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# Perspectives and challenges of global cattle and sheep meat and milk production

**M P Petrovic<sup>1,5</sup>, V Caro Petrovic<sup>1</sup>, I F Gorlov<sup>2</sup>, M I Slozenkina<sup>2</sup>,  
M I Selionova<sup>3</sup>, I S Nikolaevna<sup>3</sup> and A Yu Itckovich<sup>4</sup>**

<sup>1</sup> Institute for Animal Husbandry, Belgrade-Zemun, Belgrade, Serbia

<sup>2</sup> Volga Region Research Institute of Manufacture and Processing of Meat-and-Milk Production, 6, Rokossovskogo Street, Volgograd, 400131, Russian Federation

<sup>3</sup> Russian State Agrarian University - Moscow Timiryazev Agricultural Academy, 49, Timiryazevskaya st., Moscow, 127550, Russian Federation

<sup>4</sup> Volgograd State Agricultural University, Universitetsky Ave., 26, Volgograd, 400002, Russian Federation

<sup>5</sup> E-mail: milanppet@yahoo.com

**Abstract.** Cattle and sheep meat and milk production is an imperative of animal husbandry in the world. Statistics show a constant trend of increasing the number of inhabitants of the planet, and thus the need for livestock products. Scientists are trying to find a balance between food needs and sustainable development. Special emphasis must be placed on respecting the differences in the understanding and choice of food, and thus milk and meat. Not all cultures have the same habits, on the other hand, the conditions for the development of animal husbandry differ significantly in terms of the natural potentials of individual countries. With the development of new technologies, it is possible to find optimal models for the successful development of animal husbandry in the future, taking into account the conservation of biodiversity.

## 1. Introduction

All species of domestic animals became descended from wild ancestors. This process, which took place in the distant past, we call domestication [1; 2; 3]. The basic mechanism of domestication of animal species was selection. Man chose for further reproduction those animals that best suited his needs and desires. We still do that today, only in a more modern way with the help of science and methodological procedures. Thus, if the females of the original ancestor of modern cattle, secreted about 100 kg of milk, needed to feed their calves, today's individual cows of high-milk breeds produce up to 15,000 kg of milk in lactation.

In addition to the improvement of morphological and physiological characteristics, domestication also changed the character of animals, so that they became tame individuals from wild ones. The selection also played a major role here, as the man kept an individual with a calmer temperament for breeding. Without selection under human control, the existence of domestic animals in the free nature is almost impossible. By separating animal species-natural populations from free nature, selection has become a basic condition



for the survival of domesticated animal-synthetic populations [4; 5; 6; 7; 8]. Today, farmers expect maximum production of meat and milk from such cattle and sheep, sometimes to the detriment of everyone, even nature itself.

## 2. Main livestock products

In addition to milk, meat is one of the most sought-after products, and the demand is growing year by year as the number of people increases. According to the UN Office for Food and Agriculture, meat production in the world today is almost five times higher than in the early 1960s, when about 70 million tons were produced annually, and during 2017, that number rose to 330 million tons of meat. The main reason for this is a significant increase in the number of inhabitants of the country, and thus the number of animals, including cattle and sheep. In the time interval from 1960 to 2017, the world's population more than doubled, so that today there are over 7.6 billion people living on Earth, and 60 years ago there were about 3 billion. Global meat consumption has increased significantly over the past 50 years, and meat is a highly valued commodity in many countries around the world, especially in highly developed ones. In accordance with the increase in the number of inhabitants, an increase in the consumption of meat and milk is inevitable. Table 1 shows a hypothetical projection of meat and milk consumption until 2050 [9].

**Table 1.** Past and projected trends in consumption of meat and milk in developing and developed countries (Thornton, 2010\*) [9].

Countries	Year	Annual per capita consumption		Total consumption	
		Meat (kg)	Milk (kg)	Meat (mt)	Milk (mt)
Developing	1980	14	34	47	114
	1990	18	38	73	152
	2002	28	44	137	222
	2015	32	55	184	323
	2030	38	67	252	452
	2050	44	78	326	585
Developed	1980	73	195	86	228
	1990	80	200	100	251
	2002	78	202	102	265
	2015	83	203	112	273
	2030	89	209	121	284
	2050	94	216	126	295

\* The mentioned author states that data for 1980–2015 adapted from Steinfeld *et al.* (2006) and for 2030–2050 from FAO (2006).

The data listed in the table speak for themselves, so there is no need to comment on them separately. Perhaps it should be pointed out that in both developing and developed countries, the trend of both production and consumption is growing.

## 3. Needs and economic interest

When we talk about the needs for meat and milk, the logic is misleading that as the human population of the planet increases, the needs for meat and milk will inevitably grow. It is a conventional approach to this problem. On that basis, projections of future consumption are made, as shown in the previous table.

We know that the consumption of meat and milk is not equal in the world. It is usually said that it is connected exclusively with the economic status of certain countries. This is somewhat true, but the fact that the use of these livestock products is also connected with the historical, cultural heritage and religion is often overlooked [10]. Not all countries in the world, all cultures and religions have the same views on consuming meat and even milk. For example, in Asia there is no tradition of daily consumption of milk and dairy products, as is the case in Europe or North America. Therefore, their view on this topic is somewhat different. Meat consumption is present almost everywhere in the world, but not everyone is equally interested in this product. Some cultures and religions do not consume certain types of meat. In some places, meat is eaten only sometimes for economic, but also religious and health reasons. Daily consumption of meat can cause disorders in the body, and can also cause certain diseases. There is a lot of research in the literature that indicates the connection between the consumption of meat and meat products with human health. Different results have been obtained, with a lot of contradictions and ambiguities [11; 12; 13; 14; 15].

Economic interest is mostly ahead of the real desires and needs for livestock to be strategically improved. That is why it is sometimes difficult to reconcile these two extremes. The trend of increasing the quantity of new technologies with the help of chemistry and manipulation of biological species of plants and animals leads to another absurdity. Limited resources are overloaded and degraded, primarily in the lower and lowland areas. The vitality and sustainability of highly selected populations are declining [3]. Finally, the quality of the products themselves, ie the food obtained for the human population, is significantly reduced. Valuable genetic resources of indigenous populations are being lost. Arable land and natural pastures of the mountainous area are lost [16]. Villages are disappearing, and an increasing number of people are migrating to cities that suffer enormous social and biological overload.

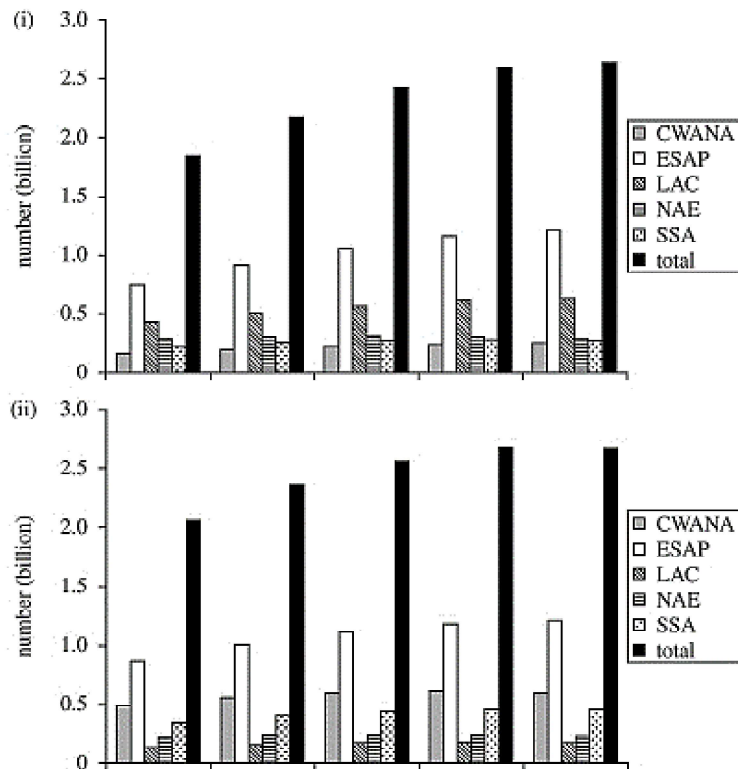
Development is not just to increase something in quantitative terms, but a comprehensive strategy for the long-term and sustainable use of all a country's natural resources. Equal investment in all areas and development of technologies and conditions for work and life everywhere.

An uncompromising increase in livestock products may not have a bright future because it is not always in line with natural resources and rules that make biodiversity sustainable. It takes a lot of knowledge and good will to find a compromise between needs, desires and possibilities. All this for the benefit of man, animals and nature in which and from which we live.

#### **4. Current state of animal husbandry and perspective**

Despite the highly productive breeds of cattle and sheep, where some animals achieve enormous individual production of meat and milk, level of production technology in animal husbandry does not give the expected results. Farmers in many parts of the world do not make the desired profit by raising animals of lower genetic potential, and the market gets fewer products. According to [9; 17], the global cattle population may increase from 1.5 billion to 2.6 billion, and the global goat and sheep population from 1.7 billion to 2.7 billion (figure 1). To increase the production of meat and milk, in addition to increasing the number of animals, it is necessary to develop and apply new methods in genetics, breeding and reproduction. The genetic potential of sheep and cattle populations is highly variable. Previous scientific research has shown that precisely because of the high variability, there is a possibility to make the development of new methods of genotype assessment selection more efficient [8]. The contribution of selection within a farm animal breed increases genetic progress in the range of 1–3% per year, relative to the mean of one or more traits of interest. This is not always satisfactory for farmers, so the crossbreeding method is often used, as a faster way to achieve the desired goal [18; 19]. Breed replacement or crossbreeding can result in a rapid improvement in productivity. It must be borne in mind that success also depends on the area and climatic conditions, with the condition and welfare of animals being important [20; 18]. In addition to selection for increased milk yield of dairy cows in Asia, for example, more mass crossbreeding of Zebu cattle with European cattle

populations can be applied. The breeds selected for crossbreeding must be suitable for the environment and production systems that can be characterized by limited resources. A special contribution to the realization of these ideas is provided to researchers by molecular genetics technologies. By analyzing DNA molecules, but also by untapped opportunities offered by population and quantitative genetics, the quantity and quality of meat and milk can be increased [20].



**Figure 1.** Projected number of (i) bovines and (ii) sheep and goats to 2050 in the ‘reference world’. CWANA, Central and West Asia and North Africa; ESAP, East and South Asia and the Pacific; LAC, Latin America and the Caribbean; NAE, North America and Europe; SSA, sub-Saharan Africa [9].

Reproduction is extremely important, because the success in production depends on the number of obtained offspring of animals. On the other hand, the reproductive efficiency of sheep and cattle is limited both by the number of pregnancies and births, and by the number of pups obtained per litter. With the development and application of new methods in reproduction, the number of lambs and calves can be increased and thus significantly improve the amount of meat for the market [21;22;23]. Particular attention must be paid to the production of animal feed, especially in areas where irrigation is necessary.

Economic growth is expected to continue into the future, typically at rates ranging from between 1.0 and 3.1 per cent [24]. Growth in industrialized countries is projected to be slower than that in developing economies [17]. It follows that there are significant opportunities to increase productivity in developing countries.

In the future, many developed countries will have to turn in addition to quantitative and productive livestock development to other attributes, such as product quality, increasing animal welfare to raise disease resistance and reducing the impact on environmental degradation.

According to many, genomic selection should be able to double the rate of genetic progress in the dairy industry [25]. Where is the quality of such products? There is not enough talk about that! organic livestock can be offered as part of an alternative to modern selection challenges in the livestock of the future.

## 5. Conclusions

Cattle and sheep meat and milk production is very important sector of animal husbandry in the world. The future of livestock production must be focused not only on the quantity but also on the quality of products - milk, meat. One of the possible solutions for the future of animal husbandry is to find a balance between modern and autochthonous breeds. Increase the number of individuals in the local population, which is more modest in diet and resources. Local domestic breeds are more resistant to diseases and need less food to produce milk and meat. Science can provide new technology projects for these areas and contribute to the overall stability of milk and meat production in the future.

## References

- [1] Troy C S, MacHugh D E, Bailey J F, Magee D A, Loftus R T, Cunningham P, Chamberlain A T, Sykes B C and Bradley D G 2001 Genetic evidence for Near-Eastern origins of European cattle *Nature* **410(6832)** 1088-91
- [2] Erohin A I and Erohin S A 2004 *Ovcevodstvo* (MGUP.Moskva) 480
- [3] Petrovic P M and Pantelic V 2015 Modern selection of domestic animals *Institute of Animal Husbandry* (Belgrade) 320
- [4] Loftus T R, Mac Hugh E D, Bradley G D, Sharp M P and Cunningham P 1994 Evidence for two independent domestications of cattle *Proc. Natl Acad. Sci. USA* **91** 2757-61
- [5] Harpending H C, Batzer M A, Gurvans M, Jordell L B, Rogers A R and Sherry S T 1998 Genetic traces of ancient demography *Proc Natl Acad Sci USA* **95** 1961-7
- [6] MacHugh D E, Shriver M D, Loftus R T, Cunningham P and Bradley D G 1997 Microsatellite DNA variation and the evolution, domestication and phylogeography of taurine and zebu cattle (*Bos taurus* and *Bos indicus*) *Genetics* **146** 1071-86
- [7] Giuffra E, Kijas J M H, Amarger V, Carlborg O, Jeon J T and Anderson L 2000 The origin of the domestic pig: independent domestication and subsequent introgression *Genetics* **154** 1785-91
- [8] Petrović P M, Ilic Z and Caro Petrović V 2015 Biology and technique of small ruminant breeding *Russian Academy of Natural Sciences Balkan Scientific Center* **500**
- [9] Thornton P K 2010 Livestock production: recent trends, future prospects *Philos Trans R Soc Lond B Biol Sci.* **365(1554)** 2853-7
- [10] Petrović P M, Petrović M M, Ružić-Muslić D, Žujović M and Caro Petrović V 2006 Inovation and Application of New Solutinos for Milk Production in Smallholder farmers *Proceedings of the International Conference Reorientirng Agricultural research to meet the Millennium Development Goals held in India* (New Delhi) 2-8
- [11] Hill J O and Melanson E L 1999 Overview of the determinants of overweight and obesity: Current evidence and research issues *Medicine and Science in Sports and Exercise* **31**(Suppl) 515–21
- [12] Kuczmarski R J, Flegal K M and Campbell F M 1994 Increasing prevalence of overweight among U.S. adults: The National Health and Nutrition Examination Surveys *Journal of the American Medical Association* **272** 205-11
- [13] WHO Technical Report Series 916 2002 Joint WHO/FAO Expert Consultation on Diet, Nutrition and the Prevention of Chronic Diseases. Geneva, Switzerland. Diet, nutrition and the prevention of chronic diseases: report of a joint WHO/FAO expert consultation, Geneva, 28 January - 1 February 2002
- [14] Melanson K, Gootman J, Myrdal A, Kline G and Rippe J M 2003 Weight loss and total lipid profile

- changes in overweight women consuming beef or chicken as the primary protein source *Nutrition* **19** 409-14
- [15] Luciano F B 2009 The impacts of lean red meat consumption on human health *a review CyTA – Journal of Food* **7** (2) 143-51
- [16] Petrovic P M, Dragana Ružic Muslic, Violeta Caro Petrovic, Nevena Maksimovic, Bogdan Cekic, Yusup A Yuldashbaev and Marina I Selionova 2017 Trends and challenges in the genetic improvement of farm animals *Invited paper at the Proceedings of the 11th International Symposium Modern Trends in Livestock Production October 11-13 pages* 1-14
- [17] Rosegrant M W et al 2009 Looking into the future for agriculture and AKST (Agricultural Knowledge Science and Technology). In *Agriculture at a crossroads* (eds McIntyre B D, Herren H R, Wakhungu J., Watson R. T.) 307-76 Washington
- [18] Caro Petrović V, Petrović P M, Ilić Z Z, Petrović M M, Ružićmuslić D, Maksimović N, Selionova M I and Mandić V 2015 Crossing system application and its effect on lambs growth traits *Biotechnology in Animal Husbandry* **31**(4) 505-14
- [19] Petrovic P M, Violeta Caro Petrovic, Dragana Ruzic Muslic, Nevena Maksimovic, Ivan Pavlovic and Bogdan Cekic, Ivan Cosic 2019 The phenomenon of heterosis and experience in crossing different breeds of sheep in Serbia *Biotechnology in Animal Husbandry* **35**(4) 311-21
- [20] Knaus W 2009 Dairy cows trapped between performance demands and adaptability *J Sci Food Agric* **89** 1107-14
- [21] Caro Petrovic V, Maksimovic N, Petrovic P M, Petrovic M M, Ilic Z Z, Ruzic Muslic D and Pesic Mikulec D 2013 Effect of inbreeding on body growth traits and sperm DNA fragmentation level in rams *Animal Science Papers and Reports* **31**(1) 27-33
- [22] Petrovic P M, Caro Petrovic V, Ilic Z Z, Ruzic Muslic D, Milenkovic M, Milosevic B and Grcak D 2013 Features of the New Breed of Sheep in Serbia Called Mis Sheep Reproductive Characteristics and Body Development *Veterinarija I Zootehnika* **64**(86) 70-5
- [23] Dvalishvili V G, Fathala M M, Vinogradov I S and Dawod A 2015 Influence of Crossbreeding Romanov Ewes with Crossbred Argali 320 Milan P Petrovic et al Romanov Rams on Male Progeny Performance and Carcass Traits *Journal of Veterinary Science and Technology* **6** 275
- [24] Van Vuuren D P et al 2009 *Outlook on agricultural change and its drivers In Agriculture at a crossroads* (Washington, DC: Island Press) 255-305
- [25] Hayes B J, Bowman P J, Chamberlain A J and Goddard M E 2009 Genomic selection in dairy cattle: progress and challenges *J Dairy Sci* **92** 433-43