Changes in the amino acid composition of buffalo milk after chemical activation of its lactoperoxidase system

T. Dimitrov¹, G. Mihaylova¹, S. Boycheva¹, N. Naydenova¹, M. Tsankova²

¹ Department of Dairy Science, Faculty of Agriculture, Trakia University, Bulgaria
² Agriculture Institute, Bulgaria

Corresponding author: T. Dimitrov. Department of Dairy Science, Faculty of Agriculture, Trakia University, 6000 Stara Zagora, Bulgaria - Tel. 35942699358 - Email: dimitrovt@uni-sz.bg

ABSTRACT: The amino acid content of bulked buffalo milk, collected from 130 buffaloes reared at a buffalo farm in the settlement of Dimitrievo, Stara Zagora region, was investigated during the period January-April 2006. The activation of the lactoperoxidase system (LPS) was done by supplementation of sodium percarbonate, providing 16 ppm active oxygen and 10 ppm thiocyanate to 1 l of milk. The amino acid content was assayed by an amino acid analyzer.

It was found out that the total content of amino acids in inactivated milk was insignificantly lower than that in activated one. More considerable increase was established for the amino acids valine, methionine, and lysine, but the differences were not statistically significant.

The total amount of essential amino acids was higher in the milk with chemically activated LPS. The limiting essential amino acid in the studied buffalo milk was methionine.

Key words: Buffalo milk, Lactoperoxidase system, Amino acids.

INTRODUCTION - Buffalo milk is a valuable nutrient with high content of milk proteins, lipids, vitamin and other biologically active substances (Zheleva, 2004; Dimitrov, 2006; Mikailoglu et al., 2005). Buffalo milk protein has a higher biological values than that of cow’s milk (Tzankova and Dimov, 2003), and also, a higher amount of nonessential and essential amino acids.

The small farms producing buffalo milk have some problems in its preservation because of the lack of refrigerating facilities. In such cases, the activation of the lactoperoxidase system (LPS) of milk is utilized (IDF, 1988, Bulletin 234; Dimitrov et al., 2006).

There are no investigations regarding the influence of activated LPS on the amino acid composition of milk. The aim of the present study was to follow out the changes occurring in the amino acid composition of buffalo milk after chemical activation of its lactoperoxidase system.

MATERIAL AND METHODS - The milk was obtained from a private buffalo farm in the settlement of Dimitrievo between 20.10.2005 and 12.04.2006, from 130 buffaloes. It was transported at a temperature of 4-6°C and delivered to the laboratory within 2 hours from milking.
The milk was divided into 2 parts - control and experimental sample. In the experimental sample 48 ppm/l percarbonate, providing 16 ppm active oxygen and 10 ppm thiocyanate, was added in order to activate the lactoperoxidase system of milk by a chemical route. Samples for analysis of amino acid composition were collected 5 hours after LPS activation. The amino acid composition of milk was assayed by using an automated amino acid analyser T 339M working on the principle of ion-exchange column chromatography.

RESULTS AND CONCLUSION - The total amount of amino acids in the studied buffalo milk (Table 1) was similar to that, observed by other authors for this kind of milk (Tzankova and Dimov, 2003). Our data exhibited a certain increase in the content of some amino acids as well as of their total amount after milk LPS activation. However, these differences were not statistically significant.

Table 1. Amino acid composition of studied buffalo milk.

| Amino acids     | Control % | S x | Chemically activated % | S x |
|-----------------|-----------|-----|-------------------------|-----|
| Aspartic acid   | 0.328     | 0.017 | 0.333                  | 0.031 |
| Theonine        | 0.146     | 0.009 | 0.156                  | 0.009 |
| Serine          | 0.114     | 0.007 | 0.129                  | 0.012 |
| Glutamic acid   | 1.014     | 0.070 | 1.006                  | 0.162 |
| Proline         | 0.415     | 0.033 | 0.436                  | 0.042 |
| Cysteine        | 0.024     | 0.001 | 0.024                  | 0.002 |
| Glycine         | 0.078     | 0.005 | 0.080                  | 0.008 |
| Alanine         | 0.135     | 0.006 | 0.148                  | 0.006 |
| Valine          | 0.276     | 0.018 | 0.299                  | 0.012 |
| Methionine      | 0.038     | 0.005 | 0.052                  | 0.009 |
| Isoleucine      | 0.234     | 0.014 | 0.253                  | 0.013 |
| Leucine         | 0.401     | 0.022 | 0.437                  | 0.021 |
| Tyrosine        | 0.158     | 0.011 | 0.174                  | 0.011 |
| Phenylalanine   | 0.193     | 0.009 | 0.210                  | 0.017 |
| Histidine       | 0.132     | 0.007 | 0.148                  | 0.006 |
| Lysine          | 0.307     | 0.020 | 0.326                  | 0.022 |
| Arginine        | 0.103     | 0.008 | 0.119                  | 0.004 |
| Total           | 4.095     | 0.255 | 4.330                  | 0.361 |

After LPS activation, an increase in the amount of essential monoaminomonocarbonic amino acids methionine, valine, leucine, isoleucine was noticed; also, the content of aspartic acid (from the group of monoaminodicarbonic), the content of lysine and arginine (from the group of diaminodicarbonic) and the levels of phenylalanine, tyrosine, histidine and proline (from the group of cyclic amino acids) were higher.
The total amount of essential amino acids after activation of milk LPS increased by 2.77%, whereas that of nonessential amino acids decreased by 2.17%. The biological value of the different foodstuffs was determined by comparing the amino acid composition of a given product with that of a reference protein (FAO, 1973), that has a completely balanced amino acid composition. A limiting amino acid, i.e. the most deficient one in milk, is the sum of methionine and cysteine. The amino acid index of the studied buffalo milk (Table 2) was higher in the sample with activated LPS (50.14%) than in control sample (43.26%). The amount of essential amino acids in the milk with activated LPS was higher by 2.77% compared to non-activated milk. The chemical activation of the lactoperoxidase system had no significant influence upon the biological value of buffalo milk.

Table 2. Amino acid index of studied buffalo milk.

| Essential amino acids, g/100 g protein | Reference protein (FAO) | Control | Chemically activated |
|---------------------------------------|------------------------|---------|---------------------|
|                                       | Amino acid | Percent of Reference protein | Amino acid | Percent of Reference protein |
| Threonine                             | 4.0        | 3.565 | 89.13 | 3.603 | 90.08 |
| Leucine                               | 7.0        | 9.792 | 139.89 | 10.092 | 144.17 |
| Isoleucine                            | 4.0        | 5.714 | 142.85 | 5.843 | 146.08 |
| Valine                                | 5.0        | 6.740 | 134.80 | 6.905 | 138.10 |
| Methionine                            | 3.5        | 0.928 | 43.26 | 1.201 | 50.14 |
| Cysteine                              | 3.5        | 0.586 | -    | 0.554 | -    |
| Lysine                                | 5.5        | 7.497 | 136.31 | 7.529 | 136.89 |
| Phenylalanine                         | 6.0        | 4.713 | 142.85 | 4.849 | 1.478 |
| Tyrosine                              | 6.0        | 3.858 | -    | 4.019 | -    |
| Tryptophan                            | 1.0        | -    | -    | - | - |
| Essential amino acids                 | 36.0       | 43.393 | -    | 44.595 | - |

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