Impact of Age and Weight at Birth on Milk Yield, Components, and Some Body Traits of Friesian Cows

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ABSTRACT

In order to ascertain amount of milk produced, nutritional value, and the unique physical characteristics of dairy cattle. Two separate studies were carried out on a private farm for cattle breeding. In the first trial, twenty-four dairy cows (Friesian-Holstein) with ages ranging from 3-4 years were divided evenly among three treatments based on live weight categories with eight cows per treatment. (Treatment1) included dairy cows had low-weight (200 kg), (treatment 2) included medium-weight (250-400 kg) and (treatment 3) included cows had heavy weights (450-650 kg).The second experiment was conducted on another set of 24 Holstein Friesian cows which were randomly distributed in three groups based: (Treatment1)that deals with young cows between 1.8 until to 2 years who were in the puberty and sexual maturity stage; middle-aged cows between the ages of 2.5 and 4 years, which called (treatment 2) and adult cows (treatment 3) between the ages of 4.5 and 6.5 year. The care and food settings for the animals in both two experiments were the same, the two studies' findings showed a significant percentage ($P \leq 0.01$) of milk components, including crude protein, crude fats, lactose, non-fat solids, and living body parameters, along with a significant increase ($P \leq 0.01$) in daily milk production. The results favored the high-weight cows (450–650 kg) in the first experiment and adult cows ages 4.5–6.5 years in the second experiment. This investigation led us to the conclusion that when high weight cows reach the fourth productive season, their productive performance improves significantly ($P \leq 0.01$) in favor of milk production, and it increases after the sixth season. However, there has been a notable improvement for the body measurements.

Keywords :Live weight, productive season, milk production, body dimensions, Friesian cows.

INTRODUCTION

The cows are regarded as one of the primary producers of livestock wealth and a significant pillar of the national economy]14[.It plays an important part in raising the financial return on cow breeding farms]15[.To estimate the genetic parameters for selection programs, it is necessary to consider the impact of certain factors, such as age and weight, on growth and production characteristics]21[as well as the important economic characteristics, such as fertility, which represents productive and reproductive efficiency]4,27[must be taken into account when estimating the genetic parameters for selection programs because the reproductive and productive qualities are influenced by age, season (period), nutritional status, and herd size.

Body weight, season (period), level of nutrition, and herd management]2[.Milk production has witnessed an increase in many

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countries of the world and achieved great leaps due to improving genetic improvement systems and improving environmental conditions including nutrition, in addition to good health care of the body's organs including the udder in dairy cows after giving at birth because of increased milk production during this period]26[. The body condition was an indicator of milk production and quality of dairy cows]16[. There is a relationship between the weight and the height of the animal. The chest circumference and abdomen, size of the udder, and the traits of those organs as specifications that may be linked to the animal's ability to give high and continuity in production for other traits (characteristics) may be identified such as characteristics related to fertility in the pelvic area and thighs or traits associated with the general health of the animal such as skin and eyes. The femininity of the animal can be inferred from its neck and head While length of the animal's productive life and its continuity can be predicted by the nature of the composition of the udder and the composition of its tissues whether fatty or spongy and the extent of its attachment to the body and shape of the teats and their composition and location on the udder]5[. These formal characteristics (traits) of any animal are subjected to the genes that the animal inherits from its parents and the formal value of any trait is determined by the interference between the genotype and animal's environment. Usually, the genetic makeup and the virtual form are synonymous. At the same time, the similarity or dissimilarity of quantitative traits can be largely determined by genotype or inheritance that is greatly affected by the environment]6.]
Milk production and its chemical components are affected by many factors such as progeny, genetic composition, gender, age, and stage of production. In addition to the influence of nutrition, climate milking method, and followed administrative systems]13[. Most studies showed a close relationship between body size, weight and body traits in dairy cows in determining genetic formal relationships]25[. In general, body dimensions have great importance in evaluating livestock in terms of the animal's external appearance to know the species and productive characteristics, body dimensions and weight of the animal in different production periods (seasons) must be recorded in livestock records because they have a major role in processes of selection and bred, the researchers found that there is a relationship between the body dimensions and the animal's continuity in producing milk so the formal characteristics are among the basics of evaluating dairy cattle such as age and weight 1]6.[Some studies have found correlation treatments with different values between some body's dimensions and milk production]6 .]
The current study aimed to evaluate the effect of live weight and age on milk production and body dimensions and determine relationships between body weights and the amount of milk produced and its components for dairy Friesian Cows .

MATERIAL AND METHODS

Two separate experiments were conducted for the private farm on dairy cows (Friesian-Holstein), the first experiment cows were using of 24 dairy cows, the animals were randomly distributed into three treatments according to the live weight factor of the dairy cows. low average weights ranged between (150 and 200 kg), medium average weights ranged between (250 and 400 kg) and high average weights ranged between (450 and 650

kg). In the second trial, 24 dairy cows were divided into three treatments based on their ages.A younger age range (1.8 to 2 years old) was used for the initial treatment, the average age of the second therapy group was between (2.5 and 4 years old) , adult age was the third treatment ranging from (4.5 to 6.5) years.

For both tests the animals were housed in a communal feeding system. A concentrated meal comprising black barley, wheat bran, urea, wheat straw, limestone, and salts was provided to them, for both experiments every dairy cow underwent uniform nutrition, management, and a medical check. Dairy cows were fed the concentrated feed twice a day 8:00 am on the first day and 5:00 pm on the second. Using the hand milking method the amount of milk produced was measured every 15 days at a rate of twice daily for two days in a row. At the same time the cows were allowed to graze for six hours every day until the conclusion of the milk production season. The Samples of milk were collected for following each morning and evening milking. The components of milk such as crude protein, crude fat, ash, lactose and non-fat solids were identified by analyzing the samples using an eco-milk instrument. Additionally, in the first and second studies the body dimensions of dairy cows were measured by using a measuring tape While

body thickness was measured using caliper equipment. ,

physical measurements

The physical measurements that were taken into consideration are as follows:

.1The height of the animal from the front: The measuring ruler was used to measure from the highest point on the body which is called Algarb perpendicular to the ground.

.2The height of the animal from the rearward:It was measured by using a measuring ruler from the last vertebra of the rump to the ground.

.3Chest depth: The caliper was used to measure from the first vertebra of the back to the breastbone (sternum.(

.4Chest circumference:The measuring tape was used at the front ribs of the chest

.5Abdominal circumference: The measuring tape was used at the end of the ribs and was wrapped around the abdominal area.

Milk production began to be recorded from the fourth day after birth, as the cows were milked twice a day at eight o'clock in the morning and four in the evening, before the milking process the newborns were isolated from their mothers at night, the next day mooring the cows were milked by hand ling method and weighted the newborns in order to calculated amount of daily milk yield by the difference between the weights of before and after sucking process.The total amount of daily milk production was calculating by added of the quantity of milk morning and evening milk that was taken from cows, from the fourth day after birth until the end of the milk production season, milk samples were collected and then combined to prepare them for chemical analysis .

Statistical analysis

Statistical analysis of the data of the studied traits in both experiments was conducted according to completely randomized design method [8] and included in the statistical program SAS [11]. Duncan's test was used to estimate the effects of live weight and age of dairy cows among treatments for all studied traits .

RESULTS AND DISCUSSION

Milk production

It was noted from a table (1) a significant effect ($P \leq 0.01$) of weight dairy cows on the

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average daily milk production and proportions of its components between the third (heavy weight), second (medium weight), compared to the first treatments (light weight) at the end of the milk season .The average milk production was 6.658, 10.900, and 17.287 kg, percentages of crude protein were 2.52, 2.95, 3.60%, ether extract 3.17, 3.85, 4.31%, lactose 4.40, 4.66, 5.50%, ash 0.52, 0.59, 0.66%, and non-fat solids 7.44, 8.20, 9.76% for the three treatments respectively.The significant increase in milk production averages in favor of heavy-weight cows (450-650 kg) and medium-weight cows (250-400 kg) compared to the light weight cows' group (150-200 kg) is attributed to the findings of]19[who found a significant superiority in an average of milk production in favor of heavy-weight animals compared to light weight animals.On the other hand, the significant superiority in daily and total milk production for cows with a medium or higher body condition score at birth compared to cows with a lower body condition score may be attributed to the fact these cows maintained a medium or high body reserve which helped in producing more milk for a longer period. When the activity of lipolytic enzymes in soft tissues increases and fat decomposition increases, the primary energy source is available in non-milk tissues in the early production stage thus providing glucose in the mammary glands to create lactose]12[which acts to increase the osmotic pressure in the mammary glands which leads to enhancing absorption of water in the mammary alveoli in large quantities and thus increasing on milk production]17[. The significant superiority in the percentage of milk protein is attributed to an increase in non-carbohydrate raw materials such as glycerol and lactate involved in glucose synthesis as well as the high concentration of propionic acid in the rumen or glucose located after the rumen area which may be reduced using some amino acids to create glucose or use them as a source of energy, thus increasing the supply and absorption of amino acids through the rumen gland]18[,]10[,]28[. The increase in milk protein may be attributed to improved nitrogen utilization efficiency and enhanced microbial protein synthesis when increases in energy availability for rumen microorganisms]23[.Also,the results showed highly significant differences in the percentage of non-fat solids in favor of heavy cows compared to medium and lightweight cows which attributed to the high percentage of lactose and a high percentage of protein (Table 1 .(

Table 1 Effect of live weight on milk yield and its composition of Holstein dairy cattle

Parameters	First treatment light weight (150-200) kg	Second treatment medium weight (250-400) kg	Third treatment heavy weight (450-650) kg
No. of cows	8	8	8
Daily milk yield (kg)**	6.658 ± 0.30c	10.900 ± 0.42 b	17.287 ± 0.49 a
Crude protein (%)**	2.52 ± 0.10 b	2.95 ± 0.20 b	3.60 ± 0.17 a
Ether Extract (%)**	3.17 ± 0.08 c	3.85 ± 0.21 b	4.31 ± 0.13 a
Lactose sugar (%)**	4.40 ± 0.23 b	4.66 ± 0.21 b	5.50 ± 0.10 a
Ash (%)**	0.52 ± 0.02 b	0.59 ± 0.03 ab	0.66 ± 0.02 a
Solids non-fats (%)**	7.44 ± 0.07 c	8.20 ± 0.34 b	9.76 ± 0.16 a

NS:Non-Significant. *:Significant differences at 0.05. **:High significant differences at 0.01.

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As for the effect of age, the results of the statistical analysis in Table (2) indicated a presence of highly significant differences (P≤0.01) in average daily milk production between adult cows (4.5-6.5) years, age young cows (1.8-2 years) and medium ages (2.5-4.00).On the other hand, we observed a significant effect of the age dairy chemical composition of milk and the results were in favor of adult ages over young and medium ages. The average of daily milk production was 8.500, 11.360, 15.268 kg and percentages of crude protein 2.50, 2.85, 3.42%, ether extract 3.24, 3.70, 4.11%, lactose 4.42, 4.60, 5.44%, ash 0.54, 0.50, 0.53% and non-fat solids 7.46, 8.02, 9.41% for the age groups of dairy cows (1.8-2, 2.5-4, 4.5-6.5) years respectively (table 2). The results presented in Table (2) indicate that the age of the animal had a significant effect on rates of milk production and the reason is attributed to the fact that milk production increases with the age of the animal]19[. Some researchers have explained that the increase in milk production and its components is due to genetic traits linked to the breed to which belongs the animal]3[Also, the result was consistent with]9[who indicated that there were significant positive relationships between the genetic and phenotypic correlations of cows and milk production, as well as between 4% corrected milk production and other body measurements. Results of the current study reinforced by]19[showed that the body condition of dairy cows had a significant effect on weekly milk production, total milk production, and fat percentage compared to the low body condition of animals.This confirms that cows are in good body condition when breeding. In addition to providing feed with high nutritional value to obtain desired productive and reproductive traits that help manage them during the different stages of production in order to increase their fertility]22,24[.

Table 2 Effect of age on milk yield and its composition of Holstein dairy cattle

Parameters	First treatment Small age (young) (1.8-2) year	Second treatment Medium age (2.50-4.00) year	Third treatment Adult age (4.50-6.50) year
No. of cows	8	8	8
Daily milk yield (kg)**	8.500 ± 0.25 c	11.360 ± 0.46 b	15.268 ± 0.33 a
Crude protein (%)**	2.50 ± 0.11 b	2.85 ± 0.22 ab	3.42± 0.20 a
Ether Extract (%)**	3.24 ± 0.06 b	3.70 ± 0.09 a	4.11 ± 0.19 a
Lactose sugar (%)**	4.42 ± 0.20 b	4.60 ± 0.25 b	5.44 ± 0.15 a
Ash (%) NS	0.54 ± 0.03 a	0.50± 0.04 a	0.53 ± 0.02 a
Solids non-fats (%)**	7.46 ± 0.13 c	8.02 ± 0.22 b	9.41 ± 0.16 a

NS: Non-Significant, *: Significant differences at 0.05, **: High significant differences at 0.01

Body Parameters

It was noted from the results shown in Table (3) that there is a highly significant effect (P≤0.01) of live weight between heavyweight (450-650 kg) and medium weights (250-400 kg) and light weights (150-200 kg) in an average of different body measurements of dairy cows. The chest circumferences were 168.120, 177.126, and 185.005cm,abdominal circumferences were 140.250, 151.750, and 162.250 cm, body height at the front of body were 129.75, 132.00, and 144.00 cm, body

height at the end of back body were 132.00, 134.50, and 146.250 cm and body length were 70.88, 80.75, and 89.12 cm for the three treatments respectively.These results showed a highly significant increase (P≤0.05) in favor of heavyweights in measurements of abdominal, and chest circumferences, body height at the front of the animal and at the end of the back body of dairy cows compared to the medium and light weights of cows (table 3). This is attributed to the presence of positive and significant correlation coefficients between live weight and studied body measurements. The correlation coefficient values were (0.76, 0.84, 0.77, 0.86, and 0.78) between the live weight of cows and measurements of body length, chest circumference, abdominal circumference and body height at the front and rear body respectively (table 4).

Table 3 Effect of live weight on body parameters of Holstein dairy cattle

Parameters	First treatment Light weight (150-200) kg	Second treatment Medium weight (250-400) kg	Third treatment Heavy weight (450-650) kg
No. of cows	8	8	8
Chest circumference (cm)**	168.120 ± 2.39 c	177.126 ± 2.91 b	185.005 ± 2.04 a
Abdominal circumference (cm)**	140.250 ± 2.39 b	151.750 ± 4.71 a	162.250 ± 3.06 a
Height of the front body (cm)**	129.75 ± 2.75 b	132.00 ± 3.26 b	144.00 ± 1.00 a
Body background height (cm)**	132.00 ± 2.64 b	134.50 ± 3.68 b	146.25 ± 1.11 a
Body length (cm)**	70.88 ± 2.20 c	80.75 ± 1.81 b	89.12 ± 0.97 a

NS: Non-Significant, *: Significant differences at 0.05, **: High significant differences at 0.01

Table 4.Correlation coefficients between live weight and various body measurements of Friesian dairy cattle

Correlation coefficients	
Body parameters	**Body weight**
Body weight	1.0000
Body length	0.76**
Chest circumference	0.84**
Abdominal circumference	0.77**
Body height in front	0.86**
Body height at butt	0.78**

As for effects of animal age, the results shown of the current study confirmed the appearance of a highly significant increase (P≤0.01) in all body measurements (table 5) in favor of the mature cows' group (4.5-6.5 years) over the middle-aged and young cows' groups except chest circumference and body length which no significant effect among treatments. The rates of chest circumference reached 155.683, 172.520, and 181.463 cm, abdominal circumference reached 140.74, 150.50, and 162.00 cm, body height at the front of the animal reached 114.50, 123.25, and 132.30 cm, and body height at the rear of the animal reached 116.75, 125.25, and 134.53 cm for

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small age, medium, and adult ages respectively (table 5). It is noted from the results that there is

a highly significant increase in most of the body measurements of dairy cows which is attributed to the presence of positive significant correlation coefficients (P≤0.01) between the age of dairy cows and body measurements studied (table 6). The values of the correlation coefficients between the age of dairy cows and body measurements represented for body length, chest circumference, abdominal circumference, and body height at front and rear body and body weight were as follows 0.79, 0.92, 0.93, 0.78, 0.94, and 0.78 (table 6 .(

The results of the study agreed with the results of]1 [who showed the existence of a highly significant correlation coefficient (P≤0.01) between the live weight of Kardiya calves and different body measurements. They noticed a significant increase in the averages of abdominal circumference and body height in the front and rear of the local Kardiya calves' groups. Also, the results of this study were supported by]7[who mentioned the existence of highly significant and positive correlation coefficients between the live weight of the southern Iraqi calves and different body measurements of the calves. The results of the current study were consistent with what was found by researchers]7[who confirmed the existence of a high significant improvement (p≤0.01) in body weight and condition in favor of the cows' group with high body condition which was positively and significantly reflected on growth improvement of their offspring compared to the growth and weights of cows and their offspring with poor body condition.

Table 5 Effect of age on body parameters of dairy cattle

Parameters	First treatment Age (1.8-2) years	Second treatment Age (2.50-4.00) years	Third treatment Age (4.50-6.50) years
No. of cows	8	8	8
Chest circumference (cm)^{NS}	155.683 ± 2.00 c	172.520± 3.30 b	181.463 ± 1.94 a
Abdominal circumference (cm)**	140.74 ± 1.88 c	150.50 ± 2.72 b	162.00 ± 1.20 a
Height of the front body (cm)*	114.50 ± 1.32 c	123.25 ± 1.93 b	132.30 ± 0.33 a
Body background height (cm)*	116.75 ± 1.65 c	125.25 ± 1.25 b	134.53 ± 1.79 a
Body length (cm)^{NS}	69.500 ± 2.69 c	79.500 ± 2.48 b	88.250 ± 0.70 a
Body weight (kg)**	200.900 ± 16.95 c	359.040 ± 16.77 b	445.390 ± 19.84 a

NS: Non-Significant, *: Significant differences at 0.05, **: High significant differences at 0.01

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Table 6 Correlation coefficients between age and various body measurements of Friesian dairy cattle.

Correlation coefficients	
Body parameters	**Age**
Age	1.00
Body length	0.79**
Chest circumference	0.92**
Abdominal circumference	0.93**
Body height in front	0.78**
Body height at butt	0.94**
Body weight	0.78**

) ** P≤0.01 (

CONCLUSION

The results of the current study indicate the effective and influential role of some factors affecting the productive performance and body measurements of dairy cows in causing significant changes in milk production and its chemical composition and changes in different body measurements and sizes. The results of the studied traits showed a highly significant increase in daily milk production accompanied by a significant improvement in milk components in favor of high and medium weights dairy cows. As for the effect of the age of dairy cows on the productive performance of milk, and body measurements.The results showed a significant improvement in milk production and its contents of nutritional compounds that extended from the fourth season until the end of the sixth season of milk production.In addition,all body measurements improved significantly in favor of the ages of (4.5-6.5 years) compared to young and middle-aged cows. The current study recommends for necessity of directing private breeders and associations towards raising dairy cows with relatively high weights exceeding 300 kg and ages ranging between 4-6 years due to their high yield in milk production which begins to gradually increase from the fourth season and continues to increase until reaching the seventh season.

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