CHEMICAL AND MICROBIOLOGICAL QUALITY OF COW'S COLOSTRUM

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ABSTRACT

Fifteen cow's Colostrum and milk samples were analyzed for concentrations of total immunoglobulin (Igs), immuno- globulin (IgG, IgA and IgM), percentages of dry matter (DM), fat, and protein, somatic cell count (SCC) and microbiological culture goals. Colostrum and milk were sampled from each cow as soon as possible after parturition, at 3rd and 7th day postcalving.

The study revealed that the chemical composition of cow's colostrum changes very fast within hours and days. The concentrations of total Igs, IgG, IgA and IgM were decreased from 7.3, 6.26, 0.414 and 0.20 gm/dl at parturition to 1.9,.1.06,0.16,.0.15 gm/dl at 3rd day. While at 7th day were 0.09, 0.060, 0.009 and 0.005 gm/dl., respectively.

Percentages of Colostrum and milk DM, fat and protein were reduced from 23.4, 6.7 and 14.22% at parturition to 16.4, 5.9 and 5.5% at 3rd day to 14.3, 4.23 and 3.1% at 7th day postcalving , respectively.

The fore milk somatic cell counts were significantly higher than milk samples along procedures from $1.1x10^6$ to $5.5x10^4$. The counts of Coliform, Staphylococcus and Enterococci in colostrum and milk samples were lowered from $8.2 x10^2$, $1.7 x 10^2$ and 20 to $2 x10^2$, $1.2 x 10^2$ and 15 cell/ml, respectively.

It concluded that a daily decline in nutritional contents of colostrum and milk take places. Hence newly born calves must be fed on colostrum within the first days of their life due to its high quality.

INTRODUCTION

Colostrum Sometimes called "mother's milk" is a thick yellower fluid than normal milk produced from the mammary glands during the first hours after birth (**Hallberg et al, 1995**). Colostrum contains essential nutrients (e.g. proteins, Lipids, carbohydrates, minerals and

vitamins) and several biologically active molecules essentially to the body's immune and growth functions (**Blum and Hammon, 2000**). So, this fluid function is to provide antibodies via immunoglobulins as they do not pass from placenta to newborn calves, that without it many newborn would simply die (**Madsen et al, 2004**).

Cow's colostrum is a natural food and is consumed safely without side effects or drug interactions and can be used to promote passive interspecies immunity due to its virtually acceptance by all other mammals. In addition, the Key immunoglobulins in cows are identical in molecular combination to humans and are not species specific.

Colostrum differs greatly in composition from mature milk (**Ontsouka et al, 2003**). Immunoglobulin G is the most abundant immunoglobulin present in colostrum, with immunoglobulin M (IgM) and immunoglobulin A (IgA) found in much lower concentrations.

The first colostrum contains very high concentration of Igs (**Korhonen et al, 2000, and Penchev , 2005**). These Igs decreased rapidly within a few days (**Madsen et al, 2004**). A positive correlation between the total protein and IgG which was represented approximately 85% of total Igs (**Mechor et al, 1992**).

The colostral total protein mean was decreased with increasing time postpartum (**Penchev 2005**).

Some colostral fat elements possess antimicrobial functions. For instance, they prevent attachment of bacteria and viruses to the intestinal mucosa (**Peterson et al 1998**). In addition the detergent action of free fatty acids mediates the lysis of bacteria, viruses and Protozoa (**Ramosh, 1998**). Fat in colostrum provides 35 - 50% of its daily energy needs which is necessary for the calf to begin thermogenesis (heat Production) (**Akré, 1994**).

Prevalence of bacteria was significantly higher during first 10 days after calving (**Miller et al, 1991**). Colostral somatic cells count (SCC) was affected by animal location , herd, management, environment pathogens. Milk somatic cells are primarily leukocytes which include macrophages, Lymphocytes, and polymorphonuclear neutrophil (PMN) and shown as epithelial cells infrequently occur in udder secretions. Staphylococcus spp., Coliforms and Streptococcus are the most frequently isolated bacteria from colostrum (**Fecteau et al, 2002**).

The objective of this study was to detect the bacteria most frequently isolated from colostrum and transitional milk during the first week post calving. Moreover, determining the quality (total Igs, IgG, IgA and IgM) and the chemical constituents (dry matter, total protein and fat percentages) of colostrum in comparison with the mature milk.

MATERIALS AND METHODS

I- Collection of Samples:

Fifteen colostrum and milk samples were collected from native breed dairy cows at their second to fourth lactation period in Sharkia Governorate. The cows were closer to parturition at 1st , 3rd and 7th day post calving. Only colostrum and milk from cows that were free from visual signs of clinical mastitis was selected.

Normal samples were collected aspetically and rapidly stored at - 20°c.

II- Laboratory procedures:-

Contents of both colostrum and milk samples were analyzed for detection of immunoglobulins using soduim sulphite turbidity test (**Khalil, 1975**). IgG IgA, and IgM by radial immunodiffusion test using a commercial kit Biocientifica (**Fahy and Mckelvey, 1965**). Colostrum and milk samples were defatted by centrifugation at 4°c for 15 minutes at 3000 Xg and skim milk was centrifuged at 10.000 Xg for 15 minutes at 4°c before the determination of Igs as described for serum.

Also, the samples were analyzed for detection of protein % using the micro kjeldahl method. Fat % using the soxhlet extraction (**Barbano and Lynch, 1991**).

In addition, dry matter content was determined by water evaporation of 1 gm of the sample at 105°c for 3 hours. Microbiological examination for enumeration of total bacteria, Coliforms, Enterococci and Staphylococci was conducted (**A. P. H. A, 1992**).

Statistical analysis was done according to (**Snedecore and Cochran, 1980**).

RESULTS AND DISCUSSION

In table (1) the levels of total Igs, IgG IgA and IgM were the highest in first portion of colostrum and dropped abruptly in the subsequent milkings.These result are inagreement with that reported by **Levieux et al., (2002)** and **Madsen et al., (2004)**. While **Singh et al., (1993)** who mentioned that colostral concentration of three Ig classes (IgG, IgA and IgM) were decreased at different rates over time.

These high levels of Igs play an important role in establishing passive immunity in the young calf until its own active immunity develops (**Quigley and Drewry, 1998**).

In Table (2) dry matter % was significant lower on the 3rd day and transitional milk than on

the first day due to the greater amount of milk solids in colostrum (**Penchev, 2005 and Ontsouka et al . 2003**).

The obtained data indicated that milk fat concentration decline significantly in mature milk than colostrum and this was inagreement with that reported by **Andrew, (2001)**. The high fat level in colostrum is necessary for initiation of thermogenesis (heat production) and energy supply (**Akrê, 1994**), as the stores of body fat of newly born calves is depleted within 18 hours (**David and Drackley, 1998**).

The present work revealed a lower total protein levels in transitional milk compared with the fore milk samples (Table 2). This finding could be attributed to the sharp fall of the concentration of Igs fractions especially IgG in the transitional milk (**Singh et al. 1993, Vacher and Blum, 1993**). Supporting this concept, **Mechor et al (1992)** who showed a positive correlation between total protein and IgG in colostrum. Moreover, **Penche (2005)** recorded more than twice drop at the seventh day post partum of total protein level, which may be referred to the dilution resulting from increased milk production.

Results recorded in Table (3) declared that average SCC were $1.1x10^6$ and $5.5x10^4$ cells/ml in colostrum and milk, respectively. These results concinceded with that reported by **Andrew (2001)**. Coliform count /ml was average $8.2x\ 10^2$ and $2x10^2$ cell / ml in colostrum and milk, respectively. Similar results were reported by **Fecteau et al. (2002)**. However a less number was recorded by **Andrew (2001)**. Percentage of isolated Staphylococci were 40 and 27% with a mean value $1.7x10^2$ and $1.2x10^2$ in colostrum and milk, respectively. While Enterococci percentage were 33 and 20 with a mean value 20 and 15 in colostrum and milk, respectively. These microorganisms were classified according to the probable origin of contamination of normal inhabitants of bovine skin or of feacal contaminants (**Fecteau et al. 2002**).

The recorded high SCC at first days post calving in colostrum could be explained on a physiological concept where penetration of cells through Leaky tight junctions between the mammary epithelial cells occurs (**Nguyen and Neville, 1998 and Ontsouka et al. 2003**). In mature milk, the SCC were lower than colostrum due to the dilution effect of milk yield (**Lacy Hulbert et al. 1995**).

It could be concluded that a daily decline in nutritional contents of colostrum and milk takes place. Hence, newly born calves must be fed on colostrum within the first hours postcalving due to its high quality and nutrition value.

Table (1): Immunoglobulin concentrations of colostrum (1st and 3rd day) and transitional milk (7th day) post calving collected from 5 clinical healthy dairy cows.

Variables	Colostrum				Transitional	
	1st day		3rd day		7th day	
	Mean	± S.E	Mean	± S.E	Mean	± S.E
Total Igs gm/dl))	7.3	± 0. 63	1.9***	± 0.14	0.09***	± 0.01
Ig G (gm/dl)	6.26	± 0.19	1.06***	± 0. 09	0.060***	± 0.001
IgA (gm/dl)	0.414	± 0.037	0.16***	± 0.015	0.009***	± 0.001
IgM (gm/dl)	0.20	± 0.018	0.15$^{N.S}$	± 0.012	0.005***	0.0005

Table (2): Dry matter (D.M.) fat and protein percentages of colostrum (1st and 3rd day) and transitional milk (7th day) post calving collected from 5 clinical healthy dairy cows.

Variable	Colostrum				Transitional Milk	
	1st day		3rd day		7th day	
	Mean	± S.E	Mean	± S.E	Mean	± S.E
Dry matter %	23.4	± 2.12	16.4 *	± 1.03	14.3 **	0.94
Fat %	6.7	± 0.5	5.9$^{N.S}$	± 0.24	4.23 *	0.24
Protein %	14.22	± 1.72	5.5 ***	± 0.63	3.1 ***	± 0.25

N.S non significant
* significant
** Highly significant
*** Highly highly significant

Table (3): Somatic cell count and culture goals for colostrum and transitional milk being fed to calves from 15 clinical healthy dairy cows.

Variable	Type of Milk	Total number of samples	Number of positive samples	%	Minimum	Maximum	Mean	± S.E
Somatic cell count (SCC) (cell/ml)	Colostrum	15	15	100	$2x10^5$	$1.4x10^7$	$1.1x10^6$	$\pm 0.1x10^6$
	Transitional milk	15	15	100	$7x10^3$	$1.1x10^6$	$5.5x10^4$	$\pm 0.5x10^3$
Coliform count (cell/ml)	Colostrum	15	8	53	60	$4x10^3$	$8.2x10^2$	$\pm 0.2x10^2$
	Transitional milk	15	6	40	30	$2.3x10^3$	$2x10^1$	$\pm 0.2x10^2$
Staphylococcus count (cell/ml)	Colostrum	15	6	40	40	$3x10^4$	$1.7x10^3$	$\pm 0.2x10^3$
	Transitional milk	15	4	27	10	$1.1x10^3$	$1.2x10^1$	$\pm 0.1x10^2$
Enterococci count (cell/ml)	Colostrum	15	5	33	10	43	20	± 0.72
	Transitional milk	15	3	20	7	31	15	± 0.91

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الجـــودة الكيميائيـــة والميكروبيـولوجيـة للسرســوب البقـــرى

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أجريت هذة الدراسة على عدد ١٥ بقرة بأحدى المزارع بمحافظة الشرقية . تم تحليل عينات سرسوب ولبن لمعرفة تركيزات الأمينوجلوبيولينات الكلية والأمينوجلوبيولن .G.A.M وتحديد النسب المئوية لكل من المادة الجافة والدهن والبروتين بالأضافة الى العد الكلى للخلايا الجسمية والفحص الميكروبيولوجى لعينات السرسوب واللبن تم تجميع عينات السرسوب واللبن من كل بقرة على حده بعد الولادة مباشرة واليوم الثالث واليوم السابع بعد الولادة .

واظهرت الدراسة تغير سريعا فى المكونات الكيميائية للسرسوب فى خلال ساعات وأيام . نقص تركيز كل من الأمينوجلوبيولينات الكلية والأمينوجلوبيولن .G.A.M من ٣ر٧ ، ٢٦ر٦ ، ٢٠ر٠ ، ٤١ر٠ جم / ١٠٠ مللى عند الولادة إلى ٩ر١ ، ٦٠ر١ ، ١٦ر٠٠ ، ١٥ر٠ جم / ١٠٠ مللى عند اليوم الثالث الى ٩٠٠ ، ٦٠٠ ، ٩٠٠ ، ٥٠٠ جم/ ١٠٠ مللى عند اليوم السابع على الترتيب .

وكانت النسب المئوية لكل من المادة الجافة والدهن والبروتين فى السرسوب نقصت من ٢٣,٤ ، ٦,٧ ، ٢٢,١٤ بعد الولادة مباشرة الى ١٦,٤ ، ٥,٩ ، ٥,٥ عند اليوم الثالث الى ١٤,٣ ، ٤,٢٣ ، ٣,١ عند اليوم السابع على الترتيب. بينما اظهر العد الكلى للخلايا الجسمية للسرسوب بعد الولادة زيادة معنوية عن مثيلاتها فى اللبن عند اليوم السابع من ١ر١ × ٦١٠ إلى ٥ر٥ × ٤١٠.

وسجل عد كل من الميكروب القولونى والميكروب العنقودى والمكورات المعوية فى السرسوب واللبن نقصا من ٢ر٨ × ٢١٠ ، ٧ر١ × ٢١٠ ، ٢٠ إلى ٢ × ٢١٠ ، ٢ر١ × ٢١٠ ، ١٥ خلية لكل مللى على الترتيب .

ويستنتج من هذة الدراسة أن هناك نقصا معنويا سريعا يحدث يوميا فى السرسوب واللبن خلال الأسبوع الأول . لذلك يجب تغذية العجول المولودة على السرسوب فى أيامها الأولى من حياتها لقيمته الغذائية العالية .