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How Have Saharan Breeder Been Able to Secure Food for Their Herds During the Containment of COVID-19? Case of Oued Souf, Algeria

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ABSTRACT

Background: In Algeria, COVID-19 containment procedures 2020-2021 have put the livestock sector in a critical situation, particularly in the Saharan regions where animal feed is based on supplies from other regions. Indeed, a famine has threatened the herds, but the breeders have been able to save their animals by an unconventional diet. The knowledge of these nutritional measures and know-how makes it possibleto evaluate local products andto guide Algerian decision-makers towards a safer food strategy that is well adapted to the Sahara region.

Methods: We used the "12MO method", which is a retrospective survey based on the declarations of the breeders for the last twelve months. 12MO served as a basic tool for a systemic analysis conducted in 110 farms in different areas of Oued Souf (Sahara of Algeria).

Result: The results highlighted changes in animal feed, under the impact of COVID-19 pandemic through unconventional feeding. 6 feeds were distinguished, including 4 crop residues (PoCR; PeCR; CCR; TCR) and 2 by-products (PD By-P; PD By-P). During a year of containment, it was not only the interrelationship (agriculture/livestock) that has secured the feeding herds in the Saharan environment, but the breeder's solidarity has significantly contributed in that also.

Key words: Animal feed, Breeders, By-products, COVID-19, Saharan rangelands.

INTRODUCTION

In Algeria, climate change has severely affected the livestock sector in arid and semi-arid areas where livestock systems are subject to several constraints (Ben Semaoune *et al*., 2019; Djellal *et al*., 2021), since the rangelands are experiencing continuous degradation leading to a scarcity of natural food resources (Mayouf *et al*., 2017). Thuslivestock feed has become the main breeders concern (Bir, 2015). Despite this, the livestock sector reached a critical situation only during the COVID-19 pandemic, because of the slowdown in agricultural and other related economic activities, which were almost because of the slowdown in agricultural and other related economic activities, which were almost completely interrupted (Ejeromedoghenen *et al*., 2020). Indeed, the COVID-19 pandemic is a global risk (Rasul, 2021), the economies of many countries have been affected (Gauly, 2021) and global livestock systems are being altered (Marchant-Forde and Boyle, 2020; Mitri *et al*., 2022). In fact, disruptions have affected the livestock sector in Argentina (Arelovich, 2021), the agriculture sector in South Asia (Gauly, 2021) and food supply chains in the United States (Peel, 2021).

As a result, livestock and meat prices have risen, with Brzakova *et al*. (2021) citing the case of the Czech Republic while Ding *et al*. (2021) reported an increase of 80.8% for China. Such a situation has increased food insecurity in Africa (Ejeromedoghenen *et al*., 2020), particularly in Niger (Ilesanmi *et al*., 2021). In Algeria, impact assessment of the pandemicis limited to the public health aspect (Aouissi *et al*., 2021), which is why we have initiated this retrospective study on animal feeding over one year of containment 2019/2020.

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MATERIALS AND METHODS

The study region

The OuedSouf region is part of the Algerian Northern Sahara (33°10′0N latitude, 7°15′0E) (Fig 1). This region is characterised by a climate desert Saharan type (Hamad *et al*., 2018), with very hot summers and mild winters (Khezzani *et al*., 2019). Temperatures often exceed 45°C in summer (Remini and Miloudi, 2021). Rainfall is low

(Nedjraoui *et al.,* 2008), or even rare in recent years (Matallah *et al.,* 2020). As in the Saharan regions, date palm is the main crop in the study area (Barkat *et al*., 2021). However, since the 2000s, the region has undergone impressive agricultural development (Ouendeno, 2019) based on irrigated agriculture (Barkat *et al*., 2021) and livestock (Khezzani *et al*., 2019). This excellent agricultural vocation (Remini and Miloudi, 2021) created significant commercial activity (Khezzani *et al.,* 2019), whose the animal feed sector shows a remarkable dynamic (Meradi *et al.,* 2016).

12MO survey

This study was only possible at the end of containment of COVID-19 and was based on the exploratory survey inspired by the 12MO method (Lesnoff, 2007; Lhostev *et al.,* 1993), which allows the impact of unusual events to be quantified quickly and over a wider area. It is a retrospective survey based on the breeder's declarations concerning the period of the last twelve months. Which study is carried out through a systemic analysis of the Boulassel *et al*. (2008). To thoroughly address this problem, we have developed a research plan where the research questions have been formulated. Thus, we formulated the following central question: How have breeders of the Algerian Sahara, been able to secure food for their herds during the COVID-19 pandemic?

To do this, survey lasted 6 months (February 2021-July 2021) with four (4) field trips per month. The questionnaire concerned the last twelve months preceding (March 2020-February 2021), which is a period characterised by the application of containment procedures in Algeria.

Data were collected using a questionnaire designed to obtain information from 110 breeders with large herds. They were selected using a non-probability sampling method known as network sampling (Julien *et al.,* 2021) where breeders are identified according to the size of their herd (≥100 head). The selected herds had to contain at least 100 animals of the same species (sheep, camels, goats or cattle).

In order to get real answers, we avoided the usual socioeconomic questions boring for breeders. We focused on the problematic related to the central question: did the breeder find a solution for feeding his herd during confinement?. The survey form is therefore divided into two parts, the first of which concerns the presentation of the herd (species, number of head, grazing area) and the second covers aspects of the herd's diet during the confinement period (missing feed, available feed, sources of available feed, price, rationing, form of use, storage).

The data from the breeders' declarations were entered and then analysed to identify the dietary parameters of interest. An initial sorting of the variables made it possible to eliminate redundant or irrelevant data. For each parameter, basic descriptive statistics (means, standard deviations and proportions) were calculated. The qualitative and quantitative data were analysed for each type of flock (sheep, camels, goats, cattle, mixed flocks, multi-species flocks). The data were analysed using SPSS software (version 22).

RESULTS AND DISCUSSION

Under normal circumstances, breeder must meet nutritional needs of animals and ensure product quality (Zirmi-Zembri and Kadi, 2016). Exceptionally, during the COVID 19 pandemic, they were limited to securing animal feed, since

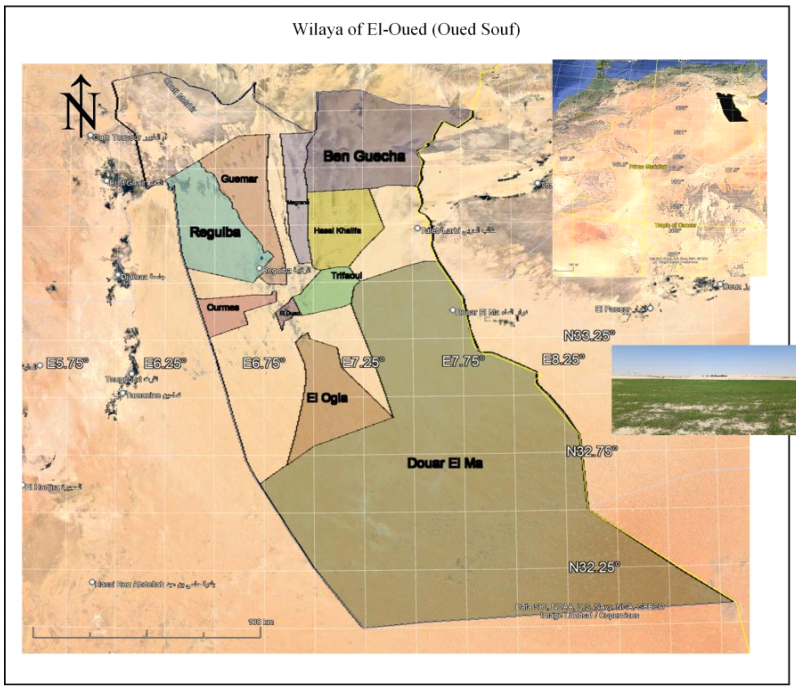

Fig 1: The map of study area.

throughout the containment year (2020-2021), no supply of feed was possible, either from importers or from grain farmers in the highlands due to stopping transport, closing borders, closing markets and reducing the activity of businesses and factories.

Although each breeder had his own method and strategies for feeding his herd, the 12MO survey revealed that almost all breeders (≥97%) were forced to use unconventional feeds that are not traditionally used in animal feeding in the study area. Younas and Yaqoob (2005) expected that unconventional feed resources will play a major role during future shortages. Indeed, during this critical period, the availability of feed was only local products with maximum demand and variability in the rate of utilization. Our results (Fig 2), reveal anunconventional animal diet composed of 6 feeds, 4 of which are vegetable crop residues and 2 of which are arboriculture by-products:

Potato crop residues (PoCR) present the highest rates with 44%, 41% and 35%, in mixed sheep and goat flocks, goat flocks and sheep flocks, respectively. PoCR (stems, leaves and roots), estimated at 125 g of residues per kg of harvested potato (Torma *et al*., 2018) represent a naturally abundant source of lignocellulosic biomass (Soltaninejada *et al*., 2022) .

Peanut crop residues (PeCR) in second place, are estimated 38%, 28% and 32% in mixed sheep and goat flocks, goat flocks and sheep flocks, respectively. According to Gowthami *et al*. (2017), this oilseed crop is the third largest source of plant protein in the world and the fourth largest source of edible oil. Arbouche *et al*. (2008), showed that the nutritional value of peanuts is promising enough for its incorporation in the diet of local livestock. Specifically, groundnut shell can be used as a feed supplement for ruminants (Akinfemi, 2010).

Both (PoCR) and (PeCR) are absent in the diet of cattle and camel herds. As for carrot crop residues (CCR), they are used in the feed of the different herds with a maximum of 21% in goats and a minimum 4% in camels. However, tomato crop residues (TCR), are absent in camel feed, their maximum rate is 24% estimated in cattle herds.

Date palm by-products (PD By-P) are present in the feed of goat, camel, sheep and sheep/goat herds with 15%, 12%, 10% and 9% respectively. The pheonicicultural wastes are very available and abundant, which can justify their frequent valorisation. Acoording Chehma and Longo (2001), the scraps of dates are concentrated feeds and the dry palms and pedicels are the coarse feeds. Djaalab *et al.* (2016), reported that the replacement of concentrates with date waste would be of an economic interest.

For olive by-products (O By-P), their use is limited to the feeding of sheep and goat flocks with low rates 3% and 1% respectively. Our result is identical to that of Khezzani *et al.* (2019) in the same study area, who reported that no significant use of (O By-P) was recorded because, pomace is discarded with solid waste, margins ~~margines~~ are evacuated with liquid waste, while pruning residues are burnt. The valorisation of (O By-P) remains important in animal feed (Al-Harthi, 2016), given that olive tree and olive farming produce large quantities of by-products (Toscano and Montemurro, 2012).

Advantageous, the availability of PoCR and PeCR is remarkable at the level of different areas of the study region which is leader in potato and peanut cultivation with 45% and 80% of the national production respectively. Unconventional feeds are products that have the potential to be used as animal feed (Younas and Yaqoob, 2005).

The result of this retrospective survey is that the different animal species of Sahara region were able to resist during this pandemic, despite the deficit in staple feed, especially barley thanks to unconventional feeds can be potentially valorized. In fact, PoCR represent a source of energy for ruminants since they are rich in starch (Martin *et al*., 2014), PeCR are rich in protein (48 to 50%) (Debbabie and Shafchak, 2008) and CCR contain significant amounts of cellulose and lignin about 25%, a percentage that surpasses that of oat grain (15%) (Eriksson *et al.,* 2004).

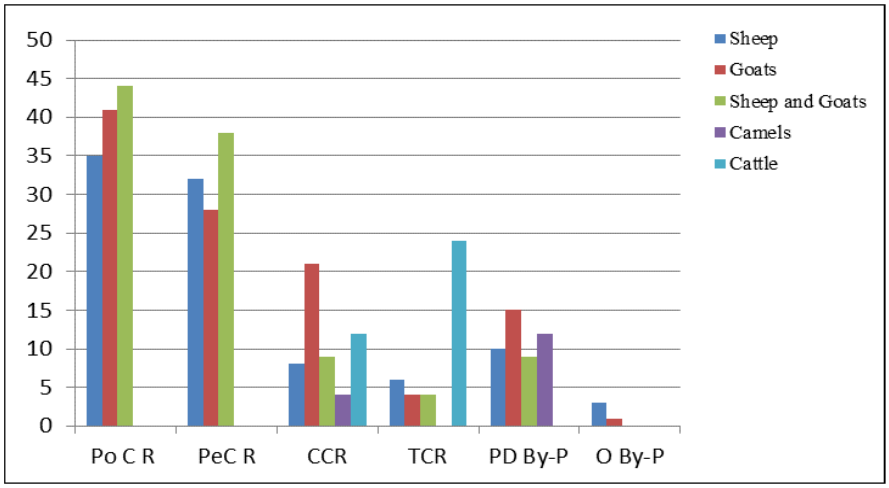

Fig 2: Rate (%) of crop residues and/or by-products used in animal feedduring containment of COVID-19.

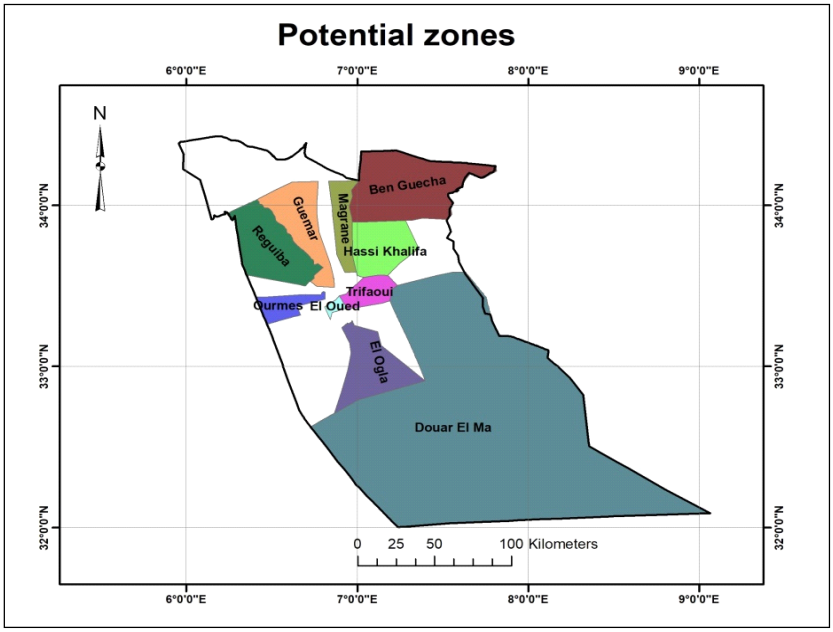

Fig 3: Potential zones of crop residues and/or by-products in the oued souf region.

According to DSA (2021), the most productive areas at the national level are Ouermes with an estimated potato production of 1,894,000 (qx) / 5,750 ha and HassiKhalifa with an estimated groundnut production of 1,514 (qx) d/ 46,965 ha. Notably, there is an awareness of the need for exchanges of agricultural residues between farmers, since the availability of agricultural by-products is distributed according to the agricultural perimeters (Fig 3). On the other hand, the emergence of new livestock systems with an increasingly strong association between agriculture and livestock has cushioned the effects of COVID-19 pandemic. Since, in Oued Souf, green fodder is assured by the farm (Senoussi and Behir, 2010). The 12MO survey allowed us to say that the livestock system in the study region is characterized by an association between agriculture and livestock, among 67% of the breeders investigated.It is for thisreason why always a part of the food is acquired at the level of the exploitation. Bir (2019) reported that a large part of the fodder consumed by the herd usually comes from the farm. According to Ouendeno (2019), the sale of the harvest is done on site at the farm level, this was confirmed by Roche *et al.* (2016) stating that mixed farming systems often rely on compensatory growth to recoup losses during food shortages.

The valorisation of local foods during the COVID-19 pandemic is certainly of great economic interest. However, it also takes a special interest in the health of breeders, in particular that Algeria is among the countries with the highest rates in the world 15.78% of victims of COVID-19 (Ababsa and Aouissi, 2020). The reason why Ejeromedoghenea *et al.* (2020) suggest further encouragingmore local food production to minimize the risk of exposure of farmers to infectious agents.

Indeed, in the regions of southern Algeria, the promotion of sustainable livestock activities is essential in the aim of ensuring a regular supply of animal protein for the oasis populations (Ben Semaoune *et al.,* 2019). In these Saharan regions, the case of OuedSouf, presents several constraints, including the difficult access to the farms scattered over the great eastern region. Our results reveal that 74% of the farms investigated are located far from infrastructure (electricity, paved road). However, the practice of breeding in the harsh desert environment has created more tolerant breeders, which has enabled them to overcome COVID-19 pandemic. According to Ouendeno (2019) the population in the Oued Souf region can adapt to difficult working conditions.

CONCLUSION

We must support such a winning food strategy, which has made it possible to produce a guide to promote local products. Itwill provide alsodetails on the processes, the regulatory framework, the impacts or even the costs linked to animal feed, in particular that the sector of livestock farming is currently evolving in an economic, climatic and health context characterized by uncertainty in choice.

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Conflict of interest: None.

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