

# THE IMPORTANCE OF BUFFALO IN MILK PRODUCTION AND BUFFALO POPULATION IN SERBIA

**P. Perišić<sup>1</sup>, V. Bogdanović<sup>1</sup>, C. Mekić<sup>1</sup>, D. Ružić-Muslić<sup>2</sup>, D. Stanojević<sup>1</sup>, M. Popovac<sup>1</sup>, S. Stepić<sup>1</sup>**

<sup>1</sup>University in Belgrade, Agricultural Faculty, Nemanjina 6, Beograd-Zemun, 11080 Zemun

<sup>2</sup>Institute for Animal Husbandry, Belgrade-Zemun, 11080 Zemun

Corresponding author: Predrag Perisic, e-mail:perisicp@agrif.bg.ac.rs

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**Abstract:** This research paper gives an analysis on the size of world's domestic buffalo populations, their milk production and the size of buffalo population in Serbia. Population of domestic buffalo in the world is constantly increasing so that in 2013 there were 199 783 549 individuals, out of which in India in the same year they raised 57.77% of buffalo world population, in Pakistan 18.87%, and in China 11.64%. The share of total world production of buffalo milk in total world milk production in 2012 was 12.92 % or 97 417 135 t out of which 67.76% was produced in India. In Serbia buffalo is raised in the regions of Raška (about 1000 individuals) and Kosovo. Populations of buffalo in central Serbia show a tendency of decreasing in size what was the reason to start a programme of *in situ* conservation 10 years ago. On the sample of buffalo population encompassed by the programme of conservation the body measures were analysed indicating that the population of buffalo is quite unequalised and that average values obtained for exterior measures are similar to the results obtained by the authors of earlier period for the population of buffalo in the area of former Yugoslavia.

**Key words:** domestic buffalo, exterior, state in population

## Introduction

Buffalo is the most distant relative of domestic beef cattle. They are at the lowest degree of evolutionary development. As wild animals they live in Asia and Africa while as domestic animals they live in Asia, Africa, Europe and South America, and as half domestic in Australia. According to most researchers and criteria for systematisation of this species, the division of buffaloes on Asian and African seems to be acceptable.

Based on: conventional morphological analysis (Bohlken, 1958), as well as craniological morphology (Groves, 1981), cited by Gates et al. (2010), subfamily of *Bovinae* se is divided into several genera, among which the two independent genera are: *Bubalus* (Asian buffalo) and *Syncerus* (African buffalo). There are also different divisions or sorting of buffaloes into separate genera or subgenera. Thus, according to Antoniusu (1922), cited by Mitić et al. (1987), *Bubalus* is divided into 3 subgenera: *Bubalus depressicornis*, *Bubalus mindorensis*, *Bubalus Bubalus* with two species: *Bubalus bubalis* (Asian buffalo) and *Bubalus caffer* (African buffalo). **Asian wild buffalo** (*Bubalus*) has three subgenera: Anoa buffalo with two varieties (*Bubalus depressicornis* and *Bubalus quarlesi*); Tamaru buffalo (*Bubalus mindorensis*); Asian buffalo – Indian buffalo- Arni (*Bubalus bubalis*).

**African wild buffalo** (*Syncerus caffer*) belongs to the genus *Syncerus*, within which there are two very different subgenera: 1) Black buffalo- savannah buffalo (*Syncerus caffer*, Cape buffalo) which has three varieties and 2) forest – red buffalo (*Syncerus caffer nanus*).

**Domestic buffalo** has an important place in agricultural production of Asia, Mediterranean countries and some African countries, such as for example in Egypt, as reported by Barakat and Alhimaidi (2012). Domestic buffaloes are raised in the regions with hot and humid climate, where cattle originating from *tura* cannot be raised. Buffaloes are resistant to many diseases being even genetically resistant to some ailments (Borriello et al., 2006).

Number of domestic buffaloes in the world is constantly increasing. According to data reported by Sambraus (2006) in 1998 in the world there was about 162 million domestic buffalo animals altogether. The countries with largest population of buffalo were India (91.8 million), China (27.8 million) and Pakistan (21.2 million). In Europe, in the same year, for example, in Italy, there was 162 000 animals, and in the republics of former Yugoslavia 16000 individuals.

**Table 1. Number of cattle and buffalo in the world in 2013 (FAOSTAT, 2015)**

Country	number cattle +buffalo	number of cattle		number of buffalo	
	Population (million)	Population (million)	% of population in the world	Population (million)	% of population in the world
World in total	1694132318	1494348769	100.00	199783549	100.00
Europe	122503662	122078279	8.17	425383	0.21
Asia	713844389	519972278	34.79	193872111	97.04
Africa	305277527	301077502	20.15	4200025	2.10
North America	101515311	101515311	6.79	-	-
South America	355325873	354046153	23.69	1279720	0.64
Oceania	40221756	40221546	2.69	210	0.0001
India	329770000	214350000	14.34	115420000	57.77
Pakistan	72000000	38300000	2.56	33700000	16.87
China	136890500	113636600	7.60	23253900	11.64

Since 1961 the number of buffalo in Asia has been constantly increasing, as well as a yield of milk quantities produced by buffalo cows in total world's milk production. According to FAO data (2015) in 2013 in India was raised 57.77% of world buffalo population, in Pakistan 18.87%, and in China 11.64%. In these three countries the number of buffalo is the highest. In India and Pakistan a constant rise of buffalo population since 1961 has been present, and it is predicted that due to rise in human population in these two countries the number of buffaloes will continue to increase and will in the highest degree determine the size of overall world population of buffalo.

Domestic buffalo, in many regions in which they are raised, are triple-purpose (milk, work, meat) animals. As draught animals, they are most useful in the countries where rice is grown since thanks to their wide and strong hooves, they can work well in swampy terrain covered with water and mud.

In total world milk production, according to FAO data, buffalo milk participates with about 12%, and according to data reported by *Pasha and Hayat* (2012), milk produced by buffalo cows yielded 12.75% of total world milk production. In South Asia, as reported by *Khan et al.* (2011), 85.4 million tons of milk were produced, of which 66.7% in India and 25.2% in Pakistan.

There are buffalo species with various production purposes (dairy type, draught type, meat type, combined type). The greatest variety of the types of species can be found in India (jaffarabadi, kundhi, mehsana, magpuri, nili, ravaja, deli and others). Buffalo cow milk yield is in the range of 1000 kg to 1300 kg, with about 18 % milk dry matter. Buffalo milk has a similar composition to sheep milk. Also there are selected buffalo populations and breeds with pronounced milk production traits (in India, Transcaucasia, Asia Minor) which can produce 4000 kg milk with 6 % to 8 % milk fat. *Khan et al.* (2011) reported that in dairy buffalo in Pakistan average daily milk yield was 5.5 liters. Mean content of fat in milk was  $7.47 \pm 0.87$  %, lactose  $5.24 \pm 0.15$  %, protein  $3.31 \pm 0.13$  % and mineral matters  $0.77 \pm 0.02$  %.

As a raw material milk is important for making dairy products in households. A production of homemade butter is particularly important, which in certain nations is used as a substitute for a lard in cooking. Buffalo milk can be successfully used for making various kinds of cheeses, while one of a well-known cheese, originally made from buffalo milk is "mozzarella". Because of the production of dairy products made by buffalo milk, which are thought to be delicacy, in Italy there is a stable population of buffaloes of a more pronounced milk production traits compared to other populations of buffalo in Mediterranean. For the same reasons (production of dairy products from buffalo milk), the buffalo farms are being established in the countries where they were not bred in the past (for example Great Britain). In European countries, buffaloes are raised in Greece, Albania, Italy, Bulgaria, Romania, former Yugoslav republics (Serbia, Montenegro, Macedonia) and in lesser degree in Hungary.

Buffalo meat is characterised by a rough and tough muscle fibres so it is of poorer quality than beef meat. Meat is dry, tough, of dark red colour and a specific taste because of which it is used more as processed meat. The meat of young buffaloes is similar to those of calves. The buffalo hide is the strongest of the hides of other large ruminants and much appreciated by a leather industry.

### *Buffalo in Serbia*

Buffalo in Serbia, alike buffalo in Europe, originate from the Asian wild buffalo. Body mass of buffalo depends on the conditions of rearing, especially in early juvenile period when scarce nutrition can be negatively reflected on the size and body mass of adult animals. Body mass of buffalo cows whose growth is finished most often ranges between 450 kg and 600 kg although female buffalo of body mass of 700 kg can be found on the terrain. According to the records of previous period, reported by *Ogrizek* (1940/41), and cited by *Mitić et al.* (1987), the mass of buffalo was between 274-507 kg. The mass of young buffalo at birth was 25-40 kg, depending on the size of a dam and conditions of nutrition. Milk yield trait of buffalo cows, according to the results cited by *Mitić et al.* (1987) ranged from 700 kg to 1300 kg (in better conditions) with 7 % to 8 % milk fat.

In Serbia buffaloes are raised in the region of Raška (municipalities of the towns of Novi Pazar, Sjenica and Tutin) and in the region of Kosovo. In central Serbia (in aforementioned three municipalities) there are about 1000 individuals.

## **Materials and Methods**

We have analysed data regarding the size of populations of buffalo in the world. On the basis of data available we have shown the share of buffalo milk in overall produced quantities of milk in the world and a share of production of the most important countries in overall world production of buffalo milk.

For the purposes of analysis of the state of domestic buffalo in Serbia the measures of body dimensions were taken on total of 37 females in the region of the municipalities of Novi Pazar and Sjenica. Buffalo population in these municipalities is included in the part of buffalo population involved in *in situ* programme for buffalo conservation.

Linear measures were taken in breeding females which had already had a calf. The values for total of 10 measures were determined (body mass, ridge height, body length, chest depth, chest width, chest girth, hip width, thigh width, buttocks width, loins height). For these linear measures we have calculated main parameters of descriptive statistics.

## Results and Discussion

Population of buffalo raised in the region of Raška has a relatively uniformed appearance. Their head is narrow and long, horns are strong and they grow outward, go backwards then curve upward. The height of withers in females in the measured population was 125.97 cm ranging from 115 to 138 cm. The height of loins was 126.98 cm. Body length of examined population was on average 142.19 cm, so the trunk was of a quadratic appearance. Chest depth is well expressed, while the chest girth and trunk width are poorly expressed. A front part of the body is more developed, the line of the backs goes down to the buttocks. Buttocks are wide in the region of thigh bone knobs and narrow in the region of buttocks bones. At the same time, buttocks are short, and the root of the tail is placed low in the trunk. Chest depth on average was 68.75 cm, chest width 44.48cm, and chest girth 184.25 cm.

**Table 2. Exterior measures of female buffalo**

Traits	Average	Stand.dev.	Cv(%)	Max	Min
Age, months	71.48	38.79	54.26	180	24
Body mass, kg	464.13	63.13	13.60	600	350
Ridge height, cm	125.97	5.96	4.73	138	115
Loins height, cm	126.98	5.17	4.07	138	117
Body length, cm	142.19	9.83	6.91	167	122
Chest depth, cm	68.75	5.67	8.25	81	55
Chest width, cm	44.48	5.68	12.76	56	33
Chest girth, cm	184.25	41.42	22.48	208	165
Hips width, cm	50.5	4.90	9.69	58	38
Thigh knobs distance , cm	51.6	8.00	15.50	66	38
Buttocks knobs distance, cm	20.10	3.46	17.19	27	13

An average female buffalo body weight was 464.13kg, with great variations existing (13.16%). Such a large discrepancy in buffalo body weight could be understood as a consequence of inadequate and diverse conditions of nutrition and care. The results obtained for exterior measures are similar to the results established by the authors in a much earlier period for buffalo population in the region of former Yugoslavia, cited by *Mitić et al.* (1987). This can all lead to a conclusion that in a previous period a breeding and selection work aimed to improve productive and therefore also exterior characteristics of buffalo which are now being raised in our country were not conducted.

Buffalo is mostly raised on farms in combination with beef cattle. There is an effort to produce sufficient quantity of butter from buffalo milk to last throughout a whole year. Because of that there is a practice among farmers not to let a baby buffalo suckle their dams but to feed them with bovine milk (by suckling

or bottle feeding) while the milk of female buffalo is taken for making dairy products immediately after the colostrum period.

Population of buffalo in central Serbia shows a decreasing tendency and due to this fact in a previous 10 year period the programme to subsidise the raising of buffalo was conducted in order to preserve the population. In most cases the programme of *in situ* conservation of buffalo was conducted (by selection and control of breeding and reproduction of buffalo in native region of breeding). There are breeders in other regions outside Raška who raise buffalo in a lesser number and they are included in the *ex situ* programme of conservation. There are some real threats that native buffalo, according to FAO criteria for preserving genetic resources, will become an endangered species, and then a critical population in Serbia.

Breeding of buffalo in Serbia in previous decades was unorganised and unsystematic. There was almost no control of productivity so that a production traits and production potential of buffalo are quite unknown. Breeding and selection work in buffalo has never been conducted except for natural selection on the resistance to ultimately extensive breeding conditions. All these resulted in very low production of milk of native females (1000-1300kg), which in Serbia is several times lower in relation to milk production realised by selected populations of buffalo in some Asian countries.

**Table 3. Production of milk in the world in 2012 (ton), Faostat (2015)**

Milk	World total, t	% of total world milk production	Production in Europe, t	% of total world milk production	Production in Asia, t	% of total world milk production	Production in India, t	% of total world milk production
Milk total	753925418	100	216089387	28.66	279666027	37.09	124850000	16.56
Milk, whole fresh cow	625754261	82.99	210336776	33.61	169765010	27.13	54000000	8.63
Milk, whole fresh buffalo	97417135	12.92	200706	0.21	94566429	97.07	66000000	67.75
Milk, whole fresh goat	17846118	2.37	2536773	14.22	10410137	58.33	4850000	27.18
Milk, whole fresh sheep	10122522	1.34	3015062	29.79	4729861	46.73	-	-
Milk, whole fresh camel	2785382	0.37	70	0.003	194590	6.99	-	-

Population of buffalo in the world is increasing therefore the production of buffalo milk is increasing as well. According to FAO (2015) participation of overall world production of buffalo milk in total world production of milk in 2012 was 12.92 % (Table 3). Of total world production of buffalo milk (97 417 135 t) 67.76% was produced in India in 2012.

## Conclusion

The population of domestic buffalo in the world is on a constant rise and in 2013 there were 199 783 549 individuals, out of which number in India in 2013 was raised 57.77% of world buffalo population. The participation of total world production of buffalo milk in overall world production of milk in 2012 was 12.92 % or 97 417 135 t, out of which 67.76% was produced in India.

In Serbia buffalo is raised in the regions of Raška (about 1000 animals) and Kosovo. Primary importance of raising buffalos in the world and in our country is production of milk and butter as major products.

On the sample of the population included in the programme of *in situ* conservation body measures were analysed which indicate that population of buffalo is rather unequalised and that average values obtained for exterior measures are similar to the results established by the authors in a much earlier period in populations of buffalo in the area of former Yugoslavia. This can lead to a conclusion that breeding and selection work in buffalo in Serbia in earlier decades was not conducted except for a natural selection on resistance to extremely extensive breeding conditions.

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## Značaj bivola u proizvodnji mleka i stanje populacije u Srbiji

*P. Perišić, V. Bogdanović, C. Mekić, D. Ružić-Muslić, D. Stanojević,  
M. Popovac, S. Stepić*

## Rezime

U radu je analizirano brojno stanje domaćih bivola u svetu, proizvodnja mleka bivola, kao i stanje populacije bivola u Srbiji. Populacija domaćih bivola u svetu stalno raste i 2013. godine bilo je 199.783.549 grla, a od tog broja u Indiji je u 2013. godini gajeno 57,77% svetske populacije bivola, u Pakistanu 18,87%, a u Kini 11,64%. Učešće ukupne svetske proizvodnje bivoljeg mleka u ukupnoj svetskoj proizvodnji mleka 2012. godine bilo je 12,92 % ili 97.417.135 t, a od toga je 67,76% proizvedeno u Indiji.

U Srbiji bivoli se gaje u području Raške oblasti (oko 1000 bivola) i na području Kosova. Populacija bivola u centralnoj Srbiji ima tendenciju smanjenja veličine, zbog čega je pre 10 godina počeo da se sprovodi program konzervacije. Na uzorku populacije (37 bivolica) obuhvaćene programom *in situ* konzervacije utvrđene su prosečne vrednosti za telesne mere. Visina grebena bivolica u populaciji koja je merena bila je 125,97 cm, visina krsta 126,98cm, dužina trupa 142,19cm, dubina grudi 68,75 cm, širina grudi 44,48cm, a obim grudi 184,25 cm. Populacija bivolica je bila dosta neujednačena što ukazuje na odsustvo odgajivačko-selekcijskog rada kod bivola u Srbiji u prethodnim decenijama.

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