Research article
iMedPub Journals
http://www.imedpub.com/
Journal of Animal Research and Nutrition
ISSN 2572-5459
2019
Vol.4 No.2:5

DOI: 10.36648/2572-5459.4.2.55

Milk Yield and Blood Biochemical Components in Local and Crossing Bovine Cows

Habeeb AAM*, El-Masry KA, Gad AE and Basuony HA

Department of Biological Applications, Radioisotopes Applications Division, Nuclear Research Center, Atomic Energy Authority, Inshas, Cairo, Egypt

***Corresponding author**: Habeeb AAM, Department of Biological Applications, Radioisotopes Applications Division, Nuclear Research Center, Atomic Energy Authority, Inshas, Cairo, Egypt, Tel: +201014456768; E-mail: dr_alnaimy@yahoo.com

Received date: June 27, 2019; **Accepted date**: July 21, 2019; **Published date**: August 04, 2019

Citation: Habeeb AAM, El-Masry KA, Gad AE, Basuony HA (2019) Milk yield and blood biochemical components in local and crossing bovine cows. J Anim Res Nutr 4: 2: 5.

Copyright: © 2019 Habeeb AAM, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract

The objective of this study was to evaluate the milk yield, milk composition and blood biochemical components as well as body weight and daily gain of newborn calves produced from local and their crossing bovine cows under desert of Inshas area at Egypt. Twenty one pregnant cows in first parity chosen according to the nearest calving day were used in the experiment. Experiment was carried out during last stage of pregnancy (four weeks before birthing) and continued to calving and 8 weeks postpartum. Experimental pregnant cows including three equal groups, each group was 7 cows. 1st group was Local bovine cows (L) while 2nd group was F_1 crossbred (H) cows; (50%, Local cows x Holstein bull) and 3rd group was F_1 crossbred (BS) cows; 50% (Local cows x Brown Swiss bull). Results showed that H cows have a highest daily milk yield and daily milk components while L cows have lowest values. Milk energy during 1st week post-partum was higher than milk energy during 4th or 8th week post-partum. Fat corrected milk yield was significantly positive correlated with milk components and was significantly negative correlated with milk energy.

Crossing cows have significantly higher total protein and albumin concentrations than L cows. Total protein, globulin and γ-globulin concentrations at parturition were significantly higher than its concentrations at late gestation period and during 8th week from lactation period. Glucose, total lipids, total cholesterol and triglycerides concentrations were not differs significantly between local cows and their crossing. Glucose and total cholesterol concentrations showed significant increase at late gestation period as well as at parturition compared with its concentrations at 8th week of lactation period. Crossing cows have significantly higher urea concentration and T_4, T_3 and Estradiol$_{17β}$ levels than its levels in L cows. Body weight of newborn both male and female calves as well as daily body weight gain of calves produced from crossing cows were higher significantly than newborn calves produced from L cows with priority to calves produced from H cows. In addition, male calves at birthing, after 4th and 8th weeks from birthing were heavier in weight and faster in growth than female ones in the three genotype breeds.

Keywords: Crossing; Cows; Milk yield; Milk components; Hormones; Born calves

Introduction

Animal protein is considered the most fundamental elements in the issue of food security in Egypt due to limited production increase of livestock sources and relies on imports from abroad [1]. Therefore it is necessary to pay attention to the dairy activity for closing the food gap of animal protein. Milk product is ranking the second in contributing to the value of animal production (26.66% of the total animal production). Milk contributes greatly to meet the needs of the body of calcium, magnesium, selenium, vitamin riboflavin, vitamin B12 and Pantothenic acid. So, milk is closest to perfection because it contains most of the nutrients that provide the human body with most food and necessary requirements [2].

Dairy cattle in Egypt play an important role for improving human nutrition as well as national income. Number of dairy cattle in Egypt is equal to 4,410,000 head at 2019 [3]. However, about 90% of dairy cattle in Egypt are local and non-descriptive type, which is termed as indigenous cows. Milk production of indigenous cows is much lower than that of superior breeds. Therefore, Egypt has been suffering from an acute shortage of milk and milk products. The low productivity of a local milking cow in Egypt is due to poor genetic characteristics. Considering the above circumstances, the present research work has been undertaken with the objectives to compare the productive performance of indigenous and its crossbred dairy cows in order to suggest the genotype suitable for sustainable small scale dairy farming in Egypt.

The objective of this study was to evaluate the milk yield, milk composition and blood biochemical components as well as body weight and daily gain of newborn calves produced from indigenous cows and their crossbred of different exotic dairy cows under desert of Inshas area at Egypt.

Materials and Methods

Experimental location and ethics

The present study was conducted in bovine farm project, Experimental Farms Project, Biological Application Department, Radioisotopes Applications Division, Nuclear Research Centre, Atomic Energy Authority, Inshas, Cairo, Egypt (latitude 31^0 12' N to 22^0 2' N, longitude 25^0 53' E to 35^0 53' E). This work was reviewed and approved by the Animal Care and Welfare Committee of Egyptian Atomic Energy Authority standard operating procedures. These ethics contain relevant information on the endeavor to reduce animal suffering and adherence to best practices in veterinary care according to the International Council for Laboratory Animal Science guidelines. The experimental procedures were carried out according to the Local Experimental Animals Care Committee and approved by the institutional ethics committee.

Animals feeding

Experimental cows were fed the ration consisted of Concentrate Feed Mixture (CFM) and Rice Straw (RS). The ingredients as percentage of the CFM were 40 crushed yellow maize, 25.5, wheat bran, 25.0 undecorticated cotton seed meal, 7.0 soybean meal, 1.0 dicalcium phosphate,1.0 sodium chloride, 0.5 mineral mixture and 50 g vitamins mixture (AD_3E). Chemical composition of the feed stuffs used in the feeding of the experimental cows were 89.8, 94.0, 15.7, 8.5, 2.7, 67.2 and 6.0% in CFM and 92.3, 83.5, 3.2, 32.7, 1.8, 44.6 and 17.7% in RS for DM, OM, CP, CF, EE, NFE and Ash, respectively (on DM basis% according to AOAC) [4]. Calculated nutritive values of the feed stuffs were 4.00 and 1.60 for net energy (MJ/kg DM), 60.82 and 30.00 for total digestible nutrients (%), 115.0, 0.00 for digestible crude protein (g/kg DM) and 0.50 and 0.20 for starch equivalent in CFM and RS, respectively. Feed CFM was offered once daily at 10 hrs while RS was offered *ad libitum* at midday.

Experimental design

Twenty one pregnant cows in first parity with nearly similar age and chosen according to the nearest calving day were used in the experiment. Experiment carried out during last stage of pregnancy as detected by rectal palpation test and continued until calving and 8 weeks postpartum. Animals were monitored from four weeks before birthing and 8 weeks after parturition.

Averages of ambient temperature and relative humidity during experimental weeks (October, November and December of 2016) were 24.5 ± 0.5 and 65.5 ± 2.6, respectively. Experimental pregnant cows including three equal groups, each group was 7 cows. 1st group was Local bovine cows (native indigenous cows, L) while 2nd group was F1 crossbred Holstein (H) cows (50%, Local cows x Holstein bull) and 3rd group was F1 crossbred Brown Swiss (BS) cows 50% (Native cows x Brown Swiss bull). Averages body weight of the three experimental cows in the beginning of the experiment were 401 ± 2, 478.5 ± 3.1 and 435 ± 3.2 kg in L, HF and BS, respectively.

Different genotype cows were maintained under same feed and farmer's management system. Born calves for the three genotype cows either male or female, were recorded and weighted at delivery time (at birth) and after 4 and 8 weeks from birthing. Average daily body weight gains of calves were also calculated from birthing to 8^{th} weeks of age. The calves were left with their mothers all time to suckling their milk.

Animals management

Each genotype breed type of pregnant cows was served in one yard. The experimental cows were left loose day and night during the experimental period in three separate soil floored yards (40x40 m) surrounded with wire fence (1.5 m height). One-third of the surface area of the yard was covered with concrete shading roof in the middle (3.5 m height) with natural ventilation. Each yard was provided also with troughs and source of drinking water to be available automatically at all time to the calves.

Animals milking, milk yield and milk analysis

Milk yield of each cow was estimated after 1^{st}, 4^{th} and 8^{th} weeks postpartum using hands milking once a day. Before the recording day, the calves were kept away from their dams by twenty four hours before hand milking. Representative milk samples of about 100 ml had taken from milk of each cow after 1^{st}, 4^{th} and 8^{th} weeks postpartum and were stored frozen immediately (-20°C) until analysis.

Fat, protein, lactose and ash content in milk samples as g/100 ml milk were determined based on inter-ferometry FTIR (Fourier Transformed Infra-Red analysis) using Milko-Scan analyzer ®, 133 B, N. FOSS, Electric, Denmark. Milk compositions as g/day were also calculated by multiplying milk yield (kg/day) by milk components as g/100 ml milk. Milk energy (MJ/kg) was computed using the multiple regression equation as following:

Milk gross energy=0.386F+0.205 SNF–0.236 where F and SNF represent percentages of fat and solids-not-fat, respectively [5].

Blood sampling and biochemical and hormonal analysis

At 4^{th} week pre-partum, at parturition and after 8^{th} week post-partum, single blood sample was withdrawn from each cow before the morning feed from the jugular vein by jugular venipuncture using disposable syringes. Blood samples with EDTA as anticoagulation were withdrawn and all tubes were placed immediately on ice-box and were transferred to the laboratory.

Plasma was separated by centrifugation (2000X g for 30 min.) and stored at -20^0C until the hormones and blood components determinations. T_3, T_4 and Estradiol$_{17\beta}$ (E_2) hormones were estimated using Radioimmunoassay technique by commercial kits provided by diagnostic product corporation, Los Angeles, USA. The unknown samples or standards are incubated with ^{125}1-labeled hormone in antibody-coated tubes. After incubation, the liquid contents of the tube are aspirated and the radioactivity is determined in computerized gamma counter. The tracer in the three hormones was labeled with iodine-125 (^{125}I). The sensitivity of E_2 assay was 5.00 pg/ml and the respective intra- and inter-assay coefficients of variation were 5.7% and 7.4% for E_2, 9.2 and 8.5 for T_3 and 7.5 and 4.6 for T_4, respectively.

Total protein, albumin, γ-globulin, glucose, urea, creatinine, total cholesterol, triglycerides and total lipids concentrations were estimated using reagent kites manufactured by Diamond Diagnostic Company (Egypt). Globulin value was calculated by subtraction of albumin value from their corresponding total protein value. All determinations were carried out in the tracer bioclimatology unit, Department of Biological Applications, Nuclear research center, Atomic Energy Authority, Inshas, Cairo, Egypt.

Statistical analysis

Data were statistically analyzed using procedure of SAS software [6] according the following model: $Y_{ijk}=\mu+G_j+T_j+GT_{ij}+e_{ijk}$ where μ=The overall mean, G_i=The fixed effect of the genetic group (1=L, 2=H crossing and 3=BS crossing), T_j=The fixed effect of time (1= 4 weeks pre-partum, 2=At parturition and 3=8 weeks post-partum), GT_{ij}=The interaction between the genetic breed and time and e_{ijk}=Random error. Significance of the difference between the means was verified by Duncan's new multiple ranges test [7]. Correlation coefficients between daily fat corrected milk yield (kg) and each of daily milk components (g) and milk energy (MJ/kg milk) were also calculated.

Results

Milk yield, compositions and milk energy

Average daily milk yield was differs significantly between local cows and their crossing cows. H crossbred cows have a highest daily milk yield while L cows have a lowest daily milk yield. BS crossbred cows have daily milk yield lower significantly than daily milk yield of H cows and higher than daily milk yield of L cows. Milk yield generally rose with time postpartum.

Average daily milk yield in both L and their crossbred cows increased with increasing time postpartum. The lowest daily milk yield was during 1st week post-partum while the highest daily milk yield was during 8th week post-partum. Similarly, milk yield corrected fat 3.5% obtained the same trend. Milk compositions (total solids, fat, protein, lactose and ash) as g/100 ml milk were not differs significantly between local cows and their crossing after calving. Milk compositions (g/100 ml milk) during 1st week post-partum were higher than those recorded during 4th or 8th week post-partum **(Table 1)**.

Table 1: Milk yield (kg/day) and composition (g/100 ml) in local bovine cows and their crossing with Holstein or Brown Swiss bulls

Milk yield and composition	Weeks post-partum	Native cows (7)	Holstein crossing cows (7)	Brown Swiss crossing cows (7)	Overall mean
Milk yield, kg/day	1st week postpartum	$4.18^c \pm 0.23$	$6.68^a \pm 0.19$	$5.48^b \pm 0.21$	$5.45^C \pm 0.72$
	4th week postpartum	$5.78^c \pm 0.23$	$8.18^a \pm 0.19$	$6.98^b \pm 0.18$	$6.98^B \pm 0.69$
	8th week postpartum	$6.98^c \pm 0.07$	$10.25^a \pm 0.2$	$8.15^b \pm 0.19$	$8.46^A \pm 0.96$
	Overall mean	$5.65^c \pm 0.81$	$8.37^a \pm 1.04$	$6.87^b \pm 0.77$	
Milk fat corrected (3.5%)	1st week postpartum	$3.95^c \pm 0.15$	$6.23^a \pm 0.18$	$5.14^b \pm 0.16$	$5.11^C \pm 0.78$
	4th week postpartum	$6.13^c \pm 0.18$	$8.35^a \pm 0.18$	$7.23^b \pm 0.15$	$7.24^B \pm 0.69$
	8th week postpartum	$7.45^c \pm 0.18$	$10.61^a \pm 0.2$	$8.57^b \pm 0.18$	$8.88^A \pm 0.77$
	Overall mean	$5.84^c \pm 1.02$	$8.40^a \pm 1.27$	$6.98^b \pm 1.0$	
Milk total solids, g/100ml	1st week postpartum	13.31 ± 0.08	13.37 ± 0.14	13.35 ± 0.09	$13.34^A \pm 0.02$
	4th week postpartum	11.95 ± 0.10	12.11 ± 0.05	12.18 ± 0.11	$12.08^B \pm 0.07$
	8th week postpartum	11.94 ± 0.08	12.09 ± 0.07	12.09 ± 0.06	$12.05^B \pm 0.05$
	Overall mean	12.40 ± 0.45	12.53 ± 0.42	12.55 ± 0.40	
Milk fat, g/100ml	1st week postpartum	3.70 ± 0.04	3.75 ± 0.05	3.73 ± 0.08	$3.73^A \pm 0.01$
	4th week postpartum	3.30 ± 0.04	3.43 ± 0.06	3.38 ± 0.06	$3.37^B \pm 0.04$
	8th week postpartum	3.28 ± 0.05	3.38 ± 0.06	3.33 ± 0.05	$3.33^B \pm 0.03$
	Overall mean	3.43 ± 0.14	3.52 ± 0.12	3.48 ± 0.13	
Milk protein, g/100ml	1st week postpartum	3.93 ± 0.06	3.98 ± 0.08	4.00 ± 0.06	$3.97^A \pm 0.02$
	4th week postpartum	3.58 ± 0.05	3.60 ± 0.04	3.65 ± 0.06	$3.61^B \pm 0.02$
	8th week postpartum	3.58 ± 0.05	3.58 ± 0.05	3.63 ± 0.06	$3.60^B \pm 0.02$

© Under License of Creative Commons Attribution 3.0 License

	Overall mean	3.70 ± 0.12	3.72 ± 0.13	3.76 ± 0.12	
Milk lactose, g/100ml	1st week postpartum	4.85 ± 0.03	4.80 ± 0.04	4.80 ± 0.04	4.82^{A} ± 0.02
	4th week postpartum	4.35 ± 0.06	4.35 ± 0.06	4.40 ± 0.07	4.37^{B} ± 0.02
	8th week postpartum	4.35 ± 0.06	4.40 ± 0.07	4.43 ± 0.09	4.39^{B} ± 0.02
	Overall mean	4.52 ± 0.17	4.52 ± 0.14	4.54 ± 0.13	
Milk ash, g/100ml	1st week postpartum	0.83 ± 0.02	0.84 ± 0.03	0.82 ± 0.03	0.83^{A} ± 0.01
	4th week postpartum	0.72 ± 0.02	0.73 ± 0.03	0.75 ± 0.02	0.73^{B} ± 0.01
	8th week postpartum	0.74 ± 0.02	0.74 ± 0.02	0.72 ± 0.02	0.73^{B} ± 0.01
	Overall mean	0.76 ± 0.03	0.77 ± 0.04	0.76 ± 0.03	

$^{a, b, c}$: Different letters in overall mean row of each parameter are differed significantly (p<0.05)

$^{A, B, C}$: Different letters in overall mean column of each parameter are differed significantly (p<0.05)

Concern daily milk components as g per day, H cows have highest daily milk components while L cows have lowest daily milk components. Brown crossing cows have daily milk components lower significantly than daily milk components of H crossing cows and higher than daily milk components of L cows **(Table 2)**.

Generally, average daily milk components in both local and their crossing cows increased with increasing time post-partum. Concern milk energy, no significant difference between the three breeds was found. Milk energy (MJ/kg milk) during 1st week post-partum was higher than milk energy during 4th or 8th week post-partum without significant difference between 4th and 8th weeks **(Table 2)**.

Correlation coefficients between daily fat corrected milk yield (kg) and each of daily milk components (g) and milk energy (MJ/kg milk) are in **Table 3**.

Table 2: Daily milk composition (g) in local bovine cows and their crossing with Holstein or Brown Swiss bulls

Daily milk composition	Weeks post-partum	Native cows (7)	Holstein crossing cows (7)	Brown Swiss crossing cows (7)	Overall mean
Daily milk solids, g	1st week postpartum	55.64^{c}	89.31^{a}	73.16^{b}	72.70^{C} ± 9.7
	4th week postpartum	69.07^{c}	99.06^{a}	85.02^{b}	84.38^{B} ± 8.7
	8th week postpartum	83.34^{c}	123.92^{a}	98.53^{b}	101.9^{A} ± 11.9
	Overall mean	70.06^{c} ± 8.0	104.9^{a} ± 10.3	86.22^{b} ± 7.3	
Daily milk fats, g	1st week postpartum	15.47^{c}	25.05^{a}	20.44^{b}	20.32^{C} ± 2.8
	4th week postpartum	21.39^{c}	30.68^{a}	23.59^{b}	25.22^{B} ± 2.8
	8th week postpartum	22.89^{c}	34.65^{a}	27.14^{b}	28.23^{A} ± 3.4
	Overall mean	19.38^{c} ± 2.3	29.46^{a} ± 2.8	23.91^{b} ± 1.9	
Daily milk protein, g	1st week postpartum	16.43^{c}	26.59^{a}	21.92^{b}	21.65^{C} ± 2.9
	4th week postpartum	20.69^{c}	29.45^{a}	25.48^{b}	25.21^{B} ± 2.5
	8th week postpartum	24.99^{c}	36.70^{a}	29.58^{b}	30.42^{A} ± 3.4
	Overall mean	20.91^{c} ± 2.5	31.14^{a} ± 3.0	25.83^{b} ± 2.2	
Daily milk lactose, g	1st week postpartum	20.27^{c}	32.06^{a}	26.30^{b}	26.21^{C} ± 3.4
	4th week postpartum	25.14^{c}	35.58^{a}	30.71^{b}	30.48^{B} ± 3.0
	8th week postpartum	30.36^{c}	45.10^{a}	36.10^{b}	37.19^{A} ± 4.3
	Overall mean	25.54^{c} ± 2.9	35.57^{a} ± 3.9	31.19^{b} ± 2.8	
Daily milk ash, g	1st week postpartum	3.47^{c}	5.61^{a}	4.49^{b}	4.52^{C} ± 0.62
	4th week postpartum	4.16^{c}	5.97^{a}	5.24^{b}	5.12^{B} ± 0.53
	8th week postpartum	5.17^{c}	7.59^{a}	5.87^{b}	6.21^{A} ± 0.72

	Overall mean	$4.29^c \pm 0.49$	$6.44^a \pm 0.61$	$5.22^b \pm 0.40$	
Milk energy, MJ/kg	1st week postpartum	3.16	3.18	3.17	$3.17^A \pm 0.01$
	4th week postpartum	2.8	2.86	2.86	$2.84^B \pm 0.02$
	8th week postpartum	2.81	2.85	2.85	$2.84^B \pm 0.01$
	Overall mean	2.92 ± 0.12	2.96 ± 0.11	2.96 ± 0.11	

$^{a, b, c}$: Different letters in overall mean row of each parameter are differed significantly (p<0.05)
$^{A, B, C}$: Different letters in overall mean column of each parameter are differed significantly (p<0.05)

Fat corrected milk yield was significantly positive correlated with daily yield each of total solids, fat, protein and lactose. Fat corrected milk yield was significantly negative correlated with daily milk energy. Milk total solids was significantly positive correlated with fat, protein and lactose and was significantly negative correlated with milk energy. Milk fat was significantly positive correlated with protein and lactose and was significantly negative correlated with milk energy. Milk protein was significantly positive correlated with lactose and was significantly negative correlated with milk energy. Milk lactose was significantly negative correlated with milk energy.

Blood biochemical components

Protein fractions: Crossing cows have significantly higher total protein and albumin concentrations than L cows. Total protein and albumin concentrations were significantly higher in H cross cows than in BS ones.

Table 3: Correlation coefficients between daily fat corrected milk yield (kg) and each of daily milk components yield (g) and milk energy (MJ/kg milk).

Items	Daily milk components yield, g				Milk energy, MJ/kg milk
	Total solids	Fat	Protein	Lactose	
Corrected milk yield, kg	0.953**	0.944**	0.956**	0.959**	-0.684**
Total solids, g/day		0.977**	0.999**	0.999**	-0.439*
Fat, g/day			0.976**	0.974**	-0.489*
Protein, g/day				0.999**	-0.448*
Lactose, g/day					-0.453*

*P < 0.05 and ** p< 0.01

Table 4: Blood biochemical of protein metabolites concentrations in local bovine cows and their crossing with Holstein or Brown Swiss bull pre and post-partum.

Protein metabolites	Weeks pre and post-partum	Native cows (7)	Holstein crossing cows (7)	Brown Swiss crossing cows (7)	Overall mean
Total protein, g/dl	4 weeks pre-partum	$7.85^b \pm 0.03$	$8.23^a \pm 0.06$	$8.30^a \pm 0.04$	$8.13^A \pm 0.12$
	At parturition	$7.10^b \pm 0.04$	$8.28^a \pm 0.06$	$7.18^b \pm 0.05$	$7.52^B \pm 0.05$
	8 weeks post-partum	$7.83^b \pm 0.05$	$8.33^a \pm 0.06$	$8.28^a \pm 0.05$	$8.15^A \pm 0.14$
	Overall mean	$7.59^c \pm 0.21$	$8.28^a \pm 0.29$	$7.92^b \pm 0.32$	
Albumin, g/dl	4 weeks pre-partum	$3.85^b \pm 0.06$	$4.53^a \pm 0.06$	$4.38^a \pm 0.05$	4.25 ± 0.21
	At parturition	$3.85^c \pm 0.03$	$4.50^a \pm 0.04$	$4.28^b \pm 0.05$	4.21 ± 0.19
	8 weeks post-partum	$3.90^c \pm 0.04$	$4.60^a \pm 0.04$	$4.25^b \pm 0.06$	4.25 ± 0.20
	Overall mean	$3.87^c \pm 0.02$	$4.54^a \pm 0.04$	$4.30^b \pm 0.01$	
Globulin, g/dl	4 weeks pre-partum	$4.00^a \pm 0.06$	$3.70^b \pm 0.06$	$3.92^a \pm 0.05$	$3.87^A \pm 0.07$
	At parturition	$3.25^b \pm 0.03$	$3.78^a \pm 0.04$	$2.90^c \pm 0.05$	$3.31^B \pm 0.23$
	8 weeks post-partum	$3.93^b \pm 0.04$	$3.73^c \pm 0.04$	$4.03^a \pm 0.06$	$3.90^A \pm 0.06$

© Under License of Creative Commons Attribution 3.0 License

	Overall mean	3.72 ± 0.17	3.74 ± 0.22	3.62 ± 0.03	
γ-globulin (Ig G), g/dl	4 weeks pre-partum	1.90 ± 0.15	1.93 ± 0.09	1.93 ± 0.11	1.92^A ± 0.01
	At parturition	1.73 ± 0.12	1.73 ± 0.06	1.75 ± 0.10	1.74^B ± 0.01
	8 weeks post-partum	1.93 ± 0.09	1.93 ± 0.05	1.95 ± 0.09	1.94^A ± 0.01
	Overall mean	1.85 ± 0.06	1.86 ± 0.07	1.88 ± 0.06	

$^{a, b, c}$: Different letters in overall mean row of each parameter are differed significantly (p<0.05)
$^{A, B, C}$: Different letters in overall mean column of each parameter are differed significantly (p<0.05)

No significant difference was observed between L and their crossing cows in globulin and γ- globulin concentrations **(Table 4)**.

Without breed type of cows, total protein, globulin and γ-globulin concentrations at parturition were significantly higher than its concentrations at late gestation period and during 8th week of lactation period. Albumin concentration was not affected significantly due to blood sampling time **(Table 4)**.

Glucose, lipids fractions and kidney function: Glucose, total lipids, total cholesterol and triglycerides concentrations were not differs significantly between L cows and their crossing **(Table 5)**. Without breed type of cows, glucose, total lipids, total cholesterol and triglycerides concentrations showed a significant increase at 4th week pre-partum and at parturition compared with its concentrations at 8th week of lactation period **(Table 5)**.

Table 5: Blood biochemical of energy metabolites concentrations and kidney function in local bovine cows and their crossing with Holstein or Brown Swiss bull pre and post-partum.

Items	Weeks pre and post-partum	Native cows (7)	Holstein crossing cows (7)	Brown Swiss crossing cows (7)	Overall mean
Glucose, mg/dl	4 weeks pre-partum	60.50 ± 1.04	61.30 ± 0.85	61.30 ± 1.25	61.03^A ± 0.27
	At parturition	52.80 ± 1.11	52.30 ± 1.25	52.30 ± 1.03	52.47^B ± 0.01
	8 weeks post-partum	44.30 ± 1.44	43.80 ± 1.11	44.50 ± 1.71	44.20^C ± 0.25
	Overall mean	52.53 ± 4.68	52.47 ± 5.06	52.70 ± 4.86	
Total lipids, mg/dl	4 weeks pre-partum	676.50 ± 16.08	672.50 ± 14.4	676.75 ± 16.6	675.25^A ± 1.19
	At parturition	652.5 ± 19.31	675.0 ± 11.90	662.5 ± 22.13	663.33^A ± 5.64
	8 weeks post-partum	615.0 ± 11.90	613.8 ± 14.63	602.5 ± 17.97	610.42^B ± 3.44
	Overall mean	648.0 ± 15.50	653.8 ± 17.33	647.3 ± 19.70	
Total cholesterol, mg/dl	4 weeks pre-partum	189.50 ± 3.88	191.25 ± 4.31	193.25 ± 3.61	191.33^A ± 1.08
	At parturition	177.00 ± 3.98	180.25 ± 5.01	180.00 ± 4.42	179.08^B ± 1.05
	8 weeks post-partum	164.50 ± 2.90	166.50 ± 4.79	174.25 ± 4.77	168.42^C ± 2.98
	Overall mean	177.00 ± 7.23	179.33 ± 7.17	182.50 ± 5.63	
Triglycerides, mg/dl	4 weeks pre-partum	76.00 ± 1.08	76.50 ± 1.26	76.25 ± 1.18	76.25^A ± 0.15
	At parturition	76.25 ± 1.31	77.00 ± 1.96	75.25 ± 1.80	76.17^A ± 0.51
	8 weeks post-partum	70.25 ± 2.25	69.00 ± 2.04	68.50 ± 3.18	59.25^B ± 0.52
	Overall mean	70.83 ± 4.58	70.83 ± 5.13	70.00 ± 4.99	
Urea, mg/dl	4 weeks pre-partum	32.8^b ± 1.25	36.0^a ± 0.91	36.0^a ± 1.22	34.92^A ± 1.08
	At parturition	25.8^b ± 0.85	30.5^a ± 1.76	30.5^a ± 1.04	28.92^B ± 1.59
	8 weeks post-partum	20.3^b ± 1.38	26.5^a ± 1.55	25.8^a ± 1.25	24.20^C ± 2.30
	Overall mean	26.30^b ± 2.26	31.00^a ± 1.59	30.77^a ± 1.60	
Creatinine, mg/dl	4 weeks pre-partum	1.00 ± 0.06	1.02 ± 0.10	1.04 ± 0.05	1.02^A ± 0.012
	At parturition	0.84 ± 0.03	0.84 ± 0.06	0.82 ± 0.04	0.83^B ± 0.007

	8 weeks post-partum	0.70 ± 0.06	0.72 ± 0.03	0.72 ± 0.06	0.71^{C} ± 0.007
	Overall mean	0.85 ± 0.09	0.86 ± 0.09	0.86 ± 0.09	

a, b, c: Different letters in overall mean row of each parameter are differed significantly (p<0.05)
A, B, C: Different letters in overall mean column of each parameter are differed significantly (p<0.05)

Concern kidney function, it is observed that crossing cows have significantly higher urea concentration than its concentration in L cows. While no significant difference was noted in creatinine concentration between L and their crossing cows. Urea and creatinine levels were significantly higher during the late gestation period than at parturition and significantly higher at parturition than concentrations during the 8th week of lactation period **(Table 5)**.

Hormonal level: Crossing cows either H or BS have significantly higher T_4, T_3 and Estradiol$_{17\beta}$ levels than its levels in L cows. Levels of T_4, T_3 and Estradiol$_{17\beta}$ hormones at late gestation period were significantly higher than at partum and the later was significantly higher than during 8^{th} week post-partum period **(Table 6)**.

Table 6: Hormonal levels in local bovine cows and their crossing with Holstein or Brown Swiss bulls pre and post-partum

Hormonal levels	Weeks pre and post-partum	Native cows (7)	Holstein crossing cows (7)	Brown Swiss crossing cows (7)	Overall mean
T4, nmol/l	4 weeks pre-partum	105.85^{b} ± 1.2	125.55^{a} ± 2.3	124.28^{a} ± 1.5	118.56^{A} ± 0.48
	At parturition	100.70^{b} ± 1.2	121.65^{a} ± 2.6	122.28^{a} ± 1.4	114.88^{B} ± 0.46
	8 weeks post-partum	84.43^{b} ± 2.0	95.98^{a} ± 2.1	95.83^{a} ± 1.9	92.08^{C} ± 0.49
	Overall mean	96.99^{b} ± 9.7	114.39^{a} ± 9.3	114.13^{a} ± 9.2	
T3, nmol/l	4 weeks pre-partum	2.98^{b} ± 0.08	4.00^{a} ± 0.06	4.05^{a} ± 0.06	3.68^{A} ± 0.02
	At parturition	2.58^{b} ± 0.06	3.20^{a} ± 0.04	3.20^{a} ± 0.04	2.99^{B} ± 0.01
	8 weeks post-partum	2.35^{b} ± 0.06	2.93^{a} ± 0.06	2.98^{a} ± 0.08	2.75^{C} ± 0.01
	Overall mean	2.63^{b} ± 0.31	3.38^{a} ± 0.32	3.41^{a} ± 0.33	
Estradiol17β, pg/ml	4 weeks pre-partum	218.50^{a} ± 3.9	242.13^{a} ± 1.0	243.75^{a} ± 1.9	234.79^{A} ± 1.55
	At parturition	124.75^{b} ± 3.5	175.00^{a} ± 7.2	177.25^{a} ± 2.0	158.48^{B} ± 0.80
	8 weeks post-partum	113.00^{b} ± 4.9	153.53^{a} ± 2.7	156.50^{a} ± 6.6	141.01^{C} ± 1.09
	Overall mean	152.1^{b} ± 21.6	190.2^{a} ± 22.7	192.5^{a} ± 22.3	

a, b, c: Different letters in overall mean row of each parameter are differed significantly (p<0.05)
A, B, C: Different letters in overall mean column of each parameter are differed significantly (p<0.05)

Body weight and gain of newborn calves from local and their crossing bovine cows

Body weight of newborn both male and female calves at birthing, after 4^{th} and 8^{th} weeks from birthing as well as daily body weight gain of calves produced from crossing bovine cows were significantly higher than newborn calves produced from L cows. Male and female calves produced from H cows were significantly heavier in weight and significantly faster in growth than those obtained from BS cows. In addition, male calves at birthing, after 4^{th} and 8^{th} weeks from birthing were significantly heavier in weight and faster in growth than female ones **(Table 7)**.

Table 7: Body weight and gain of newborn calves from native bovine cows and their crossing with Holstein or Brown Swiss bulls

Body weight (BW) and body gain of newborn calves	Sex and No	Native calves	Holstein crossing calves	Brown Swiss crossing calves	Overall mean
BW at birthing, kg	Male (4)	27.33^{b} ± 0.95	33.25^{a} ± 1.04	30.60^{a} ± 1.05	30.39^{A} ± 1.88
	Female (3)	26.67^{b} ± 0.58	30.33^{a} ± 0.22	28.00^{a} ± 0.53	28.33^{B} ± 1.07
	Overall mean (7)	27.29^{c} ± 0.71	32.00^{a} ± 0.95	29.3^{b} ± 1.11	
BW after 4 weeks from birthing, kg	Male (4)	39.53^{c} ± 1.18	52.80^{a} ± 0.59	48.90^{b} ± 1.20	47.08^{A} ± 1.94

© Under License of Creative Commons Attribution 3.0 License

	Female (3)	38.92^c ± 1.23	51.05^a ± 0.92	47.58^b ± 1.10	45.85^B ± 1.61
	Overall mean (7)	39.23^c ± 0.31	51.93^a ± 0.88	48.24^b ± 0.66	
BW after 8weeks from birthing, kg	Male (5)	58.67^c ± 0.58	76.50^a ± 0.90	67.00^b ± 2.05	67.39^A ± 1.16
	Female (2)	54.67^c ± 1.15	73.00^a ± 1.73	64.00^b ± 0.53	63.89^B ± 1.30
	Overall mean (7)	56.57^c ± 1.06	75.00^a ± 1.38	66.14^b ± 1.78	
Daily body gain, g/day	Male (5)	522.00^c ± 13.1	721.00^a ± 23.2	573.40^b ± 22.1	605.47^A ± 29.7
	Female (2)	466.67^c ± 16.8	711.00^a ± 26.3	583.50^b ± 17.9	587.06^B ± 30.6
	Overall mean (7)	488.00^c ± 17.3	716.71^a ± 22.4	576.29^b ± 19.6	

$^{a, b, c}$: Different letters in overall mean row of each parameter are differed significantly ($p<0.05$)
$^{A, B, C}$: Different letters in overall mean column of each parameter are differed significantly ($p<0.05$)

Discussion

Milk yield, milk components and milk energy

This variation in daily milk yield might be due to the variation in genetic makeup of different breeds of cows included in the study. Highest milk yield was observed for Holstein cross. The lowest milk yield and lowest birth weight of calves were found in local cows.

Concern milk energy, milk compositions (total solids, fat, protein, lactose and ash) as g/100 ml milk were not differs significantly between local and their crossing cows, therefore no significant difference between the three breeds in milk energy was found. The highest milk energy during 1st week post-partum may be due to the highest total solids values.

When daily fat corrected milk yield increase, milk components shall naturally increase; therefore fat corrected milk yield was significantly positive correlated with total solids, fat, protein and lactose and was significantly negative correlated with milk energy.

Results of the present study were also in line with several previous studies. Similarly, production performances of Holstein crossbred were superior to other dairy crossbreds [8,9]. Islam et al. [10] in Bangladesh found that the highest average milk yields per day per cow and total lactation yield per cow was observed in Holstein Friesian cross and concluded that Holstein Friesian cross showed better performance. Rahman et al. [11] found that the lowest average milk production in local cows and highest average milk production were observed in local x Friesian cows. Mamun et al. [12] and Bisrat and Nigussie [13] reported also that the daily and total milk yields were found significantly higher in Holstein crossbred than indigenous cows. Khoda et al. [14] found that there was a significant difference among the different genotypes of cow for daily milk yield; Holstein Friesian-Sahiwal-Local (L) had the highest daily milk production followed by 75% Holstein Friesian (HF)-25% Local, 62.5% HF-37.5% L, 50% Holstein Friesian (HF)-50% L while daily milk yield of Deshi (local) cow was lowest daily milk yield. Ayano [15] confirmed that the performance of crossbred cows for production traits had increased as exotic blood level increase cows with exotic blood level. Kassahun [16] studied the average daily milk yield for local and their crossbreed of different exotic blood level and concluded that crossbred cows were better than indigenous cow's in terms of their productive performance.

Blood biochemical components

Protein fraction: In our results data showed that the total protein and albumin levels were significantly affected by genotype breed and crossing cows have significantly higher levels than L cows. This may be due to that the crossing cows have best thyroid hormonal levels as shown in **Table 6**.

The total protein, globulin and γ-globulin levels were significantly affected from the physiological period and increased during lactation (8th weeks postpartum) if compared to late gestation 4th weeks pre-partum). The variations reflect the maternal requirements of proteins need for milking and providing immune-globulins [17,18]. The higher concentrate provided during the lactation is generally associated with higher levels of starch in the diet which increased production of propionic acid in the rumen and an increased microbial protein supply [19]. This is reflected, in our study, by an increase of total serum protein during the lactation and a slight decrease during the late gestation period.

Glucose and lipid profile: Glucose, total lipids, total cholesterol and triglycerides concentrations significantly affected by the physiological status and so the variation recorded in these metabolites concentrations during different physiological phases are expected. The lowest values in these components at 8th week of lactation period may be due to withdrawn of these metabolites in lactation process in udder of cows.

The transition from gestation to lactation is a period of great metabolic stress for dairy cows [20]. In fact, the milk production and its composition are found to profoundly influence the metabolically status of dairy cows [19]. Probably because, during the parturition and lactation period, there is an increase in the demands for regulatory mechanism, responsible for all the processes involved with milking [21]. At this purpose, characteristic changes in lipid metabolism were found during pregnancy and lactation in most mammals. Endocrine profiles change and lipolisis and lipogenesis are regulated to increase lipid reserve during pregnancy and subsequently, these reserves are utilized following parturition and the initiation of lactation [22]. Douglas et al. [23] demonstrating that concentrations of lipids increased at parturition despite the kind of fed administered.

Kidney function: Urea level was significantly affected by genotype breed and crossing cows have significantly higher levels than L cows. This may be due to that the crossing cows have higher protein metabolic efficiency of food nutrition than local cows. Therefore the end product of protein metabolism as urea increased in crossing cows relative to local cows.

The renal function, principally represented by urea and creatinine concentrations, was significantly affected during the different physiological phases. The lowest values in urea and creatinine in the blood during 8th week of lactation period may be due to withdrawn these metabolites in lactation process.

Despite the late gestation is strictly dependent on the dietary intake of proteins, more relevant during lactation because of the increased requirements [18]. The urea and creatinine levels showed the higher levels during the late pregnancy and early lactation due to that during the late gestation, the mother, for the fetal maternal circulation, assumes the load of organic waste of the newborn [24]. So, the increase in serum creatinine levels could be attributed to the development of the fetal musculature [18].

Hormonal level: Crossing cows either H or BS have significantly higher T_4, T_3 and $Estradiol_{17\beta}$ levels than those observed in L cows. The higher T_4, T_3 and $Estradiol_{17\beta}$ levels in crossing cows either H or BS than its levels in L cows may be due to that there are increases in the demands of these hormones for regulatory mechanism of processes of high milk yield in crossing cows.

Levels of T_4, T_3 and $Estradiol_{17\beta}$ hormones were significantly at late gestation period higher than at parturition and the levels of hormones at parturition were significantly higher than during 8^{th} week post-partum period. The lower levels of T_4, T_3 and $Estradiol_{17\beta}$ hormones at parturition and post-partum may be due to that the parturition and the post-partum periods are the most stressful physical stress phases in dairy cow productive life [25-28].

Body weight (BW) and body gain of newborn calve: Highest birth weight, body weight after 4 and 8 weeks and average daily gain of calves were observed for Holstein cross and lowest birth weight, body weight after 4 and 8 weeks and average daily gain of calves were found in local cows. El-fouly et al. [29] found that crossbreeding between BS bull and balady cows successes in increasing body weight at birth and at weaning as well as at 12 months of age in crossbred calves which considered an effective solution for improving low producing native cattle. The results of Atta et al. [30] showed that baladi X BS crossbred surpassed the baldy local cattle in growth and adaptability to heat stress conditions. Habeeb et al. [31] decided that growth traits of crossbred bovine calves were better than growth traits of purebred calves under both winter and summer seasons.

The variation in respect to live body weight and daily body gain in new born calves between indigenous and crossbred cows was attributed due to the genetic variation of the breeds.

Conclusion

Considering the overall performance it could be concluded that Holstein crossbred cows have a highest productive performance and are more suitable for sustainable and profitable dairy farming in the desert of Inshas area at Sharkia governorate, Egypt. We recommend that Governorate of Sharkia should be improving genetic potential of native breeds though crossing with Holstein bull to improve milk production and reach optimum production as a result of re enhance heterosis effect.

Conflict of Interest

The authors declare that they have no conflict of interest.

References

1. Mahrous, Hanan M (2016) Milk production and its role in food security in Egypt. Int J Chemtech Res CODEN (USA) 9: 329-340
2. Metwaly YM, Ali AI (2010) An economic study on dairy production and consumption in Egypt. Egypt J Agric Res 20: 141-150.
3. usda.gov/topics/animals
4. techstreet.com/standards/official-methods-of-analysis-of-aoac-international-18th-edition-revision-3?product_id=1678986
5. maff.go.jp/e/
6. support.sas.com/documentation/cdl/en/statug/63962/HTML/default/viewer.htm#titlepage.htm
7. Duncan DB (1955) Multiple range and multiple-F-tests. Biometrics 11: 1-42.
8. Mondal SC, Alam MM, Rashid MM, Ali MY, Hossain MM (2005) Comparative Study on the Productive and Reproductive Performance of Different Dairy Genotypes Reared in Bangladesh Agricultural University Dairy Farm. Pak J Nutr 4: 222-225.
9. Islam MA, Sarder MJU, Jahan SS, Islam MH (2016) Evaluate the productive and reproductive performance considering genotypes of dairy cows. Int J Food Sci Nutr 5: 10-15.
10. Islam MT, Shoshe NZ, Islam MT, Howlader MMR, Islam MS (2014) Evaluation of productive and reproductive performance of indigenous and crossbred dairy cows at Sylhet district in Bangladesh. J Sylhet Agril Univ 1:155-159.
11. Rahman MH, Ali MY, Juyena NS, Bari FY (2017) Evaluation of productive and reproductive performances of local and crossbred cows in Manikgonj district of Bangladesh. Asian J Med Biol Res 3: 330-334.
12. Mamun MJA, Khan MAS, Sarker MAH, Islam MN (2015) Productive and reproductive performance of Holstein Friesian crossbred and indigenous cow under small holder farming system. Bang J Anim Sci 44: 166-170.

© Under License of Creative Commons Attribution 3.0 License

13. Bisrat M, Nigussie H (2016) Comparative evaluation on productive and reproductive performance of indigenous and crossbred dairy cow managed under smallholder farmers in Endamehoni district, Tigray, Ethiopia. J Biol Agric Healthc 6: 96-100.

14. Khoda MS, Sarker NR, Bhuiyan AKFH, Bhuiyan MSA (2015) Evaluation of productive and reproductive performances of crossbred and Deshi dairy genotypes in Bangladesh. Int J Nat Soc Sci 2: 06-13

15. cgspace.cgiar.org/handle/10568/76178

16. cgspace.cgiar.org/handle/10568/77363

17. Mohri M, Sharifi K, Eidi S (2007) Hematology and serum biochemistry of Holstein dairy calves: age related changes and comparison with blood composition in adults. Res Vet Sci T 83:30–39.

18. Roubies N, Panouis N, Fytianou A, Katsoulos PD, Giadinis N, et al. (2006) Effects of age and reproductive stage on certain serum biochemical parameters of Chios sheep under greek rearing conditions. J Vet Med 53:277–281.

19. Heck JML, van Valenberg HJF, Djikstra J, van Hooijodonk ACM (2009) Seasonal variation in the Dutch bovine raw milk composition. J Dairy Sci 92: 4745–4755.

20. Rollin E, Berghaus RD, Rapnicki P, Godden SM, Overton MW (2010) The effect of injectable butaphosphan and cyanocobalamin on postpartum serum b Hydroxybutyrate, calcium and phosphorus concentrations in dairy cattle. J Dairy Sci 93: 978–987.

21. Krajnicakova M, Kovac G, Kostecky M, Valocky I, Maracek I, et al. (2003) Selected clinic-biochemical parameters in the puerperal period of goats. Bull Vet Inst Pulawy T 47:177–182

22. Roche JR, Frggens NC, Kay JK, Fisher MW, Stafford KJ, et al. (2009) Invited review: Body condition score and its association with dairy cow productivity, health and welfare. J Dairy Sci 92:5769–5801.

23. Douglas GN, Overton TR, Bateman HG, Drackley JK (2004) Peripartal metabolism and production of Holstein cows fed diets supplemented with fat during the dry period. J Dairy Sci 87: 4210–4220.

24. Ferrell CL (1991) Maternal and fetal influences on uterine and conceptus development in the cow: II. Blood Flow and nutrient flux. J Anim Sci T 69: 1954–1965.

25. Piccione G, Caola G, Giannetto C, Grasso F, Calanni Runzo S, et al. (2009) Selected biochemical serum parameters in ewes during pregnancy, post-parturition, lactation and dry period. Anim Sci Pap Rep 27: 321–330.

26. Piccione G, Casella S, Lutri L, Vazzana I, Ferrantelli V, et al. (2010) Reference values for some haematological, haematochemical, and electrophoretic parameters in the Girgentana goat. Turk J Anim Sci 34:197–204.

27. Nessim MZ (2010) Role of Some Hormones and Blood Components during Pregnancy and Post- Partum Periods in Baladi Cows. J Radiat Res Appl Sci 3: 1319-1334.

28. Tanaka M, Kamiya Y, Suzuki T, Nakai Y (2011) Changes in oxidative status in periparturient dairy cows in hot conditions. Animal Science Journal 82: 320–324.

29. El-Fouly HA, El-Masry KA, Gamal MH (1998) Effect of calves sex on some reproductive traits of balady cows and growth performance of their balady and crossbred (BSx Balady) calves. Zagazig Vet J 26: 69-78.

30. Atta MAA, Marai, El-Darawany AA, El-Masry KA (2014) Adaptability of bovine calves under subtropical environment. Zagazig J Agric Res 41:793-802.

31. esrsaeg.net/proceeding/1.pdf