Effect of year of birth is suppose to be due to the differences in herd size, environmental conditions, management practices, availability of fodders and plan of breeding.

Table 2. LSM[1] ± SE of age at first calving (AFC) of Holstein cows as affected by average daily gain (ADG), farm, season and year of birth

Factors	NO.	AFC (mo.)	Level of significance (P)
Overall mean	576	25.7 ± 0.25	
ADG group:			< 0.001
G1	124	29.1[a] ± 0.31	
G2	300	25.5[b] ± 0.21	
G3	86	24.4[c] ± 0.33	
G4	66	23.8[c] ± 0.40	
Farm:			< 0.001
FARM1	451	25.0[b] ± 0.19	
FARM2	125	26.4[a] ± 0.31	
Season of birth:			NS
Winter	189	25.6 ± 0.24	
Spring	76	26.1 ± 0.36	
Summer	105	25.6 ± 0.31	
Autumn	206	25.6 ± 0.24	
Year of birth:			< 0.001
2004	278	26.5[a] ± 0.27	
2005	102	26.5[a] ± 0.33	
2006	100	24.7[b] ± 0.33	
2007	96	25.1[b] ± 0.33	

[1]*= Means within each classification have different letters are significantly different (P<0.05).*
G1= ADG with an average of 650 g/day, G2= ADG with an average of 775 g/day, G3= ADG with an average of 875 g/day and G4= ADG with an average of 950 g/day, FARM1= Copenhagen farm, FARM2= Sami Asaad farm, NS= non-significan

2. Milk yield and days open of the first two lactations

The overall mean of milk production traits and days open during the first two lactations are shown in Table (3). The first lactation 305 day milk yield (305d-MY1) obtained in the present study is higher than that obtained on Holstein heifers in Egypt by Sadek *et al*. (1994; 4372 kg), but it is lower than that obtained by Cooke *et al*. (2013; 8830 kg).

The overall mean of milk yield / day of cow age till the end of the first lactation (MY1/DCA) was 7.2 ± 0.9 kg. This value increased to 11.8 ± 0.3 kg when calculated till the end of the second lactation (MY2/DCA), which is higher than that obtained by Cooke *et al*. (2013; 10.9 kg) on the same genotype. The overall mean of 305d-MY2 represented about 107% of 305d-MY1 (8245 *vs.* 7730 kg). DO1 in this study was longer than that obtained by Cooke *et al*. (2013) by about 64 days.

The overall mean of DO2 was almost equal to the DO1 (Table 3), which is longer than that reported by Cooke *et al*. (2013; 129 days). This means that the overall mean of calving interval of the first and second Holstein calvers in the present study equals to about 15 months.

Effect of average daily gain

ADG has no effect on 305-days milk yield during the first two lactations, while there was a difference in favor of G3 compared to G1 by 2 % in the first lactation and 6.65% between G4 and G1 in the second lactation (Table 3).

Pirlo *et al*. (1997), Waldo *et al*. (1998) and Abeni *et al*. (2000) reported no significant effect of prepubertal growth rate on milk production of Holstein hiefers, which agree with the present results.

On the other hand, many studies stated significant negative effects of prepubertal growth rate on milk production. Increasing ADG before puberty resulted in a decrease in milk production (Van Amburgh *et al*., 1998, Lammers *et al*., 1999., Abeni *et al*., 2000., Radcliff *et al*., 2000 and Meyer *et al*., 2004). Van Amburgh *et al*. (1998) found that the 305-d milk yield decreased significantly for heifers grown at 0.94 kg/d (9387 kg) compared with those of 0.68 kg/d (9873 kg). Meyer *et al*. (2004) added that mammary parenchymal development was retarded by the shorter period to puberty in rapidly growing heifers. However, Bayram *et al*. (2009) found that Holstein heifers of low ADG produced less (P ≤ 0.05) 305-days milk yield than the high ADG in the second parity. Cooke *et al*. (2013) found that the faster growing heifers had lower 305d-MY2 (9340 ± 210 kg), compared with the slow growing ones (10,546 ± 183 kg).

The differences among means of the four groups of ADG for MY1/DCA were not significant. However, G4 yielded MY1/DCA greater than G1 by 0.5 kg/ day of cow age. Comparison between G4 and G1 for MY2/DCA indicated that the difference (12.7 %) was highly significant (P<0.01). Cooke *et al*. (2013) found also that the milk yield per day of life time until the third parity decreased (P<0.001) progressively from 12.0 ± 0.4 kg in the faster growing heifers to 9.0 ± 0.6 kg in the slower ones.

Days open (DO1) of G1 is longer than G3 and G4 of the first parity. DO1 of G4 was shorter (P < 0.05) than that of G1 by 23%, while DO2 of G4 was significantly shorter by 12.4% than G1 (Table 3), which suppose to increase reproductive efficiency of the high growers. Bayram *et al*. (2009) found that DO1 of Holstein cows of ADG ≥ 499.2 g/day (129.0

days) were lower than those of ADG < 499.2 g/day (145.9 days), but the difference was not significant. The authors added that DO2 of Holstein cows in the moderate group were longer (P<0.05) than slower ones. Cooke *et al*. (2013) found that DO1 of heifers having low ADG was longer (P<0.05, 170 ± 18 days) than that having high ADG (128± 11 days). They reported similar trend for DO2, however, the difference was not-significant (144 *vs*. 127 days for slow and faster growing heifers, resp.).

Table 3. LSM[1] ± SE of 305-day milk yield (305d-MY), days open (DO) and milk yield / day of cow age (MY/DCA) of Holstein cows during the first two lactations

Factors	NO.	First lactation					
		305d-MY1 (kg)		MY1/DCA (kg)		DO1 (day)	
		x̄ ± SE	P<	x̄ ± SE	P<	x̄ ± SE	P<
Overall mean	576	7730 ± 130		7.2 ± 0.9		202 ± 11	
ADG group:			NS		NS		0. 05
G1	124	7660 ± 156		6.8 ± 1.1		234[a] ± 13	
G2	300	7795 ± 103		6.8 ± 0.7		203[b] ± 90	
G3	86	7810 ± 170		7.9 ± 1.4		183[b] ± 14	
G4	66	7650 ± 204		7.3 ± 1.2		190[b] ± 17	
Farm:			0.001		0.001		0.001
FARM1	451	8585[b] ± 94		9.5[a] ± 0.7 a		174[b] ± 8	
FARM2	125	6875[a] ± 16		4.8[b] ± 1.2 b		230[a] ± 14	
Season of calving :			NS		NS		0.01
Winter	204	7700 ± 119		6.3 ± 0.8		194[b] ± 10	
Spring	113	7490 ± 161		7.2 ± 1.1		242[a] ± 14	
Summer	102	7755 ± 166		7.6 ± 1.2		212[ab] ± 14	
Autumn	157	7975 ± 140		7.7 ± 1.0		161[c] ± 12	
Year of calving:			0.01		NS		0.01
2007	244	6815[c] ± 141		6.5 ± 1.0		259[a] ± 12	
2008	116	7730[b] ± 168		7.0 ± 1.2		214[b] ± 14	
2009	110	8365[a] ± 168		6.3 ± 1.2		190[b] ± 14	
2010	106	8010[ab] ± 159		8.9 ± 1.1		145[c] ± 13	
		Second lactation					
		305d-MY2 (kg)		MY2/DCA (kg)		DO2 (day)	
		x̄ ± SE	P<	x̄ ± SE	P<	x̄ ± SE	P<
Overall mean	576	8245 ± 193		11.8 ± 0.3		198 ± 11	
ADG:			NS		0.01		NS
G1	124	8050 ± 230		11.0[b] ± 0.3		208 ± 13	
G2	300	8105 ± 166		11.9[a] ± 0.2		201 ± 9	
G3	86	8245 ± 242		12.1[a] ± 0.3		196 ± 14	
G4	66	8585 ± 295		12.4[a] ± 0.4		185 ± 17	
Farm:			0.01		0.01		NS
FARM1	451	8845[a] ± 139		13.2[a] ± 0.2		188 ± 80	
FARM2	125	7645[b] ± 246		10.5[b] ± 0.3		208 ± 14	
Season of calving:			NS		0. 05		0. 05
Winter	199	8395 ± 175		11.8[a] ± 0.2		194[b] ± 10	
Spring	31	7865 ± 394		11.3[a] ± 0.5		242[a] ± 22	
Summer	86	8175 ± 241		11.9[a] ± 0.3		174[b] ± 14	
Autumn	260	8545 ± 154		12.4[a] ± 0.2		181[b] ± 90	
Year of calving:			NS		0.01		NS
2008	206	7945 ± 229		11.0[b] ± 0.3		201 ± 13	
2009	132	8510 ± 225		11.5[b] ± 0.3		197 ± 13	
2010	104	8330 ± 246		12.4[a] ± 0.3		207 ± 14	
2011	134	8190 ± 209		12.4[a] ± 0.3		186 ± 12	

[1]= *Means within each classification have different letters are significantly different (P<0.05).*

G1= ADG with an average of 650 g/day, G2= ADG with an average of 775 g/day, G3= ADG with an average of 875 g/day and G4= ADG with an average of 950 g/day, FARM1= Copenhagen farm, FARM2= Sami Asaad farm, NS= non-significan

Effect of farm

Farm had highly significant effect (P<0.001) on all traits studied of the first parity. FARM1 had better values for 305d-MY1 and MY1/DCA than those of FARM2. Moreover, DO1 in FARM1 was better than that in FARM2 (Table 3).

Farm also has highly significant effect on milk production traits during the second parity, while this effect was not-significant on DO2. The present

finding on milk production traits is supported by the results of Sadek *et al.* (1994) on Holstein cows in Egypt.

Effect of season of calving

Season of calving had no significant effect on 305d-MY1 or MY1/DCA; however, it was significant (P < 0.01) on DO1. Cows calved in autumn season had higher 305d-MY1 and MY1/DCA compared to those calved in the other seasons (Table 3). This may be because the peak of lactation for autumn calvers occurred in winter when the environmental factors are appropriate and green fodders are available. This means that lactating cows spent most of their lactation period under optimal conditions relative to the others seasons.

Cows calved in spring had longer DO1 relative to other seasons (Table 3). This may be due to that the post-partum resumption of ovarian and estrous activities are coincided with the start of summer months where heat stress is at most and breeding period is coincided with the hot months (summer season) where reproductive efficiency came down (Marzouk, 1998).

The present trend is in consistence with that reported by Samoul (2011) in Egypt. The authors indicated that ambient temperature and ration composition were among the factors responsible for the seasonal variation in reproductive traits. In addition, Mahmoud *et al.* (1991) stated that long day light length was accompanied with long DO. Short estrous cases and silent ovulation in hot season add another difficulty to heat detection. Heat stress resulted in poor reproductive efficiency (ovulation rate, repeat breeding and conception rate, etc.). The lowest values of DO1 were recorded in this study during the cooler months (autumn and winter seasons). El-Fouly *et al.* (1976) reported that preparing the animals to have the full chance for conception during the season of full ovarian activity (Oct. - March) could reduce DO considerably.

Effect of season of second calving on 305d-MY2 is not significant, but it was significant (P < 0.05) on MY2/DCA and DO2. As in the first lactation, cows calved in autumn had higher values of 305d-MY2 and MY2/DCA compared to those calved in the other seasons (Table 3). Cows calved in spring season had longer (P < 0.05) period of DO2 relative to those calved in other seasons (Table 3). Meanwhile, the lowest value of DO2 was recorded in this study during summer season. Similar trend was reported by Samoul (2011) in Egypt.

Effect of year of calving

Year of calving affected significantly (P < 0.01) 305d-MY1 and DO1 traits. Cows calved in 2009 had higher value of 305d-MY1, while the lowest values were of year 2007 (Table 3). Although, the MY1/DCA in 2010 was higher than those in 2007, 2008 and 2009, the differences were not significant. The DO of cows calved in 2010 was lower (P < 0.05)

than that of those calved in 2007, 2008 and 2009 (Table 3).

The effect of the year of the second calving on 305d-MY2 and DO2 was not significant but it was a highly significant (P < 0.01) on MY2/DCA. Cows calved in 2009 had higher values of 305d-MY2, while in 2008 the lowest values were recorded. The MY2/DCA in 2010 and 2011 was higher than those in 2008 and 2009. DO2 in 2010 was higher than those in 2008, 2009 and 2011 (Table 3).

Sadek *et al.* (1994) found a significant effect of year of calving on milk yield and days open of Holstein cows in Egypt, which is inconsistence with the present findings.

CONCLUSION

The present results showed that productive and reproductive performance of the faster growing Holstein heifers is better than that of slower ones. The ADG of Holstein heifers during the period from birth to conception affected significantly AFC, DO1 and MY2/DCA. Further studies are still needed to test these results on large number of animals in different dairy systems.

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تأثير الزيادة اليومية في وزن الجسم على العمر عند أول ولادة وإنتاج اللبن المستقبلي لعجلات الهولشتين في مصر

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استخدم في الدراسة ١١٥٢ سجلاً لعدد ٥٧٦ بقرة هولشتين من مزرعتين تجاريتين (مزرعة كوبنهاجن ومزرعة سامي أسعد) خلال الفترة من ٢٠٠٧ إلى٢٠١٠. كان الغرض من الدراسة هو تحديد تأثير معدل الزيادة اليومية في وزن عجلات الهولشتين على العمر عند أول ولادة وإنتاجها المستقبلي من اللبن.

تم تقسيم العجلات تبعاً لمعدلات الزيادة اليومية إلى أربع مجموعات: (ج١) بمتوسط ٦٥٠ جم / يوم (ج٢) بمتوسط ٧٧٥ جم / يوم، (ج٣) بمتوسط ٨٧٥ جم / يوم، (ج٤) بمتوسط ٩٥٠ جم / يوم.

وصلت العجلات في (ج٤) إلى العمر عند أول ولادة بحوالي ٥.٣ شهر أقل من ج١ بطيئة النمو وكان الفارق عالي المعنوية (0.001< P). كان لمعدل الزيادة اليومية تأثير إيجابي على الصفات الإنتاجية في أول موسمين. كان الإنتاج خلال ٣٠٥ يوم في (ج٤) مشابها لما هو عليه في (ج١) في الموسم الأول، لكن كان إنتاج الحليب في ٣٠٥ يوم أعلى في (ج٤) عما هو عليه في ج١ في الموسم الثاني، ولكن كان الفرق (٥٣٥ كجم) ليس معنويا.

حققت العجلات الأسرع نمواً (ج٤) (زيادة لكنها لم تكن كبيرة في انتاج اللبن في اليوم من حياة البقرة حتى نهاية الموسم الأول مقارنة مع المنخفضة النمو (ج١) بنسبة ٧.٤٪. لكن حتى نهاية الموسم الثاني كان (ج٤) أعلى معنويا (0.01< P) مقارنة مع (ج١) بنسبة ١٢.٧٪. كانت الفترة مفتوحة في (ج٤) في الموسم الأول أقصر من تلك التي في(ج١) بحوالي ٤٤ يوم (0.05< P)، ويمثل ذلك حوالي ٢٣٪ أقل و امتد هذا التأثير للموسم الثاني ولكن الفرق (٢٣ يوما) كان ١٢.٤٪، ولم يكن معنويا .

ومن النتائج السابقة نستنتج أن معدل الزيادة اليومية في وزن جسم عجلات الهولشتين خلال الفترة من الولادة وحتى الحمل تؤثر بشكل معنوي على العمر عند أول ولادة ، الفترة المفتوحة في الموسم الأول و في انتاج اللبن في اليوم من حياة البقرة حتى نهاية الموسم الثاني. والعجلات الأسرع نموا تلد للمرة الأولى في وقت أقل ٥.٣ شهراً عما هو عليه في بطيئة النمو ، وتنتج لبناً أكثر بفارق ٥٣٥ كجم وتتميز باقل فترة مفتوحة (٦٧) يوماً حتى نهاية الموسم الثاني مقارنة مع العجلات بطيئة النمو.