

Diachronic Changes in the Size of Domestic Mammals in Medieval and Post-Medieval Poland

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(with 12 figures and 2 tables)

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Abstract

This article presents an osteometric analysis of selected bones of the most important domestic mammals. They were considered in the context of cultural, economic and political changes that took place in Poland from the Roman to the Post-Medieval periods. The results provided a basis for discussion on the diachronic changes in the body size of cattle, horse, sheep, pig and dog. The most clearly visible statistical trends in size were revealed by the data analysed for dog, cattle and, to some extent, horse. Sheep and pig were more stable. Biometrical results were reported and discussed with historical knowledge on forms of the aforementioned mammals in Poland. It was possible to conclude from these results that political, economic and social changes during the Middle Ages and Post-Medieval times had a diverse impact on the size of body and forms of domestic mammals in Poland.

Keywords: Archaeozoology, osteometry, domestic mammals, Roman period, Medieval, Post-Medieval, Poland.

An introduction to the general historical background

The history of contemporary Poland, as a Central-European country, can be divided into a number of significant periods of cultural and economic development. The oldest one, connected with the formation of the state, took place in the early Middle Ages. At that time, after the collapse of the social structures functioning in the period of Roman influences (or Roman period), the peoples identified as Slavs formed, around the 6th–7th century, pagan tribal communities, and later, in the 10th century, one of them (Polans) led by the local dynasty of Piasts, created a state which followed the patterns of other contemporary European Christian states (BUKO 2011). It was based on economically and commercially strong centers in Greater Poland created by Mieszko I, the first ruler, which

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were reinforced by his consecutive heirs. Those centers included central sites, so-called strongholds surrounded by wooden-earth dikes. In those strongholds, the secular elites of those times (such as the state administration and warriors with families) resided. In the closest neighborhood of the strongholds, were open settlements consisting of a type of a village populated by people of a lower social status, who were producing all the indispensable goods for the strongholds, including food obtained from the cultivation of plants and livestock rearing, fishing and hunting.

Until around the 13th century, after complex political and social events, amongst others the division of the autocratic state into several small dynastic princedoms, losing political and economic supervision over a part of the original territory, and after inviting the Teutonic Order to participate in crusades against the neighbouring Prussian tribes, a new settlement, social, economic and cultural system was gradually formed (TOPOLSKI 1986). Its most visible element, distinct from the earlier period, was the located town based on the Lübeck, Magdeburg and Chełmno (Kulm) laws defined by self-government and inhabitants whose occupation was craftsmanship and commerce. Even though every town was also given agricultural lands for the needs of the inhabitants, the raising of animals and agriculture was not of primary significance. The place of former settlements was gradually taken by granges, consisting of a few villages owned by local secular elites and the Church. The raw materials indispensable for the development of craftsmanship in towns derived from these. In the case of animals, these were skins, bones, tallow, bristles and sheep fleece. This period, called the late Middle Ages, finished at the end of the 15th century.

In the early Post-Medieval period, until around the 18th century, economic, social and political phenomena in the Republic of Poland, stretching between two seas, the Baltic and Black Sea, were undergoing various transformations, resulting, amongst others, from numerous conflicts with neighboring countries. On the one hand, this led to economic regression, on the other hand, it caused a necessity of reconstruction following the destruction. This geopolitical situation concluded with the loss of independence, and led to the appearance of Prussian, Austrian and Russia economic patterns (TOPOLSKI 1986).

Considering the fact that domestic animals, and the raw materials and products obtained from them is one of the basic factors of economic development, we can expect that, like other things, they were undergoing changes created by human activity. One of the features important for humans was undoubtedly the size of cattle, sheep, goat or pig. This feature determined the quantity of produced protein and fat, or the size and quality of skins. In the case of species such as the horse or dog, looking at contemporary racial differentiation, their body size was subject to changes according to their utilitarian value during life and according to the preferences of the owners of these species. The information about the size of the aforementioned mammals and its variability can be followed based on historical sources, however only from the 19th century. In this situation, bones discovered during excavations and osteometric examinations used in the field of archaeology, are an invaluable way to analyze and understand this question. Throughout decades of development of archaeozoological research in Poland and analyses conducted



Fig. 1. Sites and main historical regions of Poland mentioned in the text (drawing by W. MILEK).

by the author, osteometric data concerning domestic mammals' bones, associated with archaeological contexts from the aforementioned three periods, have been collected. They come from various sites and, depending on the specific species, we can construct variability trends based on them.

Materials and methods

One short article cannot comprise detailed studies on all domestic mammals. The complexity of this question was also not addressed in reference to the indicated temporal and spatial scope. For years, however, it is one of the key research topics of the author. So far, this issue was most comprehensively covered in the publications of the studies on the size of domestic mammals in Early Medieval centers (Fig. 1), such as Ostrów Lednicki (MAKOWIECKI 2001), Chełmno (MAKOWIECKI 2010), Łęczyca (MAKOWIECKI 2014), and recently Poznań (MAKOWIECKI 2016). Only a small part of these studies is available to the international community, as it was published in English (MAKOWIECKI 2006a, b, 2009), and concerns dog, cattle and horse. The present work, even though it is merely a contribution to these broader studies, is, however, the first approach to the investigation into the changes of size of aforementioned domestic mammals in the context of social, political and economic changes in the indicated periods.

In order to realize this aim, osteometric data from the sites located mostly in Greater Poland, Lower Silesia, Pomerania and Kulmerland, was used. This derives from both unpublished data collected by the author and from other researchers (*e. g.*, KUBASIEWICZ

& GAWLIKOWSKI 1965; KUBASIEWICZ 1977; MAKOWIECKI 2001, 2010, 2014, 2016). In the case of cattle, the analyses was conducted based on the greatest length of the lateral half (GLI) of the astragalus, the greatest length (GL) of metacarpus III+IV and metatarsus III+IV. All measurements and abbreviations follow VON DEN DRIESCH (1976). The height in withers calculated based on CALKIN (1960, 1970) coefficients was also used. For sheep, the greatest length (GL) of metacarpus III+IV and metatarsus III+IV as well as of other long bones was used, and the height in withers was calculated based on them (TEICHERT 1975). For pig, metacarpus III and IV, matatarsus III and IV and astragalus were the most numerous, and the height in withers was calculated based on them and TEICHERT's (1969) coefficient. In the case of this species, only the data concerning Poznań was used (MAKOWIECKI 2016). For the horse, the measurements of GL and LI of metacarpus III and metacarpus IV were used, as well as those of shoulder and radius bones. Based on them the height in withers was calculated with the usage of the data comprised in VITT's (1952) table. In the case of dog, the height in withers was used, calculated based on the length of long bones and HARCOURT's (1974) coefficients, however, taking into account only the data from Gdańsk. Graphic and statistic features were obtained using the Statistica 9 program.

An overview of significance of domestic mammals throughout the 5th/6th–19th century based on archaeozoology

Based on numerous analyzes of bone remains excavated from Early Medieval settlements, we can conclude that breeding of domestic mammals, such as cattle, sheep or pig constituted in that time the basis of food production. From the first two, also skin, bones and horn sheaths, besides meat, were obtained. While in the tribal period Slavs mostly focused on cattle breeding (DEMBIŃSKA 1975), later, in the 10th century, in the period of early state formation on the territory of Greater Poland, the most important role in the production of food consisting of meat and fat was played by raising pigs (Fig. 2). This economic model was maintained until the mid-13th century, not only in the core area of Poland, but it was also introduced in many stronghold centers and proto-urban centers to the north, that is in Pomerania, and even in Lower Silesia, located to the south (MAKOWIECKI 2006a, 2009, 2010, 2014). In the late Middle Ages, due to food and technological needs of the newly-created towns, mostly cattle were being bred, and, to a lesser extent, pig. Next to cattle, an important role was also played by sheep and goat. In both stages of the Middle Ages, horses and dogs were bred as well (MAKOWIECKI 2016). A small percentage of remains of these species allow us think that their populations were not as numerous as those of the aforementioned species. We must also add that while in case of dog it was difficult to conclude anything about its alimentary significance, in the case of horses, traces of butchery processing (butchering using large blades) registered on its bones from some archaeological sites, indicate its occasional role as a food item, at least in case of some specimens of this mammal. Also, its usage for riding is undoubted.

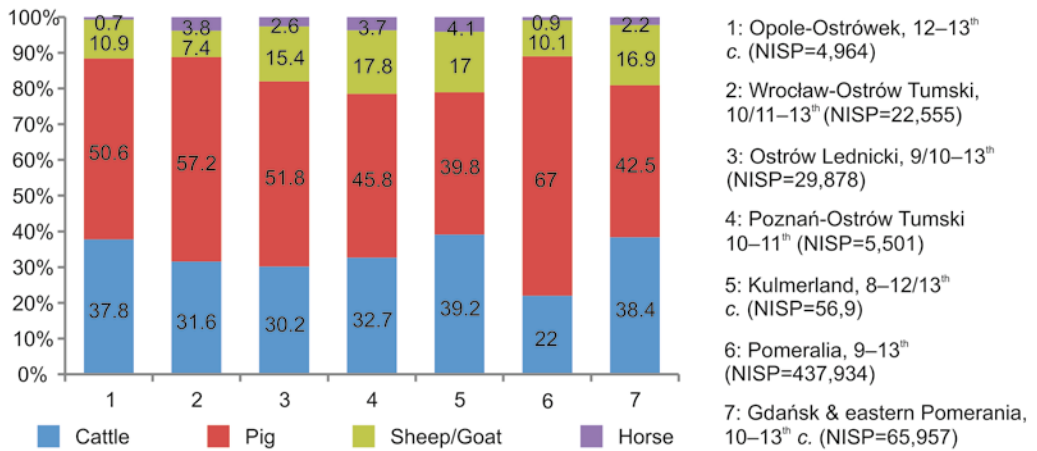


Fig. 2. Percentage of domestic mammals in the central strongholds of the Piast monarchy (by CHRZANOWSKA & MOLENDNA 1978; CHRZANOWSKA 1986; MAKOWIECKI 2001, 2016; MAKOWIECKI *et al.* in press; STĘPIEŃ *et al.* 2010).

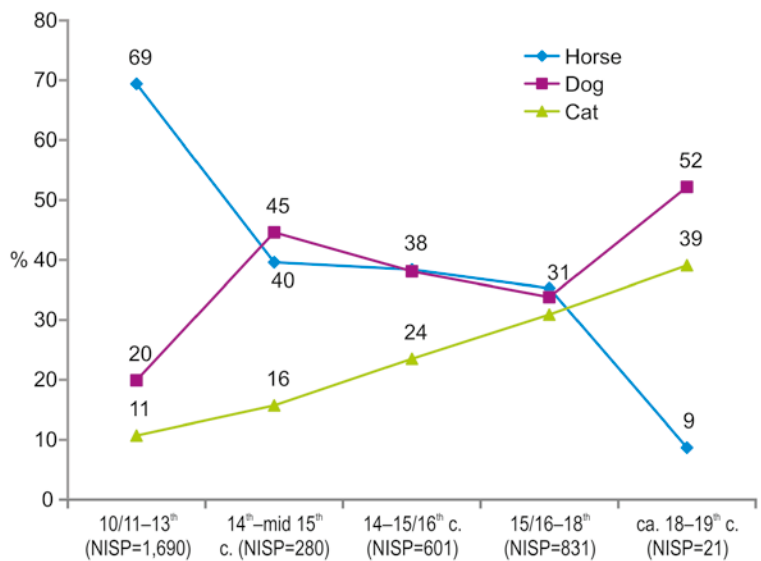


Fig. 3. Gdańsk. Changes in bone percentage of horse, dog and cat (MAKOWIECKI & MAKOWIECKA 2013).

Its elite and military significance has been registered in the accounts of travelers and merchants who described Mieszko’s state. As it turns out, most likely due to the price of horses, this ruler was equipping his warriors with these palfreys (LABUDA 1999). From other accounts, as well as from archaeozoological analyzes, we can read the fact that the horse was considered a palfrey of the Slavic gods (LABUDA 1999; MAKOWIECKI & MAKOWIECKA 2014). The utilitarian function of the horse changed with the development of towns. While its remains constituted often up to 4–5% of the collections of fauna of

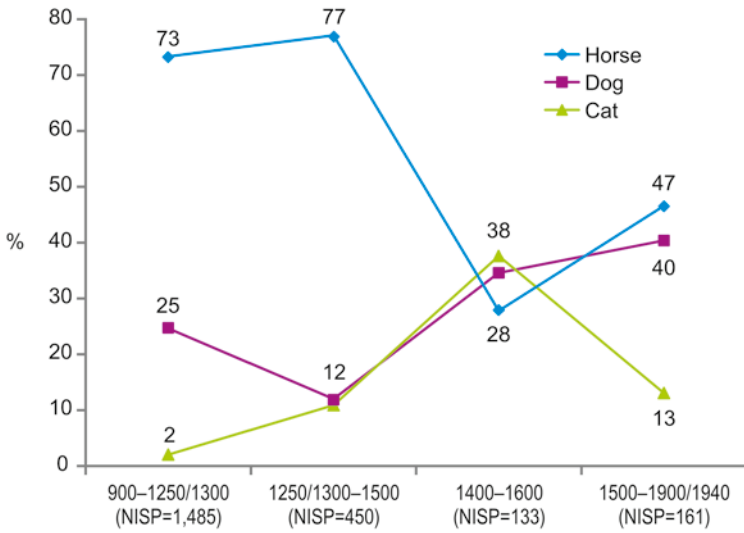


Fig. 4. Poznań. Changes in bone percentage of horse, dog and cat (data by MAKOWIECKI 2016).

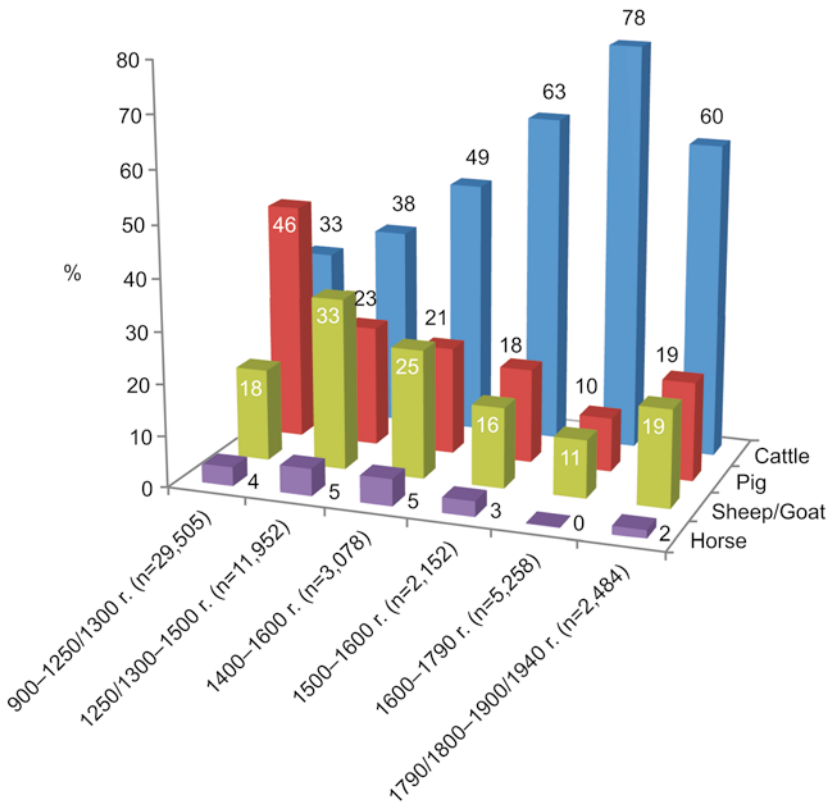


Fig. 5. Poznań. Percentage composition of domestic mammals by historical stages (MAKOWIECKI 2016).

Early Medieval centers, later, in towns such as Gdański and Poznań in the Late Medieval and Early Post-Medieval material, it was registered more rarely. In turn, the percentage of bones of dog and cat increased (Figs 3, 4).

Archaeozoological data referring to the Post-Medieval period are not that numerous as for the Middle Ages. Those obtained from Poznań (MAKOWIECKI 2016), Gdańsk (MAKOWIECKI & MAKOWIECKA 2013) and Stargard (MAKOWIECKI & WIEJACKA 2016) indicate quite clearly the continuation of the tendency formed in the late Middle Ages, with the dominance of cattle, and with lesser numbers of sheep and pig, particularly visible in the case of Poznań (Fig. 5).

Cattle – *Bos primigenius f. taurus*

Numerous studies conducted at many sites have indicated that in the early Middle Ages, both in the tribal period as well as in the beginnings of the state of Piast dynasty, cattle of a small size, defined as *Bos brachyceros* was bred (SCHRAMM 1976; MAKOWIECKI 2001, 2009). Regardless of the region, in Greater Poland, Silesia or Pomerania, the statistical features of metric values of bones are similar. A good example of this is the GLI of astragalus (Fig. 6), as well as GL metacarpus III+IV (Fig. 7). The height in withers calculated from them, with the use of CALKIN (1960, 1970) coefficients allow us to estimate that mean values of the feature at particular sites was around 102–103 cm (MAKOWIECKI 2006a). The data obtained from Late Medieval specimens are already not that numerous. However, those collected from cities such as Gdańsk, Poznań, Stargard, Białogard and Kołobrzeg do not indicate changes in height, and at the same time in form, of the bred cattle. We can tell about some signs of increase of size only in reference to the Post-Medieval period, to which belong specimens discovered in Poznań (Fig. 8) and Gdańsk (MAKOWIECKI *et al.* in press), and which exceeded in size those from the early and late Middle Ages. It was probably a result of progress in cattle breeding, aimed not only at production of meat, but also at the milk efficiency of cows. An example of this can be found in the studies of cattle in Greater Poland (MAKOWIECKI 2016). It turns out that in the Post-Medieval period, interference in the local population of Poznań's cattle, and probably more broadly, of cattle in entire Greater Poland, took place most likely already in the 16–17th century. A sign of this can be seen in registering higher values of height in withers. The observed fact could have been influenced by the import of specimens from other regions. We know that from the end of the 14th century cattle were being imported from Southern Rus (CHMIELEWSKI 1962). In the 17th and 18th centuries, in Eastern Greater Poland, cattle called “common” or “ordinary” was kept, and the specimens with a homogeneous coat dominated (BARANOWSKI 1958, 1967). The quoted author states an opinion of significant mixing of breeding material, what would have been caused by the wars of the second half of the 17th century and early 18th century. If we agree, that probably it was an effect of random local hybridization of Medieval populations with breeds coming to Polish territories from various regions of Europe. In this context the statistical features would reflect, on the one hand the mixing of breeds, and on the other hand, could be a

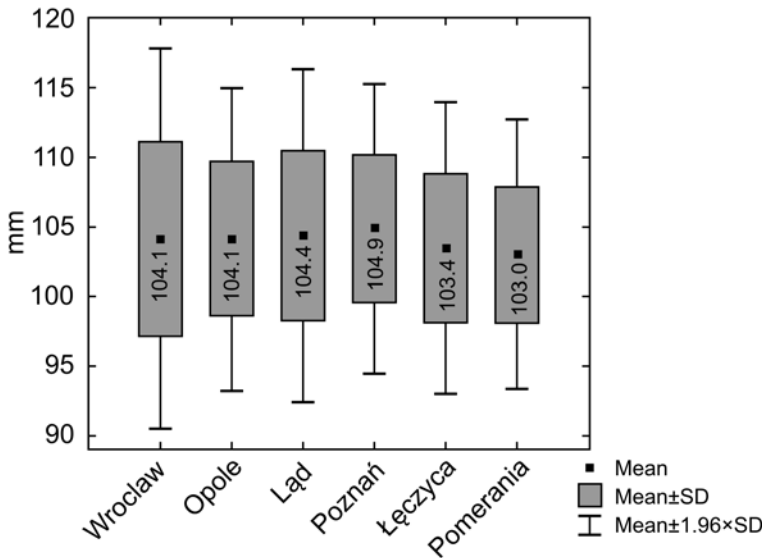


Fig. 6. Cattle – *Bos primigenius* f. *taurus*. Astragalus – statistical characteristics of the greatest lateral length (GLI).

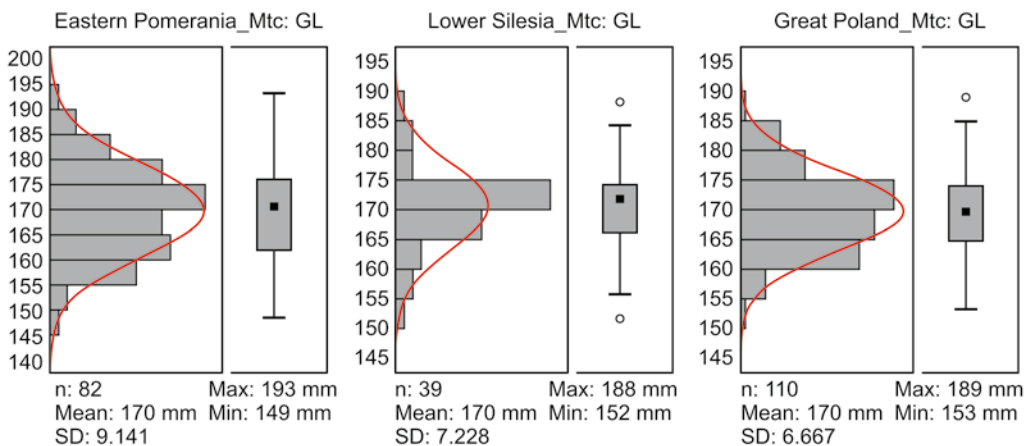


Fig. 7. Cattle – *Bos primigenius* f. *taurus*. Metacarpus III+IV – statistical characteristics of greatest length (GL).

sign of improved breeding, obtained through mixing the local populations with larger steppe and Frisian cattle brought amongst others to Eastern Greater Poland (BARANOWSKI 1958, 1967). According to historical data, already in 1631, Lew SAPIEHA imported to his manorial estates 26 Dutch cows, but this tendency became more popular only in the second half of the 18th century (TOPOLSKI 1953). It is considered that in that time, up to the mid-20th century, the indigenous red cattle were widely bred in Greater Poland. The aforementioned caesura is considered the beginning of the increased influx of breeds of foreign origin. Mostly lowland black-and-white cattle were imported, superseding the indigenous cattle, particularly in the northern part of Greater Poland (MRÓWCZYŃSKI 1961).

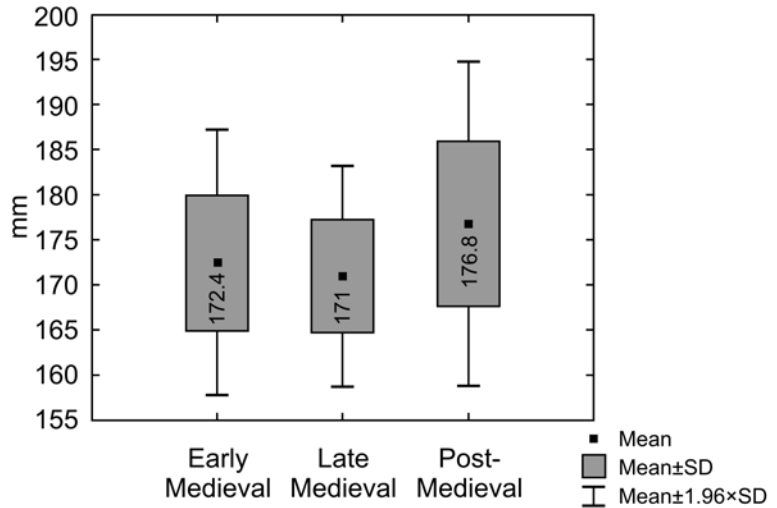


Fig. 8. Poznań. Cattle – *Bos primigenius* f. *taurus*. The greatest length (GL) boxplot of metacarpus III+IV.

Horse – *Equus ferus* f. *caballus*

Horse, as the only species of domestic mammals (amongst farm mammals such as cattle, sheep, goat, pig) was kept and used in the Middle Ages for largely non-consumption purposes. Even though it is a usually accepted opinion, the presence of horse remains can be also observed among the remains of vertebrates used for subsistence (pig, cattle, sheep, goat, wild game, birds and fish), mostly in farms (waste and production pits, living areas – pit-houses). This might suggest consumption of horse meat (MAKOWIECKI 2001). From Early Medieval annals we can gather information that the significance of the horse in the symbolic culture, that is in prophetic rituals and regarding the horse as the gods' palfrey, had a particular character among the Polabian Slavs and those inhabiting Western Pomerania (LABUDA 1999). Based on that, one can conclude that the horse also played a certain role in the ideological (magical) sphere in other regions, what can be confirmed by occasionally discovered deposits of horse skeletons and skulls, treated as foundation deposits (MAKOWIECKI & MAKOWIECKA 2014). This phenomenon, with Christianity spreading, would gradually disappear like other pagan activities and practices.

Most of the metric data was collected from the long bones of Early Medieval horses discovered in many sites located in several historical regions such as Western Pomerania, Eastern Pomerania, Greater Poland, Kulmerland and Lower Silesia. In this article only the height in withers was used. Considering the obtained statistic features (Fig. 9) we can tell that in contrast to cattle, horse populations were varied. The smallest were used in Eastern Pomerania and Kulmerland, that is in the regions located peripherally in relation to Greater Poland that was the center of the Piast state. It cannot be excluded that the separateness of both populations was influenced by presence of wild horses living in the territories in that time occupied by the Prussians. Bigger horses in Silesia and Western

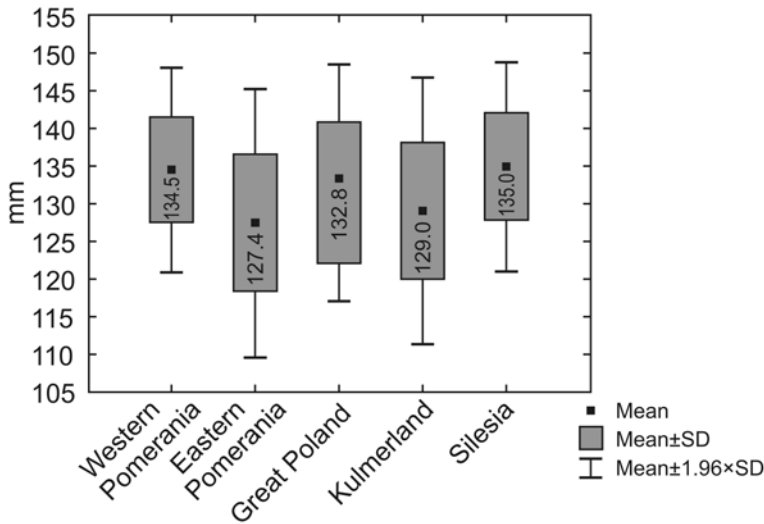


Fig. 9. Box plot of horse withers heights in the early Middle Ages in different historical regions of Poland (author's data and collected by author from published and unpublished reports).

Pomerania can be considered an effect of the closeness of peoples inhabiting those terrains and peoples of Western and Southern Europe. It is worth mentioning that the horses of Slavs inhabiting territory located on the left bank of Oder had a mean height of around 135 cm and a range of 116–151 cm (MÜLLER 1979). It must be added that the population from the 9–10th century was bigger than from the 5–6th century, which, according to MÜLLER (1985: p. 33) was an effect of selecting bigger specimens for horseback riding. Also horses from Mikulczyce, in the southern part of Western Slavic territories were similar to the Silesian population, and had a mean height of 136 cm and range of 126–149 cm (MÜLLER 1979). It is also worth emphasizing that the quoted author studied skeletons of specimens intentionally buried, while the characteristic of horses from the period of the Piasts is based on specimens discovered among the post-consumption materials. It therefore represents an average population, and because of that almost all specimens are lower than the populations of Polabian Slavs and Slavs of southern regions. These consisted of specimens selected for horseback riding, especially in Silesia, Greater Poland and Western Pomerania.

Some conclusions about changes of horses in this part of Europe can be made already in reference to the late Middle Ages, when the Teutonic Order's state was developing in the Kulmerland and in Prussia and Eastern Pomerania. From the data included in accounting books we can tell that they were using several groups of horses of various size (CHEĆ 2005). Indeed, while following metric data concerning horses of those times and of early Post-Medieval times we can notice an increase of the mean height in withers by about 3 cm (Fig. 10A). However, a similar analysis of the data concerning Poznań does not provide any basis for the conclusion about the usage of higher horses in the late Middle Ages than in the early Middle Ages (Fig. 10B). It cannot be excluded though that the lack of difference is a result of the fact that in the city and adjacent granges people used work horses, and not horses which served military

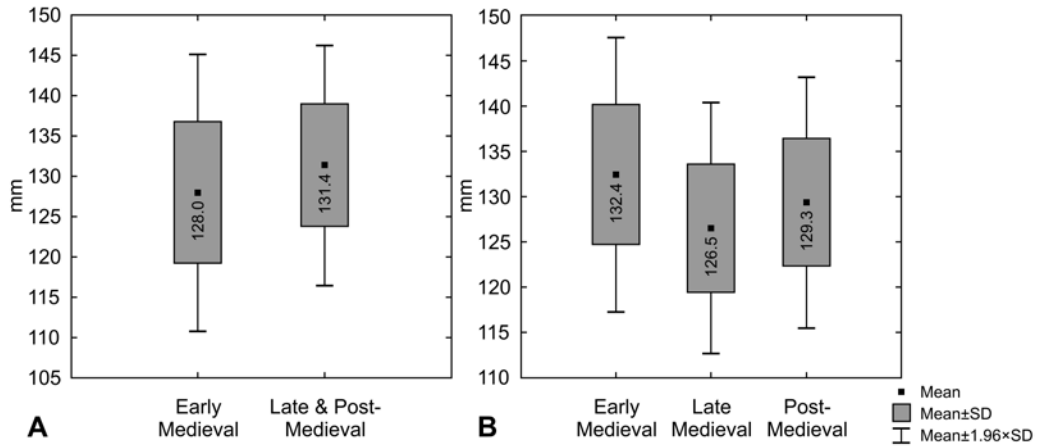


Fig. 10. Box plot of horse withers heights: A: Eastern Pomerania (Vistula Region and Kulmerland – author's unpublished data), B: Poznan (from MAKOWIECKI 2016).

purposes in cavalry. At the same time, in the areas close to Vistula, we can observe higher heights in withers – a result of the influences of horses bred by the Teutonic Order.

Some explanation of the aforementioned results can be found in the data taken from historical sources. According to them a huge range of various breeds of horses existed on Polish territory between the 16th and 19th century. In the studs of magnates and nobles palfreys of noble blood and high quality were bred (BARANOWSKI 1964: p. 205; PRUSKI 1967). The second group consisted of primitive horses used by serfs as work horses. They were small like donkeys. This was a result of bad treatment by peasants, as they did not belong to them but to the manor. Because of that they were poorly fed, and very early, already in the second year, they were being harnessed to ploughs. This had a basic influence on their height and the development of their bones and muscles, it had also a bad influence on the breeding condition of these animals. The symptoms appeared especially among small specimens when hybridization was happening randomly. These kinds of horses were already present in the beginning of the 19th century and rarely reached the height of 122 cm, and their bones were delicate (PRUSKI 1967: p. 174).

Based on these remarks we can tell that the population of horses analysed here belonged to a typical, in that time, group of work animals used in agriculture by serfs. It is important to add that in that time peasants referred to these animals mostly with aversion, as the ox was better for tillage and was easiest in maintenance. Horses could not pull as heavy a load as oxen. They were better only for harrowing and only when few of them were harnessed into a so-called key. Further aversion towards these animals resulted from their bigger sensitivity to the inconvenient environmental conditions and bad nutrition which was very common.

Sheep – *Ovis orientalis f. aries*

So far, osteometric studies for this species concerned the early Middle Ages (SCHRAMM 1967). They have demonstrated that at that time in the Piasts' centers people were breeding homogeneous populations similar in size to contemporary heath sheep. However, we can follow changes in the size of sheep in the aforementioned periods based on the data collected from Poznań (MAKOWIECKI 2016). Analysing the results included in Table 1, we can tell that the height in withers of sheep in the early Middle Ages was the same as in the Post-Medieval period, while in the late Middle Ages the specimens were higher on average by 1.5 cm. Conducted tests of t-student allowed us to tell that the differences in height in withers were not significant for $p=0.001$, while they turned out significant in the case of some populations only for $p=0.05$ (e. g., metatarsal bone). It is important to add that in case of the aggregate comparison of the height in withers calculated from all the bones (Tab. 1), particular populations did not differ from each other at the level of $p=0.05$.

It is difficult to conclude about changes in sheep breeding which would lead to the development of breeds based on the metric data. We can suppose that in the Middle Ages, and most likely also in the Post-Medieval period, people were breeding mostly local

Table 1. Poznań, sheep – *Ovis ammon f. aries*. Measures of statistical dispersion in height at withers.

Period*	n	Mean	Min.	Max.	Range	SD	V%
<i>Radius</i>							
EM	12	60.8	53.4	66.7	13.3	4.613	7.585
<i>Os metacarpale III et IV</i>							
EM	8	60.0	56.7	65.5	8.8	2.834	4.722
LM	33	60.8	50.5	68.8	18.3	4.146	6.814
EM-LM	2	66.0	65.5	66.5	1.0	0.707	1.071
LM-PME	5	63.1	55.6	67.9	12.3	4.772	7.567
PM	2	66.2	65.0	67.3	2.3	1.626	2.459
<i>Os metatarsale III et IV</i>							
EM	12	59.6	54.9	63.1	8.2	2.245	3.767
LM	35	62.3	56.3	69.5	13.2	3.620	5.806
LM-PME	10	63.2	58.6	68.1	9.5	2.798	4.425
PME	7	58.2	52.4	62.4	10.0	3.292	5.652
All specimens							
EM	31	60.0	53.4	66.7	13.3	3.294	5.492
LM	69	61.5	50.5	69.5	19.0	4.022	6.540
PME	9	60.0	52.4	67.3	14.9	4.540	7.567

* EM – Early Medieval, LM – Late Medieval, PME – Post-Medieval

sheep. According to the historical data, in the 18th century in Eastern Greater Poland there was a type of sheep called primitive – “ordinary” (BARANOWSKI 1958: p. 194), and deriving from local breeds, such as heath sheep and “świniarka” sheep. Among the characteristic features of those breeds we can find a small size and a type of coating called the “sheepskin coat” (NOWICKI *et al.* 1995), and earlier “mixed wool”. It distinguishes itself by the down hair being close to the core hair or being significantly longer than those. This causes formation of the so-called locus knob. In the beginning of the 20th century, the milkiness of these mixed sheep was assessed as about 40–50 liters a year. From one specimen people could obtain 3 kilos of wool serving for the production of thicker materials, such as blankets, tapestries and worsted (SAWICKI 1931: p. 142). The skins from heath sheep, as typical sheepskin sheep, were suitable for sheepskin coats because they were durable while worn. The coat of the świniarka was usually white, occasionally black and piebald, while heath sheep were gray, occasionally gray-white or reddish-black (MOCZARSKI 1927). These sheep were low, and the average height in withers for the świniarka sheep was 61.4 cm, and for the heath sheep was 57.8 cm (HOLUB 1938). The first of them was closer to the paleopopulation of Poznań.

Pig – *Sus scrofa f. domestica*

The basis for analysis were complete specimens of bones such as humerus, radius, ulna, femur, tibia, metacarpus III and IV, metatarsus III and IV, astragalus and calcaneus (MAKOWIECKI 2016). It was possible, based on the hand bone and the bone of the foot, to calculate a parameter for populations from the Early Medieval to Post-Medieval periods. As much as 26 specimens from 33 of metacarpus III and IV were dated back to the early Middle Ages (Tab. 2). The mean height for the aforementioned period was the largest, coming up to 77.7 cm, with, as the same time, the broadest range. Specimens from the late Middle Ages and Post-Medieval period were lower by almost 7 cm. However, in that case, the height in withers was calculated only from 7 bones, what could have had an influence on the mean. Even less specimens were available for calculating results for the Post-Medieval period. Here, the mean value was almost exactly the same as for the Late Medieval period. The height in withers was calculated from the metatarsus only in the case of 12 specimens, and most of them were associated with the early Middle Ages. Also in this case, the mean was higher from that estimated for the Post-Medieval period. Based on the calcaneus, the value of the feature was estimated in the case of 13 specimens, and only one of them came from a Late Medieval population, while the rest of them derived from an Early Medieval one. The mean value for that period reached only 71.4 cm, so it was clearly lower from that calculated based on the metacarpal and metatarsal. This state of things was influenced by the lack of specimens from the upper range of sizes, that is those exceeding 80 cm. Based on the astragalus, the height in withers was examined for as many as 59 specimens, while most of them, 44, represented the population from the early Middle Ages. This time the mean value for the early Middle Ages was lower than that calculated from the metacarpal bone and

metatarsal bone, reaching only 70.4 cm (Table 2). One again, populations of specimens exceeding the limit of 80 cm were lacking. The same mean height was calculated from the bones dated back to the late Middle Ages, while the specimens from the populations from the end of the Middle Ages and from the Post-Medieval period were slightly higher, by about 2 cm.

Based on the metrical observations concerning pigs, we can state a thesis that in the case of particular periods any significant changes in the size of bred specimens did not take place. It was probably a result of the fact that this species was used only one-sidedly, for meat and fat, and not much attention was paid to its improvement. The lack of progress is understandable because with the increasingly shrinking deciduous forest resources, including oak forests, less and less acorns were available to be used as pannage (CHMIELEWSKI 1962: p. 122). It is not surprising then that in the 17th century, pigs were also fed by weeds, leaves, offal of vegetable and fruit (TOPOLSKI 1953: p. 89). It is also important to remember, that while in the 14th–15th centuries there was a balance between vegetal and animal production (CHMIELEWSKI 1962: p. 120), in the 16th century, with the development of the manor-farm economy, this relation was significantly shaken. It is that time, when more profits were obtained from vegetal production, as the breeding of livestock was relatively small, and one of its more important effects was obtaining manure. The situation was similar in Greater Poland, however, animal production in this

Table 2. Poznań, pig – *Sus scrofa* f. domestica. Measures of statistical dispersion in height at withers.

Period*	n	Mean	Min.	Max.	Range	SD	V%
<i>Humerus. radius. ulna. tibia</i>							
EM*	8	79.9	71.7	86.6	14.9	5.850	7.320
<i>Os metacarpale III et IV</i>							
EM	26	77.7	67.9	87.7	19.8	5.006	6.441
LM	4	71.0	65.0	76.1	11.1	5.105	7.188
PME	3	70.9	65.5	79.8	14.3	7.744	10.917
<i>Os metatarsale III et IV</i>							
EM	9	76.4	73.9	81.7	7.8	2.545	3.332
PME	3	72.8	70.9	74.7	3.8	1.900	2.610
<i>Calcaneus</i>							
EM	12	71.4	64.4	77.4	13.0	4.545	6.369
LM	1	65.4	65.4	65.4			
<i>Astragalus</i>							
EM	44	70.4	60.9	77.1	16.2	3.461	4.914
LM	9	70.0	65.5	79.8	14.3	4.541	6.487
LM-PME	6	72.6	67.3	75.7	8.4	3.061	4.219

* EM – Early Medieval, LM – Late Medieval, PME – Post-Medieval

region was maintained at a higher level than in other regions, *e. g.*, in Mazowsze (TOPOLSKI 1958: p. 221). As less attention was paid to animal production, including ruminants which were a source of products such as milk and wool, even less attention was paid to pig that was used, as mentioned above, for a single purpose.

Dog – *Canis lupus f. familiaris*

The dog is the most faithful and most popular animal companion of contemporary Man. Looking at this mammal through the lens of breeding patterns and neighborhood cross-breeds, we can see a broad diversity of proportions of elements of their body, size and coat. We can distinguish, amongst others, shepherd dogs, guard dogs, watch dogs, terriers, dachshunds, hounds for big game, hounds for small animals, pointers, dog companions, greyhounds or: utility dogs, hunting dogs, terriers, greyhounds and dog companions (NOJMANOVÁ & HUMPÁL 1987). From the up to date research on the diversity of dogs through the osteometric data it is clear that already in the Neolithic there were specimens smaller than wolves as their height in withers was between 39 and 46 cm (PIĄTKOWSKA-MAŁECKA & GUBERNAT 2003). They were as those in the Alpine region, where the range of the aforementioned feature was 35–54 cm, with specimens most often ranging from 41 to 47 cm (BENECKE 1994). It is possible, that such specimens were more useful for guarding ruminants' herds and farmers' homes, than for hunting, that, as we gather from the data, was practiced rarely.

In the pre-Roman and Roman periods, considering the populations of dogs from the Kujawy region, dogs of a much bigger size were kept (Fig. 11). They were constituting a homogeneous population with a height in wither 28.9 to 63.1 cm and mean of 54.8 cm, with a relatively small coefficient of variation being 10%. Among them were also specimens of brachymel dogs, which most likely came from Roman provinces. The participation of these specimens and, in general, of small dogs, increased within the Early Medieval population, which served the inhabitants of stronghold centers. This population was lower, reaching only 51.1 cm, and, at the same time, more diverse, as the coefficient of variation was 15.5%. Even smaller dogs were kept by burghers from Late Medieval and Early Post-Medieval towns. Their mean was only 42.5 cm, with a very big range 22.6 to 71.0 cm and the biggest coefficient of variation – 28.7%. While the described changes concerned dogs whose bones were found at sites of various regions, the research conducted on bones of dogs from Gdańsk showed a trend of decrease of height in withers (Fig. 12). The biggest specimens were kept in the Early Medieval stronghold; in late Medieval towns they were already smaller by 10 cm, and in Post-Medieval towns by 20 cm.

It is clear from these analyses that the variability of dog forms was quite a dynamic phenomenon already in prehistoric periods. For about 2000 years, a characteristic feature was a one-direction tendency of decrease of participation of bigger dogs and of an increase in the number of small specimens. This could have been the effect of changes

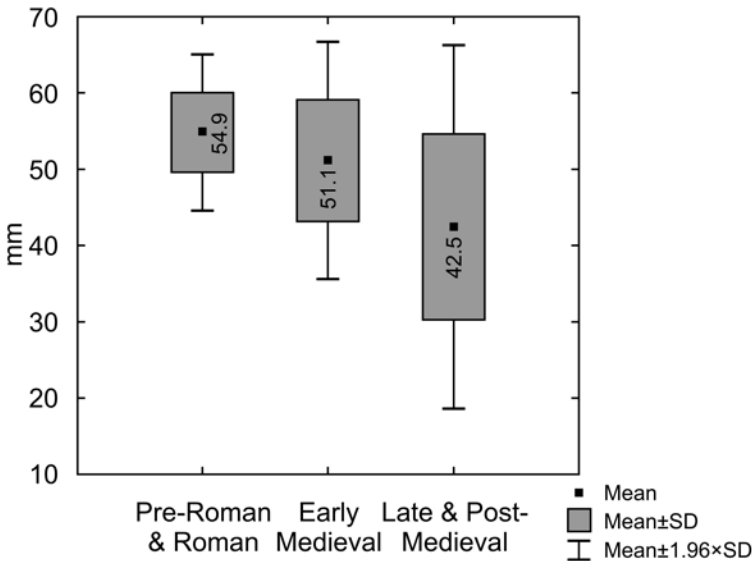


Fig. 11. Dog – *Canis lupus f. familiaris*. Changes in withers heights from pre-Roman to Post-Medieval (from MAKOWIECKI 2006).

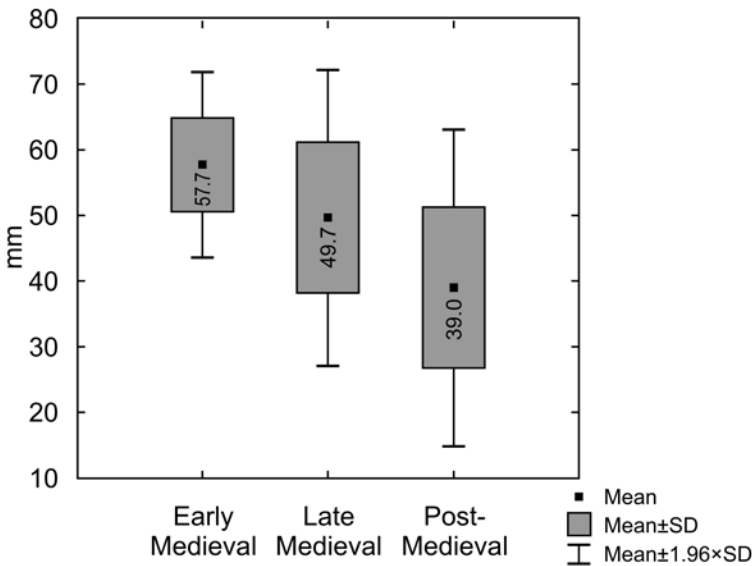


Fig. 12. Dog – *Canis lupus f. familiaris*. Box plot of withers heights in Gdańsk (author's data and collected by author from published and unpublished reports).

taking place within the functions of settlements and their social structure. With these changes, a need to own dogs of much bigger diversity of breeds was forming. The development of towns was, in this regard, a basic factor conducive to the increase in the number of dogs of low and mean breeds. The dogs kept (used) in settlements with the character of a village, had, besides accompanying their owners, definite economic tasks, including watching, helping in grazing of herds of cattle and sheep, as well as taking part in hunting.

Concluding remarks

In general, we can say that political and social changes in the Middle Ages and Post-Medieval period had a diverse influence on the forms of domestic mammals. The characteristics presented above show the most significant dynamic can be found in the case of dog. This trend is clear both for the whole area of Polish lands as well as in particular regions. Most of the remaining species, particularly horse and cattle, could have been dependent on political and social changes taking place in specific regions. Larger specimens from Eastern Pomerania were the effect of the presence of the Teutonic Order and of the influx of settlers from Western Europe. In Greater Poland, a region of stable Slavic settlement, the basis were local breeds of horses and ordinary cattle, as well as local sheep. In the case of pig and sheep, the same primitive populations were kept since the early Middle Ages until at least the beginning of the 19th century. In the end it is worth adding, that the foregoing observations seem to be a good basis for undertaking complex studies, that, besides traditional osteometrics will include biomolecular and geometric morphometric methods.

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