

Early Neolithic farmers modified the reproductive cycle of sheep

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The study on the remains of animals found at the site of the Chaves cave in Huesca, led by the Universitat Autònoma de Barcelona, obtains new data on the control of breeding and feeding of the first domesticated sheep herds found in the western Mediterranean region during the Neolithic. The modification of their natural birthing cycles affected their physiology and resulted in prolonged periods of fertility. Credit: Alejandro Sierra

A study led by the UAB on the remains of animals found at the site of the Chaves cave obtains new data on the control of breeding and feeding of the first domesticated sheep herds found in the western Mediterranean region during the Neolithic period. The results,

exceptional first time evidence of how early flocks of domesticated sheep fed and reproduced within the Iberian Peninsula, are currently the first example of the modification of sheep's seasonal reproductive rhythms with the aim of adapting them to human needs.

The project includes technical approaches based on [stable isotope analysis](#) and dental microwear of animal remains from more than 7,500 years ago found in the Neolithic Chaves cave site in Huesca, in the central Pyrenean region of Spain. The research was coordinated from the Archeozoology Laboratory of the UAB Department of Antiquity, with the participation of researchers from the University of Zaragoza, the Museum of Natural History of Paris, and the Catalan Institute of Human Palaeocology and Social Evolution (IPHES) in Tarragona.

"The alteration of seasonal breeding rhythms in livestock represented a huge milestone for prehistoric societies, making it possible to have access to meat and milk throughout the year, and this in turn had a huge impact on diet, on the economy and on the social organization of the first farming communities, and set down the bases for farming strategies which continue to be carried out now. Until very recently, [animal husbandry](#) in the Neolithic period was thought to be in its initial stages, although new possibilities in biogeochemical analyses used in this study have revealed husbandry practices that were fully consolidated since the beginning of the Neolithic," says Dr. Maria Saña, lecturer at the UAB Department of Prehistory and coordinator of the project.

The domestication of sheep did not occur in the Iberian Peninsula. Its agriotype, the *Ovis orientalis*, can be found in central and southeastern Asia. "What is surprising is the speed in which the sheep are integrated into animal husbandry strategies and their enormous economic importance in the earliest periods of the Neolithic. What we see is a rapid and successful adoption, which demonstrates that their mechanisms of adaptation to both the new environment and their new

economic role were well known and controlled by a part of human communities. The selective pressures applied on the species were artificial, they pursued specific objectives and were well defined. This new evidence represents a turning point in the research into animal domestication and the origins of animal husbandry. It was made possible by the new approach that we took with this study, focused on exploring the changes in breeding and feeding of these first flocks of sheep," states Alejandro Sierra, researcher at the UAB and at the University of Zaragoza, and first author of the article recently published in *Journal of Archeological Science: Reports*.

The research focused on the study of sheep rearing in the Neolithic Chaves cave (5600-5300 BCE) in the Pyrenean foothills, a site that is "spectacular for the quality and number of remains recovered. When compared to Neolithic levels of fauna, its 12,754 recognisable remains are at least threefold of what is found in other Neolithic sites on the peninsula, with domesticated sheep and goats being the most numerous species, and with the largest presence of pigs of all the Neolithic sites. All of this points to the stabling of [animals](#) and to the type of stable settlement known to be dedicated to animal husbandry, and within a large cave that had 3,000 square meters of habitable space," affirms Pilar Utrilla, professor at the University of Zaragoza and director of the archeological interventions.

The results obtained at the Chaves site show that in the Iberian Peninsula, the birth of lambs also occurred in autumn and winter seasons, which is what is now considered to be an "out of optimal season" birthing, an aspect that contrasts significantly with the livestock regimes documented in other parts of Europe during the Neolithic, with births occurring mainly in spring. The modification of the natural birthing cycles of wild sheep affected the physiology of the animals of this species, prolonging their fertility period. That was the result of a more intense and continued human control, altering interactions

between females and males, a breeding strategy that sought greater predictability in livestock production. "Autumn birthing in the early Neolithic in the Chaves cave would confirm the antiquity of this practice in the Western Mediterranean basin, implying a combination of the biological capacity of sheep, zootechnical skills of the agricultors, and favorable environmental conditions," states Dr. Marie Balasse, researcher at the Museum of Natural History in Paris.

The study also demonstrates that this greater control and selective pressure also had an effect on the diet and movement of the species. By applying for the first time a combination of dental microwear and stable C-13 and O-18 isotope analyses on sequential samples of second and third molar enamel bioapatite, scientists were able to detect that the flock of sheep at Chaves did not eat a greatly varied diet, neither among the sheep nor throughout the year. The results of the dental microwear show that Neolithic sheep had a more controlled diet than wild animals living in the same types of environments and which grazed on good plant covers, with still very little human impact on their lives. The sheep would graze near the cave during most of the year, and were probably also fed forage. The verification of the use of extraordinary forage is also a novelty. "The results of what the sheep from the Chaves cave ate are surprising when compared with what we expected. We were able to document diets consisting of intensive and established differences between young and adult sheep, and these characteristics can be related to a tight control on livestock production during those earliest periods of the Neolithic," states Dr. Florent Rivals, ICREA research professor at the IPHES.

"The results obtained on the breeding and feeding of [sheep](#) of the Chaves cave are key for the discovery of economic systems in early farming societies of the Iberian Peninsula. The new methodology applied in this study will no doubt be fundamental in further studying animal husbandry in prehistoric times," concludes Dr. Alejandro Sierra.

More information: Alejandro Sierra et al, Sheep husbandry in the early Neolithic of the Pyrenees: New data on feeding and reproduction in the cave of Chaves, *Journal of Archaeological Science: Reports* (2021). [DOI: 10.1016/j.jasrep.2021.102935](https://doi.org/10.1016/j.jasrep.2021.102935)

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