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# The project IOΣTO as a contribution to the enhancement of sheep breeding in mountain areas of Sardinia

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**Abstract.** The authors describe several phases of a project aiming at the production, evaluation and enhancement of a new meat foodstuff, the suckling lamb obtained by crossing *Ovis aries* with *Ovis g musimon*. This crossbred was mentioned since the first century A.C., and nowadays its birth is still possible in natural environment, where sheep farms are close to the mouflon habitat. This foodstuff could be proposed as a gastronomic attraction in the naturalistic mountain areas of Sardinia. The research has a dual purpose: (i) to stimulate the regional sheep farming, which is undergoing an economic crisis, despite its great productive potential; and (ii) to establish a stronger link between animal husbandry and tourism, the two most important sections of the Sardinian economy. The project started with the registration of a trademark, IOΣTO. Later, it was followed by the birth of the crossbred lambs, the analysis of reproductive and productive parameters, the sensorial and chemical examination of meat, the training of traceability methods and finally the marketing analysis. The letter Σ, included in the trademark name, has a symbolic meaning, because the project brings together several partners such as University (conception and implementation), sheep breeders (production), restaurant tenants (marketing) and public bodies (sponsoring and assistance).

**Keywords.** Mouflon – Sarda ewe – Lamb meat – New product.

## **Le projet IOΣTO comme contribution à la valorisation et l'amélioration ovine dans les zones montagneuses de la Sardaigne**

**Résumé.** Les auteurs décrivent les diverses phases d'un projet ayant pour objectif la production, l'évaluation et la valorisation d'un nouveau produit carné ovine représenté par l'agneau de lait obtenu par l'accouplement entre *Ovis aries* et *Ovis g musimon*. Ce croisement, dont l'existence a été documentée dès le premier siècle A.C., se réalise encore naturellement dans les aires où l'élevage ovine est limitrophe à l'habitat du mouflon. Ce produit peut constituer un élément d'attraction gastronomique dans les aires montagneuses naturelles de la Sardaigne où vit encore le mouflon à l'état sauvage. Cette recherche a un double objectif : (i) la stimulation du secteur ovine régional qui, malgré ses grandes potentialités productives, subit une crise ; et (ii) l'instauration d'un lien plus solide entre deux importants secteurs économiques pour l'île, à savoir, l'élevage et le tourisme. Le projet a démarré avec l'enregistrement d'une marque, IOΣTO, suivi par la production des animaux, avec analyses de différents paramètres reproductifs et productifs. Par la suite vient l'évaluation chimique et sensorielle des viandes et la mise au point des méthodes pour la traçabilité du produit. Le programme s'est poursuivi par l'étude du marché. La même lettre Σ de la marque a une signification symbolique vu que le projet regroupe plusieurs partenaires comme l'Université (conception et réalisation), les éleveurs (production), les restaurateurs (commercialisation) et les administrations publiques (collaboration et sponsoring).

**Mots-clés.** Mouflon – Brebis Sarde – Viande d'agneau – Nouveau produit.

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## **I – Introduction**

Sardinia owes great part of its international notoriety to the beauty of its sea which led, from the 60's, to the development of an elite coastal tourism. But the Island has naturalistic wealth also in the internal areas which, thanks to a low anthropic development, maintained themselves nearly

intact. Besides the pure landscape and the presence of interesting autochthonous animal and vegetal species, the tourist is attracted to archaeology and traditions of central Sardinia which, better than other places, has known how to conserve ancient uses and habits. Tourism represents a fundamental sector of the Sardinian economy, but dairy sheep breeding is important as well. This sector, with an inventory of 3 million heads, has a milk production higher than that of the entire France or Spain (<http://www.istat.it>; <http://www.fao.org>).

Sardinian sheep milk is transformed into cheese, three of which obtained Protected Designation of Origin (PDO) recognition (CE Regulations 1107 and 1263/1996). The "Pecorino Romano" cheese is the most important quantitatively. The market value of this cheese being very low adversely affects the commercial value of milk, periodically undergoing a crisis regarding the entire regional ovine sector (Carcangiu and Vacca, 2005). Besides the economic aspects, the sector has also a social relevance, especially, in the small villages where sheep and goat breeding represents one of the few income sources available for the population. In the mountain areas, sheep breeding is still carried out in a traditional way and sometimes milk is processed on farm. In this context, it is obvious that production should have a higher added value, which usually is obtained through a Protected Geographical Indication - Protected Designation of Origin (PGI-PDO) recognition (Boyazoglu and Morand-Fehr, 2001).

It is important as well to increase the value of meat, but the trend toward milk production of the Sardinian sheep breeding does not support this production. The suckling lamb represents the only valuable product, such that it obtained the PGI recognition (Reg. CE 138/01). But also the "Agnello di Sardegna" does not always achieve a fair reward that pays for the production cost, which is high, as it is fed with sheep milk. Another weakness in Sardinia is the limited offer of the local products in restaurants, which besides being a direct market outlet, represents an effective instrument to make the products known. The knowledge of these points of weakness helps planning the interventions that might increase the value of the products and therefore, the farmers' income. Among many others, the proposal of new products able to attract modern consumers, always more demanding and aware of the nutritional value of food. For this reason new research is necessary for their evaluation and characterization, along with an adequate marketing survey.

With the present paper we want to describe a research program regarding a new sheep meat product, the suckling lamb obtained by crossing the mouflon (*Ovis g. musimon*) and the Sarda ewe (*Ovis aries*). The project has two objectives: (i) the first is to give an example that might stimulate the Sardinian sheep breeding sector in order to propose new products; and (ii) the second is to create the bases for the unification of the two leading sectors of the economy, animal husbandry and tourism, with the prospect of increasing the output of the mountain areas of Sardinia.

## II – Material and methods

The project was conceived, carried out and coordinated by the University of Sassari, in cooperation with the University of Cagliari (marketing study), with some farmers' unions (production), catering operators (marketing) and the Regione Autonoma della Sardegna (RAS) (collaboration and sponsoring). The mouflon x sheep crossbred is known in the Mediterranean Basin since the 1<sup>st</sup> century A.C. (Plinius Major in the *Naturalis Historia*) and towards the end of the XVIII century its presence in Sardinia is reported by the naturalist Francesco Cetti (*Storia Naturale di Sardegna*). It is still present in some limited areas of the Region, where sheep breeding is close to the mouflon habitat and in the Faculty of Veterinary Medicine of Sassari where, since several years ago, some biological (Masala *et al.*, 1991) and reproductive (Berlinguer *et al.*, 2003) aspects are investigated.

The idea of utilizing this crossbred in a more productive way originated from the need to improve meat production of Sarda ewe exploiting heterosis effect. Since meat sheep breeds are not reared in Sardinia and because of the difficulties of adaptation encountered by non

autochthonous breeds (Sanna *et al.*, 2001), it was thought useful to test the cross with the European mouflon, which is autochthonous of the island. The first step of the project was the design of a trademark and its registration. Farmers were selected and preliminary studies regarding *in vivo* and *post mortem* traits were carried out. The first subject of a meeting accompanied with the preparation of original dishes based on the product and carefully prepared by chefs. The publicity given to the event by most important regional media attracted the interest of new partners, with whom a new funding from the RAS was obtained to develop a research project aimed at evaluating, characterizing and increasing the value of this new product.

The program started with the study of the effectiveness of some artificial insemination (AI) techniques. After lambs slaughtering, at 40 days of age, productive performances were evaluated (slaughtering performance, classification and tissue composition of the carcasses) according to the methods proposed by ASPA (1991). Chemical composition, cholesterol content and fatty acid profile of intramuscular lipids were determined using AOAC methods (1997) on *longissimus dorsi* and *semitendinosus* muscles. Fatty acid composition was determined also on perirenal and pelvic fat. Meats were evaluated by sensory analysis, with Consumer test, using a paired preference test and rating on a 1 to 5 hedonic scale (ASPA, 1996). In all the investigations, the crossbred values were compared to those obtained by an analogous group of purebred Sarda suckling lambs. The research also included the set up of traceability systems and marketing analysis.

### III – Results and discussion

The conceiving of the "IOΣTO" trademark is based on the gathering of historical data and the acronym of "Incrocio Ovino Sardo Tutelato all'Origine" (Sardinian ovine crossbred originally protected). The letter S has been substituted by the letter Σ, which is the symbol of the sum in mathematics, to signify the involvement in the project of several partners. It is a reference to the ancient, since the name ΙΧΗΝΟΣΣΑ, which means footprint, given by Greeks to Sardinia contains the letter Σ. But losto in the history of Sardinia is also the name of a Sardo-Punic hero that died in the 215 B.C. while trying to chase away the Roman invaders. "Tutelato all'Origine" (protected at the origin) is part of the acronym, because the research group wants to guarantee the control of the food chain and to develop analytical methods useful for traceability.

Results from the different steps of the research were presented during several scientific congresses. Among the AI techniques utilized (Vacca *et al.*, 2007b), the cervical one, using fresh semen, which in addition to its easy application, gave significantly higher results (47,5% vs 32,5%) than laparoscopic technique, with frozen semen.

The crossbred slaughtering performance (Carcangiu *et al.*, 2004) showed better results than that of the traditional Sardinian suckling lamb, showing higher ( $P<0.01$ ) dressing percentages (71.2% vs 68.3%). Skin, gastrointestinal tract ( $P<0.01$ ) and the heart, lungs and liver ( $P<0.05$ ) were heavier in Sarda lambs. Carcass classification is as follows: (i) weight category, carcasses of both groups were graded "A" (weight until 7 kg); (ii) meat colour, mouflon x Sarda were classified as pink, while Sarda lambs were light pink; and (iii) fat cover, all carcasses of both groups were in the 3<sup>rd</sup> class (average). As a result, all the carcasses were graded as 1<sup>st</sup> quality. Results from carcass dissection (Vacca *et al.*, 2005a) showed that crossbreds have a higher muscle tissue percentage ( $P<0.01$ ) (62.8% vs 57.9%) and a lower incidence of bone + tendons component (24.3% vs 27.6%) compared to purebred lambs. The difference between groups was significant when considering the separable adipose tissue, which was lower ( $P<0.05$ ) in the crossbred (12.9% vs 14.5%). The analysis on the muscles chemical composition (Dettori *et al.*, 2004b) showed significantly lower values ( $P<0.05$ ) of total lipids in the *semitendinosus* (1.8% vs 3.4%) and a higher ( $P<0.05$ ) mineral content in the *longissimus dorsi* muscle (1.1 vs 1.0) in favour of the crossbred.

Total cholesterol content was significantly lower ( $P < 0.01$ ) in the group of the mouflon x Sarda lambs (280 vs 410 mg/100g) in both muscles. The fatty acid composition of the muscle and adipose tissues did not show relevant differences between the two groups of animals (Dettori *et al.*, 2004a; Vacca *et al.*, 2005b) except for a higher ( $P < 0.01$ ) monounsaturated fatty acids (MUFA) (41.9% vs 35.8%) and a lower saturated fatty acids (SFA) ( $P < 0.05$ ) (40.7 vs 48.9) content in the *longissimus dorsi* muscle of the Sarda lambs. In the sensory analysis (Vacca *et al.*, 2007a), the consumer test showed ( $P < 0.01$ ) a preference (4,9 vs 4,1 score) towards the crossbred meat.

When answering the question about the reason for such choice, most of the evaluators thought that the crossbred meat had a more marked taste, typical of the game. The classical methods used for traceability of meats were assayed. The genetic nearness did not allow for a clear distinction between the two species based on the use of protein electrophoresis methods (IEF). Better results are expected from the chromatographic analysis. Nevertheless, because proteins are expressed in a tissue-specific way and undergo denaturation, we are currently setting up species discrimination methods based on DNA analysis. The use of DNA markers such as SINE retrotransposons might be useful, since they have a value as phylogenetic markers (Nijman *et al.*, 2002).

In the issue of marketing, we can assert that the product raised a visible interest from the first trials. The major enthusiasm has been shown by the restaurant tenants which recognized in the product a strong attraction, particularly in those mountain areas where mouflon still lives in the wild. We believe that the success of the product could be obtained through a limited production and its distribution should be restricted in the areas of naturalistic interest of Central Sardinia. It would be ideal to insert this production in an eco-gastronomic journey where the tourist is immersed in an ethnic and environmental context of international reputation, might have the opportunity of appreciating flavours and tastes of the local products.

Another aspect that shows the good impact of the project is that often the crossbred is identified as *losto*, which is only the registered trademark so far. Surely the popularity derived from the advertising that followed the meeting held in Sardinia about the theme, with several articles in the regional newspapers and some reports on local and national TV networks. Unintentionally, the answer given to a reader contributed to enhance the popularity of the crossbred. He thought that it was an animal obtained with genetic manipulations and decided to express its worry through a newspaper article. A curious anecdote, which shows the interest generated, has been the appearance of a cartoon on a local newspaper. The cartoon illustrates a lamb dressed like a superhero and named "losto - the Good", and two ewes of which one says: "I feel peaceful since he is here" and the other answers; "he is a hero; he says he will sacrifice to us". This episode represents a little satisfaction because becoming object of satire means having reached the fame.

## IV – Conclusions

This research program, which is in progress, allowed a better knowledge about the characteristics of the mouflon x Sarda ewe crossbred and the individuation of some peculiarity that might increase its value. A positive consideration needs to be given to the lower fat infiltration in the carcasses and the lower cholesterol content of meats compared to the Sarda purebred suckling lamb, in terms of consequences on the human health. Sensory properties have also an important role, which might attract the attention of people searching for foods with a distinct and marked taste. The activities necessary for the quality certification of the product and the traceability methods still have to be carried out. Moreover, it is essential for the success of this new product to maintain the link with the territory and the direct relationship between producers and restaurateurs. This experience is thought to be positive not only for the obtained results but because it represents an example for revitalizing a sector that displays signals of crisis. Most of all, it is useful because it contributes to make nearer two economic compartments

of great importance for the Central Sardinia which, for its development, should direct the efforts on the most typical resources: environment, agriculture, culture and tourism.

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