



THE ECOLOGICAL DISTRIBUTION OF BOVINE RACES AND ITS CORRELATION WITH LOW DENSITY LIPOPROTEIN OXIDATION IN ALBANIAN POPULATIONS

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SYNOPSIS

Key words:

bovine races,
A1 milk,
beta-casein,
LDL.

Beta-casein is a cow's milk protein that occurs predominantly in two forms, A1 and A2. Epidemiological evidence suggests that per capita consumption of beta-casein A1 is associated with national mortality rates from ischemic heart disease. We tested whether beta-casein A1 and A2 variants differentially affect plasma cholesterol concentrations in humans. Different regions of Albania are more than one-breed regions. We calculated the ecological distribution of bovine races from Center of Agriculture Technology Transfer data. During this study 82 persons were chosen randomly, where 42 participants used in their diet A1 milk and 40 ones used only A2 milk. Mean low-density lipoprotein cholesterol concentrations was 129,29 mg/dl after the A1 diet and 120,15 mg/dl after the A2 diets. We found that dairy products containing beta-casein A1 or A2 exerted differential effects ($P > 0.05$) on plasma cholesterol concentrations in humans.

INTRODUCTION

Milk proteins are usually divided into two great "historical" groups, depending on their behaviour by acidification at pH 4.6. The soluble fraction (approximately 14%), named "whey protein", is constituted by several different proteins, the most important ones are alfa-lactalbumin and beta-lactoglobulin. The fraction insoluble (approximately 80%), named "whole casein", is constituted of four different native caseins (Cn): alfa s1-Cn, alfa s2-Cn, beta-Cn and kappa-Cn. Each milk protein

presents two or more forms genetically determined by autosomal and codominant alleles. The variant of beta-Cn is determined by a pair of genes on the sixth chromosome. There are two major alleles (or variants) of the gene. These are called the A1 and A2 beta-casein alleles. Beta-Cn A1 differs from the progenitor A2 allele in that in position 67 of the A2 molecule a proline has been replaced by a histidine. The different scientists have proved that during the digestion of A1, or A1-like, beta casein is produced beta casomorphin-7 (BCM 7) which is known to be an oxidant of LDL (Torreilles & Guerin, 1995). Oxidation involves the lipid moiety of LDL in a chain reaction mechanism. In the initial phase, free radicals preferentially attack highly oxidizable polyunsaturated fatty acids. Subsequent recruitment of other molecules includes cholesterol and phospholipids. The process of oxidation is counteracted by antioxidants present in LDL. By-products formed during oxidation of LDL lipids, which may have biological activity, react with amino acid residues of the LDL protein backbone with the consequent modification of chemical and immunological properties responsible for cellular receptor shift (Iuliano et al., 2003). Oxidized LDL has many characteristics that potentially promote atherogenesis (Chisolm & Steinberg, 2000; Steinberg, 1997): 1 – oxidized LDL is recognized by the scavenger receptors and can therefore give rise to foam cells (Chisolm & Steinberg, 2000; Steinberg, 1997). 2 – Oxidized LDL stimulates endothelium to secrete monocyte chemotactic protein 1 (MCP-1), which induces the infiltration of monocytes into the subendothelial space (Chisolm & Steinberg, 2000; Steinberg, 1997). 3 – Oxidized LDL can also induce migration and proliferation of smooth muscle cells and impede endothelial cell migration (Chisolm & Steinberg, 2000; Steinberg, 1997). 4 – Oxidized LDL may interfere with endothelium-mediated relaxation and stimulate platelet adhesion and aggregation through inhibition or reduced endothelial production of nitric oxide (NO) (Chisolm & Steinberg, 2000; Steinberg, 1997). Some components of oxidized LDL, like oxysterols or phosphatidylcholine, especially if ceramide presents, may induce cell injury by both apoptotic and necrotic pathways (Mertens & Holvoet, 2001; Deigner et al., 2001). These proatherogenic properties of oxidized LDL may explain the great variability in the incidence of CAD at any level of plasma cholesterol and why the modification of LDL plays an important role in the development of atherosclerosis.

There is substantial evidence that oxidized LDL is present in vivo within atherosclerotic lesion but not in normal arterial wall (Witztum & Steinberg, 2001; Chisolm & Steinberg, 2000). LDL that is extracted from human and animal atherosclerotic lesions shares the characteristics with respect to the physical, chemical, immunological and biological properties with oxidized LDL (Yla-Herttuala et al., 1989; Palinski et al., 1989).

SUBJECT AND METHOD OF RESEARCH

The aim of this study was to determine all the bovine races (imported or native) present in farms of Albania and to test whether the cow milk do affect LDL values present in blood of Albanian persons that use cow milk in their diet.

This study has been realized in 4 stages.

1. COW BREED DISTRIBUTION. Different regions of Albania are more than one-breed regions. We calculated the ecological distribution of bovine races from Center of Agriculture Technology Transfer data (Leka et al., 2009).

2. A1/A2 AND OTHER BETA-CASEIN FRACTIONS. These were estimated by breed from electrophoresis of milk protein under acidic conditions (Laknori & Rexha, 2008).

3. LDL VALUES. Blood samples were taken from 82 people who used in their diet cow milk that differed in the proportion of beta-casein A1 and A2 variants.

4. INTERPRETATION OF DATA COLLECTED. Data collected were divided in 2 groups: group one include LDL values of the persons that use in their diet A1 bovine milk and in the second group are the LDL values of the persons that use A2 bovine milk. We use a *t* test to examine differences on a scale dependent variable between two groups comprising the levels of one independent variable or factor.

RESULTS AND DISCUSSION

Data obtained from Center of Agriculture Technology Transfer for breed distribution in different regions in Albania and the results of gel electrophoresis (in order to determine what kind of milk they have) are shown in table 1.

During this study we analyzed blood samples of 82 persons (table 2) from whom 42 used A1 milk and 40 persons used dairy A2 milk. Data collected where tested with *t* test in order to see if LDL values are significantly bigger (over range) in persons that use A1 milk.

For *t* test ($P > 0.05$) the 2 hypothesis are:

H_0 : There is no difference between two means.

H_1 : There is difference between two means.

The calculation show that $t_s=3,1$. As this value is bigger that $t_{0.05[80]}$ Hypothesis 1 is accepted. This means that A1 milk does affect LDL oxidation in humans.

Table 1: Cow breed distribution in Albania.

| Cow Breed | Albanian region | Imported or Native | Type of milk |
|------------------|--|--------------------|--------------|
| Holstein | Berat, Dibra, Gjirakastra, Elbasan, Fier, Korça, Kukës, Lezha, Shkodra, Tirana, Vlora | Imported | A1/A2 |
| Simmental | Berat, Gjirakastra, Fier, Korça, Lezha, Shkodra, Tirana, Vlora | Imported | A1/A2 |
| Jersey | Berat, Dibra, Gjirakastra, Elbasan, Kukës, Lezha, Shkodra, Tirana, Vlora | Imported | A1/A2 |
| Bushaj | Tropoja | Native | A2 |
| Norwegian Red | Elbasan, Fier, Kukës | Imported | A1/A2 |
| Tarentaise | Dibra, Korca | Imported | A1/A2 |

Table 2: LDL values.

| LDL VALUES GROUP 1 | FREQUENCY | LDL VALUES GROUP 2 | FREQUENCY |
|-------------------------------|-------------|-----------------------|-----------|
| 85 | 1 | 113 | 6 |
| 109 | 1 | 114 | 8 |
| 110 | 1 | 115 | 5 |
| 112 | 3 | 116 | 5 |
| 113 | 4 | 119 | 3 |
| 118 | 7 | 120 | 2 |
| 127 | 1 | 128 | 2 |
| 130 | 1 | 129 | 2 |
| 131 | 2 | 135 | 2 |
| 132 | 2 | 136 | 5 |
| 133 | 4 | | |
| 135 | 2 | | |
| 136 | 4 | | |
| 151 | 6 | | |
| 159 | 3 | | |
| SUM | 1881 | 1112 | 40 |
| AVERAGE | 129,2857143 | 120,15 | |
| STANDART DEVIACION | 16,67374995 | 8,486943215 | |

CONCLUSIONS

Data collected show that:

- Bovine races present in many regions of Albania (Berat, Gjikastër, Lezhë, Shkoder, Tiranë) are: Holstein, Jersey, Simmental, while the races less distributed are: Bushaj - the only native race (Tropoje), Norwegian Red (present in farms of Elbasan, Fier, Kukës) and Tarentaise (in Dibra, Kukës and Korçë).
- The milk from all the imported races differed in the proportion of beta-casein A1 and A2 variants, meanwhile only Bushaj produce A2 milk.
- Ldl oxidation is stronger in individuals that use A1 milk in their diet ($P > 0.05$).

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