

**-37-SUMMARY OF**

**NUTRITIONAL AND IMMUNOLOGICAL STUDIES ON BARKI  
SHEEP MILK**

**A Thesis**

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**By**

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**SUMMARY AND CONCLUSIONS**

**The present study aimed at gathering more information on physico-chemical characteristics, structure of different protein constituents as well as molecular and immunological properties of Barki sheep milk components in order to evaluate their significant role in human health and nutrition as well as for successful development of dairy**

sheep industries. To achieve the goals of the study the followings  
:were carried out

Individual milk samples were collected from four different groups .<sup>1</sup>  
(25 animals, each) of Barki sheep. Samples collected through two  
successive seasons (March -August 2003 & 2005) of lactation  
analyzed for all physico-chemical characteristics. The lactation  
period was divided into 3 sub-periods; colostrum (1st–7th day), mid-  
lactation milk (2nd – 13th week) and the late- lactation (14th – 17th  
.week

Purification of sheep-milk proteins; caseins ( $\alpha$ s- and  $\beta$ -) and .<sup>2</sup>  
.proteose-peptone (PP) took place

Isolated proteins were tested for purity using polyacrylamide .<sup>3</sup>  
.gel electrophoretic analysis

Different reholological and technological properties of sheep milk .<sup>4</sup>  
.proteins were studied

The digestibility of milk proteins by pepsin and trypsin and the .<sup>5</sup>  
.effect of heat treatment on it was studied

For immunological analysis, antiserum was prepared by injection .<sup>6</sup>  
.of proteins in rabbits

Quantitative analysis for immune system proteins in milk was .<sup>7</sup>  
.carried out in milk through the whole lactation period

Biological value of prepared proteins was evaluated using the .<sup>8</sup>  
:following

.Determination of amino acids composition a.

.Feeding of experimental animals (rats) on caseins b.

The effect of heat and enzymatic treatments on the biological c.  
.value of prepared proteins was also studied

:The obtained results revealed the following

Changes in physical and gross composition of Barki sheep milk .<sup>1</sup>  
during colostrum, mid- and late–lactation period behave as that of  
.other species; however, it is different in contents

Lactation period and season of lactation have significant .<sup>2</sup>  
.effects on physico-chemical properties of Barki sheep milk

Although, the analyzed samples were pooled from different .<sup>3</sup>  
animals of different groups, the variations in all parameters were  
.markedly recorded due to the individuality effect

Vitamin C was higher in colostrum than normal milk. Its concentration was markedly decreased in colostrum and mid-lactation of the second lactation period. However, there was a significant increase in late-lactation of the second season

Minerals concentrations were significantly affected by lactation period. This mainly due to the physiological status of the animal and the feeding regimen

Lactation period had a significant effect on fatty acids composition of Barki sheep milk. Meanwhile, Barki sheep milk is characterized by lower ratio of saturated and higher unsaturated fatty acids than not only other sheep breeds but also camel, buffalo and goat milk fats. This property indicates the higher biological and nutritional value of fat

Amino acids composition of Barki sheep milk was highly affected by lactation period due to changes in EAA and NEAA patterns. This may due to the fact that the requirements of kids for proteins are quite different after birth than at the advanced stage of growth. The level of EAAs are equal to the satisfactory quality balance of EAAs for human diet or exceeds the FAO/WHO/UNU requirements for amino acids of that breed

The solubility, viscosity, emulsifying capacity and foam properties of sheep milk HCl casein increased with increasing concentration or pH values. Comparing to cow milk HCl casein, solubility of sheep milk HCl casein was higher than that of cow milk HCl casein at all pH and concentration. Whereas, the viscosity, emulsifying capacity and foam properties of sheep milk HCl casein were higher than that of cow milk

The solubility, emulsifying capacity and foaming properties of sheep milk HCl casein increased after enzymatic digestion with trypsin after 5 and 15 min. On the contrary, treatment of casein with trypsin resulted in decreasing in viscosity

SDS-PAGE electrophoretic pattern of sheep milk showed a unique pattern comparing to those of cow, camel, goat and buffalo milks

Alkaline native-PAGE electrophoretic pattern of purified sheep-milk casein showed a marked difference in migration positions of  $\alpha$ - and  $\beta$ -caseins. Since, the sheep-milk  $\alpha$ -casein was faster in migration than that of  $\beta$ -casein

No changes in sheep-milk casein behaviour were happened when milk or casein solution was heated from 60 to 100°C for 30 min. SDS- PAGE of pepsin and trypsin-treated sheep milk showed that their actions of on heat milk were pronounced and the hydrolysis rates were temperature and time dependent. This means the digestibility of Barki sheep milk by pepsin can be increased by heat treatment as pasteurization.

$\beta$ -casein was more faster in digestion by pepsin than  $\alpha$ s-casein.  $\beta$ -casein in raw or heated caseins was completely digested after 2 hrs of pepsin treatment.

Feeding rats on sheep casein resulted in significant reduction of cholesterol, increase of HDL. Increase in globulins than that of cow casein.

There was no significant difference in the activities of aspartate amino transferase (AST) and alanine amino transferase (ALT), total bilirubin, and urea concentration in plasma of sheep and cow caseins. No significant differences between the sheep and cow caseins in all parameters of erythrocytic count. But different results were recorded with leukocytic contents. Since there were significant increase in TLC and neutrophils count in blood of sheep milk casein fed rats. On the contrary, significant decreases were found in eosinophils, lymphocytes and monocytes in the same blood samples. This means that sheep casein is more immune stimulator and it has a higher biological value than cow casein.

The highest recovery of immunoglobulins from sheep blood serum was obtained by twice precipitation with 30 % saturated ammonium sulphate solution.

The concentrations of immune-system proteins in sheep milk were highly affected by period and season of lactation. They were decreased with lactation period progress. The decreasing rate was highly significant through the colostrum period especially for IgG, lactoperoxidase and lysozyme.

SDS-PAGE pattern of Barki sheep-milk proteins through the whole lactation period showed that IgG band was present in high intensity in whey samples in day 1 then decreased until the end of lactation period. The result showed that  $\beta$ -lg was the major whey protein in normal milk samples, followed by  $\alpha$ -la.

Lactoperoxidase activity was higher at 1st and 2nd days after .۲۱  
parturition followed by marked decrease until the day 7th then  
disappeared from the gel. This result reveals that lactoperoxidase  
activity is very critical to the offspring during the first day after  
.birth

Lysozyme activity was highly affected by lactation period as well .۲۲  
.as season

When whey was heated at 60°C for 30 min, no marked effects on .۲۳  
whey proteins denaturation were observed. While, at 70°C for 30  
min significant changes in whey proteins denaturation were found.  
Denaturation rate differ among different proteins. Ig(s) were the  
highest denatured protein while  $\alpha$ -la was the lowest one. When  
temperature was raised to 80°C for 30 min, the denaturation rates of  
all whey proteins were increased except  $\alpha$ -la. At 90°C for 30 min,  
another increase in denaturation of all proteins bands were  
disappeared from the gel, i.e., completely denatured. This behaviour  
.is completely different than those of goat and camel milks

Sheep milk proteose peptone was more hydrolyzed by trypsin .۲۴  
.than pepsin

The activity of LP was totally lost by heat treatment at 60°C for .۲۵  
30 min. while, no significant effect on IgG, LZ and LF was found  
even when temperature was raised to 70°C for the same time, .At  
80°C, about 90% of IgG activity was lost versus 50% for LF but no  
effect on LZ. At 90°C, LF lost about 77% of its activity versus 33%  
for LZ. But both of them lost its activity at 100°C .The order of heat  
resistance was LZ > LF > IgG > LP. This order is different than that of  
goat milk proteins. Based on the above results, it can be expected  
that if Barki sheep milk is pasteurized at 60°C for 30 min, no effect  
on all immune proteins activities except LP. However, boiling will  
.result in losing the entire activity of all immune proteins

### Conclusions

Barki sheep-milk composition is highly affected by season and .۱  
.lactation period

Barki sheep-milk proteins have higher nutritional and biological .۲  
.values than those of cow milk

.Barki sheep milk does not considered as an immune milk .۳