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Study on the Physical Conditions of Horses for Better Management of Welfare in Conditions of Climate Change in the Diourbel Region, Senegal

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ABSTRACT

OBJECTIVES: This quasi-experimental study aimed to investigate the effects of the "Application ODS" mobile app on educating one-day surgery (ODS) patients about anesthesia practices, specifically its impact on their knowledge and clinical outcomes.

METHODS: The sample consisted of 62 ODS patients at Lampang Hospital, randomly divided into experimental (n=31) and control (n=31) groups. The "Application ODS," a general information questionnaire, a knowledge assessment form, and a clinical outcome record form were utilized. Data analysis employed descriptive statistics, paired t-test, independent t-test, and chi-square test.

RESULTS: Pre-test and post-test scores the experimental group's mean knowledge score increased significantly more (11.03±0.65 to 17.83±0.73) than the control group's (10.77±0.55 to 12.55±0.77) ($p<0.001$). The experimental group achieved a high knowledge level and had no adverse events, with significantly lower hospital stay rates than the control group ($p=0.015$, $p=0.019$). Surgery cancellation or postponement did not differ significantly between groups.

CONCLUSIONS: The "Application ODS" effectively increased ODS patients' knowledge and improved some clinical outcomes. Widespread adoption should be promoted to enhance healthcare quality and safety for this patient group. Further app development based on user needs and larger, long-term studies are recommended to inform appropriate policies.

KEYWORDS: Welfare, horse, Owners, Correlation, Diourbel, Senegal

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INTRODUCTION

With an estimated population of 557,000 individuals (ANSD, 2016), the equine is a key player in the Senegalese economy. The horse occupies a central place in agricultural production and transport systems in Senegal (Harris, *et al.*, 2018 ; Owens, *et al.*, 2016 ; Ndour , 2010; Akpo , 2004; Lhoste , 2004) . Indeed, Horses serve a multifaceted role in various societies, particularly in rural areas and developing countries, where they are integral to transportation, agriculture, and economic activities. They are utilized for a wide range of tasks, including transporting people to markets and hospitals, delivering essential goods and construction materials (cement, scrap metal), and assisting in agricultural activities such as plowing fields and herding livestock (Merridale-Punter, *et al.*,2024). Also; the horse is used for a wide range distributing consumer goods (gas, beverages), collecting waste and household garbage, transporting agricultural and fishery products, as well as for more specific work such as dredging rivers or transporting construction materials to construction sites." (Merridale-Punter, *et al.*,2024, Ndiaye, 2021; McGreevy et al., 2016; Gueye, 2009; Ndao, 2009). Its versatility makes it an indispensable tool for the country's economic and social development through rural activities, contributing to food security and the income of rural households (Merridale-Punter, *et al.*,2024; Faye, 2013).

The diversity of equine breeds makes it possible to meet the specific needs of different environments and the diversity of activities. However, breeding and working conditions are often suboptimal, highlighting the need to improve animal welfare and farm efficiency (Adam, *et al., 2023*; Abboud, *et al., 2021;* Harris et al., 2018; Owens et al., 2016; Lhoste, 2004). It is in this context that this study was conducted with the general objective of contributing to improving the welfare management of draft horses. Thus, the specific objectives were to observe the level of welfare management of injuries

and to analyze the existing correlation between injuries and harnesses, but also between injuries and body condition score.

I. MATERIALS AND METHODS

To ensure the representativeness of this study, a rigorous data collection protocol was implemented, inspired by the recommendations of Martin (2015) concerning the selection of random samples in animal populations. A random sample of 200 horses was selected from the population of 1225 vaccinated horses recorded by the vaccination service. In order to assess the breeding and working conditions of the horses, a quantitative and qualitative survey of a sample of 126 owners was carried out. This methodological approach, combining surveys and direct observations, is in line with the recommendations of Dupont et al. (2018) for the assessment of animal welfare in horse farms. The questionnaires, administered to the owners, focused on the characteristics of the horses, feeding practices, hygiene conditions and health problems encountered. Additional direct observations of horses were made in the field to assess body condition, equipment used and working practices. The data collected were analysed using Excel statistical software, thus highlighting the main deficiencies in animal welfare following the recommendations of Hair et al. (2014) regarding the analysis of quantitative data in the field of social sciences.

II. RESULTS AND DISCUSSION

II.1 RESULTS

II.1.1. General characteristics

The results showed that the horse owners surveyed are exclusively men. The majority of them (61.9%) are aged 30 to 59, followed by young people aged 18 to 28 (23.8%) and people over 60 (14.29%). The study observed 200 horses, a slight majority of which were males (54%). Most of the horses were acquired by purchase (82%). Of the 200 horses, 94 (47%) were harnessed to a cart and 41% of the horses had injuries, mainly observed during the winter period (field work).

The results also showed that 8.8% of horses have a working time of less than 5 hours and 1.60% have a working time of 5 hours while 89.6% have a working time of more than 5 hours. And according to the survey, only 19.05% of horses with a working time of more than 5 hours take a break during work. The study also revealed that all the respondents groom their males either in the morning, in the afternoon, in the evening or rarely.

II.1.2. Quality of the hitch and harnesses

The majority of harnesses (72%) are considered to be in acceptable condition, 10% are in good condition and 18% are in poor condition. Harnesses are generally in good condition (80% acceptable and 12% good), but 8% are considered unacceptable and likely to cause injuries. Injuries are most often caused by the harness (25%) and located at the level of the passage of the straps and the chest. Although frequent, these injuries only lead to an interruption of use in 4.5% of cases. As for shoeing, it is a rare practice, with only 1% of owners shoeing their horses.

II.1.3. Feed quality and body condition score

The results showed that all the horse owners interviewed manage to cover a large part of the food needs of their equines through the collection of crop residues. Complementary feeds (peanut haulm, concentrates) are purchased in case of shortage. They also revealed that the Feed is mainly composed of peanut haulm (60.18%), cowpea haulm (26.70%) and bush straw (13.12%) for coarse feed, as well as millet (88.81%) and corn for cereals. Concentrates, added to drinking water, represent 54.12% of the Feed. Millet husks (23.71%) and millet bran (22.16%) are also used, especially in the dry season.

The average cost of a daily feed ration is 4556 FCFA. Horses are also fed in two or three meals. Watering is provided three times a day for 70% of horses. The main feed constraints are related to the shortage and high cost of peanut haulm and concentrates, especially in the dry season. The results showed that the body condition score (BCS) of horses is generally good: 55% have a BCS of 3.3, 50% of 2, 13% of 4 and only 0.51% of 1. These results showed that the inadequate composition of feed rations, particularly due to the shortage and high cost of peanut haulm and concentrates, has direct repercussions on the body condition score and welfare of horses.

II.1.4. Correlation between lesions and body condition scores

The survey showed that among all the horses observed, 82 (41%) presented lesions. Thus, horses with lesions had the following body condition scores **(BCS)** :

- 9.5% have NEC 2;
- 26.5% have NEC 3;
- 5% NEC 4.

Calculation of the correlation between lesions and body condition score:

x =lesions	19	53	10
y = NEC	2	3	4

The correlation coefficient ($\hat{\rho}$)

$$\hat{\rho}(x, y) = \frac{\mathrm{Cov}(x, y)}{\sqrt{\mathrm{Var}(x) \times \mathrm{Var}(y)}}$$

Cov : covariance ; Var: variance

For lesions and body condition score, the correlation coefficient is **–0.198 <0.** From this result, there is a weak negative correlation between lesions and body condition score where **x** = lesions and **y** = NEC.

II.1.5. Correlation between lesions and harness quality

Observations showed that 25% of the total injuries were related to harnesses. These injuries were distributed as follows:

- 15% are severity 0;
- 9% are severity 1;
- 1% are severity 2.

Calculate the Correlation between harnesses and lesions:

x =lesions	**30**	**18**	**2**
y = severity	**0**	**1**	**2**

For injuries and harness quality, the correlation coefficient is **–1.221 <0** . According to the results, there is a strong negative correlation between the severity of injuries and the quality of harnesses where **x** = injuries and **y** = severity.

II.1.6. Health monitoring

The survey revealed that only 49.5% of horses have a health record. In the event of illness, 56.3% of owners consult a veterinarian, while the others prefer traditional treatments. The most common conditions are colic, respiratory problems (cough) and skin diseases. Vaccination against African horse sickness is widely practiced (92.5%). On the other hand, deworming is less systematic, with only 79% of owners carrying it out, often in the event of illness.

II.2. DISCUSSION

II .2 .1. General characteristics

All respondents are men, confirming the results of previous studies (Mbacké, 2022; Ndong , 2023; Tine, 2023) which highlight the male predominance in horse-related activities, probably due to socio-cultural factors. The average age of owners is 45 years and the minimum is 18 years, similar to the results of Tine (2023). This age group is often associated with better consideration of animal welfare because adults have more responsibilities and restraints regarding the mistreatment of horses . Furthermore, the minimum age (18 years) encountered during the survey is in accordance with the provisions relating to interministerial decree no. 18457 dated December 9, 2016 regulating transport by animal-drawn vehicles, which states in its article 22 that: "The minimum age of candidate coachmen is set at 15 years of age." However, the presence of young owners (from 18 years old) raises questions about their training and their ability to ensure the welfare of horses. Although this young generation can bring a new dynamism, it is essential to put in place specific training to guarantee the welfare of the animals

The study of 200 horses revealed a predominance of males (54%), an observation confirmed by other local research (Ndiaye, 2021; Ndong , 2023; Tine, 2023). This trend is explained by the preferential use of stallions for work and transport, unlike mares, often reserved for reproduction and agricultural work (Merridale-Punter, *et al.*,2024). The majority of horses (82%) were acquired by purchase, in accordance with the results of Tine (2023). This predominance could be linked to insufficient mastery of equine reproduction by some owners, as well as a limited number of mares per farm. Only 47% of horses are harnessed to a cart. This relatively low rate could be explained by financial constraints, the alternation of horse use and the large number of mares in the workforce.

The results of this study highlighted the intensive use of horses, with 89.6% of them working more than 5 hours per day. This prolonged working time, combined with a low percentage of horses receiving breaks (19.05%), raises concerns about animal welfare. Previous studies have shown that excessive working hours can lead to chronic fatigue, injuries and a reduction in the general welfare of horses (Adam, *et al., 2023*; Owens et al., 2016; Harris et al., 2018). Regular breaks are essential to allow horses to rest, drink and feed, helping to maintain their physical and mental health. The low rate of horses receiving breaks observed in this study is therefore concerning.

All owners surveyed groom their horses, but with varying frequencies. While most do this work on their horses daily, 26.5% of owners rarely do it on their mares, especially during the dry season due to reduced physical activity with field work. However, it is widely recognized that grooming improves the appearance and health of horses (Cochran et al., 2023). It promotes the removal of dirt, parasites and strengthens the bond between the horse and its owner. These results highlight the importance given to grooming, although some practices vary according to the seasons and the sex of the horses.

II.2.2 . Quality of the hitch and harnesses

The study confirms the exclusive use of carts as a means of transport, in agreement with the work of Ndong (2023). However, the condition of these carts and their harnesses is variable. While 33% of the carts are considered to be in an acceptable condition, 14% are in poor condition. For the harnesses, 40% are in an acceptable condition, but 7% are inadequate. The presence of many harnesses in poor condition could contribute to the appearance of lesions in horses, as observed previously in the study.

The observed injuries (25%) are mainly located at the points of contact with the harness (girths, withers, chest). Their severity is generally low (71% of injuries of severity 0 or 1). Although frequent, these injuries only lead to an interruption of use in 4.5% of cases. This low proportion suggests that owners generally adapt the horses' working conditions according to their injuries. These injuries could be linked to the quality of the harness, mistreatment, or working conditions (Adam, *et al.*, 2023; Abboud, *et al., 2021*). Shoeing is very rarely practiced (1% of horses), mainly due to the lack of tarmac roads in rural areas.

II.2.3. Feed quality and body condition score

I. Horse feeding is mainly based on local fodder (haulm, millet) supplemented by concentrates. These feeding practices are similar to those observed in Mbour by Ndiaye (2021). Financial constraints limit access to industrial concentrates, pushing owners to favor more economical feeds, even if their availability may be seasonal. To optimize feed use, owners split rations into 2 or 3 daily meals. Regarding watering, the majority of owners (70%) water their horses three times a day, in line with the results of Ndiaye (2021). The assessment of the body condition score (BCS) reveals that the majority of horses (55%) are at an average level (BCS 3), considered optimal to ensure good health and satisfactory performance (Adam, *et al., 2023*; Abboud, *et al., 2021*; BROOKE, 2013). To improve their Feed, it is necessary to diversify fodder sources, develop fodder crops adapted to local conditions and set up efficient storage systems. This will not only improve animal health but also increase productivity .

III.2.4 . Correlation between lesions and body condition score

The study found that although 26.5% of horses had lesions, only 4.5% of these lesions required time off work. There was a weak negative correlation (r = -0.198) between the presence of lesions and body condition score (BCS). This suggests that an increase in the number of lesions tends to be associated with a slight decrease in BCS. However, this relationship is weak and other factors, such as age, sex, general health and lifestyle, could also influence BCS (McGreevy et al., 2016). Horses with the lowest BCS (1 and 2) may have experienced weight loss due to their lesions, thus affecting their general body condition. Nevertheless, the weak strength of this correlation highlights the complexity of factors influencing BCS.

III.2.4 . Correlation between lesions and harness quality

The study found that 25% of the injuries observed were related to harness use. The severity of these injuries varied, with 15% classified as mild (severity 0), 9% as moderate (severity 1) and 1% as severe (severity 2). A negative and statistically significant correlation (r = -1.221) was established between harness quality and injury severity, suggesting that a deterioration in harness condition is associated with an increase in injury severity. Although this correlation is strong, it is important to note that it does not demonstrate a direct cause-and-effect relationship. Other factors, such as the force of impact during an accident, the age and health of the horse, can also influence the severity of injuries (McGreevy et al., 2016). These findings highlight the importance of regularly checking harness condition and replacing it if it deteriorates to prevent injuries. Nevertheless, these results highlight the importance of using harnesses in good condition to minimise the risk of serious injuries. Although other factors can influence the severity of injuries, the use of suitable and well-maintained harnesses is an essential preventive measure.

II.2.5. Health monitoring

The survey reveals that only 49.5% of horses have a health booklet, despite its mandatory nature (interministerial decree no. 18457). This lack of compliance could be explained by a lack of awareness or financial means. The main diseases encountered are colic, respiratory diseases and skin diseases. In the event of illness, 56.3% of owners consult a veterinarian, while the others prefer traditional treatments. Regarding vaccination, 92.5% of owners vaccinate their horses against African horse sickness, in accordance with health recommendations. This rate is comparable to that observed by Tine (2023). Non-vaccinations may be linked to the arrival of new animals or to difficulties in accessing vaccination. For deworming, 79% of owners carry out treatments, often in the event of illness. The others do not deworm their animals regularly.

CONCLUSION

The survey of 200 horse owners revealed that horse breeding is a predominantly male activity, practiced by men with an average age of 45. Among the horses studied, 54% are males used mainly for traction. The surveys revealed that 25% of the lesions observed are related to the use of poorly fitted harnesses. These lesions, often wounds or skin irritations, are treated with traditional herbal remedies. Despite these difficulties, 55% of the horses have a satisfactory body condition, demonstrating the resilience of these animals in sometimes difficult breeding conditions. This study therefore highlights the need for a comprehensive approach to improve the welfare of traction horses, including improving harnesses and maintaining good physical condition. Thus, to improve the welfare of horses, it is necessary to increase owners' awareness of good breeding practices, facilitate access to veterinary care and promote the use of suitable equipment.

CONSENT

Verbal and/or written consent has been obtained.

CONFLICTS OF INTEREST:

The authors declare that they have no conflict of interest.

AUTHORS' CONTRIBUTIONS

OK is the lead author of this manuscript. He designed the research questions and method and participated in all phases of its implementation. AB supervised the design process and research direction, and corrected and edited the final manuscript. AF worked on data accuracy and provided advice for the data collection work. MB contributed to all data collection through surveys and field observations.

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