**Socio-economic and health analysis of donkeys in Dakoro and Bermo in the region of Maradi, Niger**

**Abstract**

The aim of the present study was to analyze the socio-economic and health aspects of donkey breeding in the departments of Dakoro (agricultural and agro-pastoral zone) and Bermo (pastoral zone) in the Maradi region of Niger. A total of 788 heads of household were surveyed sampling using multi-stage cluster. SPSS version 20 software was used for data analysis. The results show that older farmers own more donkeys than younger ones. The pastoral zone is much more densely populated with donkeys (p<0.05), with an average per household of 12.05±8.54 and a proportion of 72% females in relation to the total number. Among the ethnic groups present in the area, the Peulh have the most donkeys (p<0.05), with an average per household of 11±8.24. Overall, donkeys are used for transporting drinking water and for water drainage. In agricultural and agro-pastoral areas, they are followed by cart traction. In pastoral areas, the donkey's role as a mount and as a gift to the bride from her family of origin is also important. The study also showed that the donkey suffers from many ailments throughout the year. Among the most prevalent are internal parasitism (25%) and colic (21%). To treat these ailments, farmers make extensive use of traditional pharmacopoeia and do the treatment themselves. This is the case for the treatment of digestive parasitosis with *Cucumis prophetarum* (the Haoussa name for N'yamanya), practiced by 56.7% of the breeders we met. The donkey's socio-economic role makes it a key component of the rural production sector. However, health care needs to be improved to make the most of the comparative advantages offered by donkey breeding.

Keywords: socio-economic, donkey, households, ailments, pharmacopoeia.

 **Introduction**

Donkey breeding is widespread in Africa. In 2023, of the world's 53 million head of donkeys, 33,148,206, or almost two-thirds, were in Africa. West Africa accounted for 6,614,885 head (20% of the African herd) (Johnston, 2023). Several studies have highlighted the socio-economic role played by this species in rural areas. This is the case of Tapsoba (2012) in Burkina Faso, who claims that the role of donkeys in the Sahel is closely linked to the socio-economic life of the people who breed them. Their ownership depends on ethnicity and agro-ecological zone. They are used for watering, transporting drinking water to households and watering animals (Kughur et al., 2016; Sow et al., 2014). They are also used during the mobility of pastoralists for transhumance (Bello, 2019; Diop & Fadiga, 2018). In remote areas, donkeys play the role of ambulance service to animals and humans (Admassu & Yosep, 2011; Starkey, 2004). In the field of education, donkeys are used by girls and disabled people as a means of transport to school (MoLHW/ UNICEF, 2011). In urban areas, despite the advantage of motorized vehicles, donkeys are preferred by smallholders for economic reasons. They are also used to transport waste (garbage) and materials in the construction and industrial sectors (Canacoo, 1994; Starkey, 2004). For households, they are a source of cash through direct sales and the sale of by-products (Bocoum et al., 2013).

Donkeys also play an important role in Niger. Their numbers are estimated at 1,949,894 head in 2020 (INS-NIGER, 2020). The Dakoro and Bermo departments are prime areas for donkey breeding. In 2021, this livestock is estimated at 75,185 donkeys (246,357 for the region) (DREL/Maradi, 2023). In this area, these animals play important socio-economic roles. They are used in the communities through loans in the form of mutual aid and solidarity. Among pastoralists, a young bride is given a donkey by her family of origin (Issoufou, 2021). Despite all the advantages attributed to donkey ownership and the significant presence of this animal, no research work aimed at developing its breeding has been devoted to it. The present study focuses on the collection and analysis of data socio-economic and health on donkey breeding in the departments of Dakoro and Bermo, in order to highlight the essential roles, they play in these localities, as well as to identify and analyze the main ailments they suffer from.

The results of the study should make it possible to take stock of donkey breeding in these areas and help improve decision-making in the sector.

**Materials and methods**

**Presentation of the study area**

The study area comprises the departments of Dakoro and Bermo, both located in the Maradi region of south-central Niger (13° and 15°26' N latitude and 6°16' and 8°36' E longitude, area of 41,796 km² or 3.3% of the country's total area, see map) (Alhassane et al., 2017). Dakoro has a population of 630,421 inhabitants made up of 79,460 households, including 74,242 households farming (Kourguéni, 2014) spread across twelve (12) communes (Dan Goulbi, Kornaka, Sabon Machi, Mayara, Adjékoria, Birni Lallée, Korahane, Dakoro, Azagor, Roumbou, Goula and Soly Tagriss). This population is estimated at 45,111 heads (DREL/Maradi, 2023). The climate is essentially Sahelo-Sahelian. Dakoro department lies between isohyets 250 and 400 mm (DREL/Maradi, 2023). Bermo department comprises 2 communes (Bermo and Gadabédji). It is a zone exclusively pastoral. The population is 52,274, including 6,335 farming households (Kourguéni, 2012). The livestock population is estimated at 618,264 head, all species combined, including 33,205 donkeys (DREL/MI, 2023). Figure 1 provides further details on the area's geographical location.



**Figure 1 :** Study area (Issoufou, 2021)

**Methodology**

**Sampling and identification of study sites**

The study area comprises 2 contiguous departments with a total of 14 communes. The whole is grouped into 03 agro-ecological zones (agricultural, agropastoral and pastoral). According to data from Niger's 2012 national directory of localities, the zone's farming households’ number 80,577 (Kourguéni, 2012). As for donkeys, they numbered 75,185 heads for the zone in 2021 (DREL/MI, 2023). Cluster and multi-stage sampling was used to determine the number of households to be surveyed and the number of donkeys to be sampled. This sampling method comprises 4 stages, as follows:

**Stage 1:** initial size (AFRISTAT, 2021)

The initial sample size is obtained by applying the following formula (1):

1. **n1 =** $\frac{t^{2}\*\hat{P}(1-\hat{P})}{e^{2}}$

**t**: sampling confidence interval is 1.96 for 95%,$\hat{P}$ : expected proportion of a population response or actual proportion. It can be set to 0.5 by default, **e**: margin of sampling error, which is 5%.

**Step 2:** Adjust sample to population size (N)

The sample fit as a function of population size (N) is determined by applying the following formula (2):

(2) 𝐧𝟐=𝐧𝟏\*𝑵𝑵+𝒏𝟏

**N**: population size (for households to be surveyed, N=80,577 and 75,185 for the asinine population)

**Step 3:** Sample adjustment according to sampling strategy (3) (𝟑): 𝒏𝟑=𝒅𝒆𝒇𝒇∗𝐧𝟐

Deff > 1 Cluster probing (default value 2)

**Step 4:** Adjust sample according to non-response rate (3%) (4)

(𝟒) 𝒏𝟒=𝒏𝟑∗r

r = (1+ non-response rate). The non-response rate used is 3% for the agricultural population and 5% for the asinine population.

A total of 788 households were sampled and 803. donkeys They selected were at random, and the geographical location of was determined the sites by GPS.

**Data analysis**

The data collected were first entered into Excel version 2016 and then transformed into numerical values. They were then processed using SPSS version 20 software, which was used to perform a univariate analysis of variance and determine the effects of departments, agro-ecological zones, communes and ethnic groups. The Duncan test of the same software was used to compare arithmetic means between departments, zones, communes and ethnic groups. A significance level of p<0.05 was used to assess statistical differences between arithmetic means.

**RESULTS**

1. **Characterization of donkey breeders**
	1. **Ethnic groups and ages of farmers surveyed**

The herders interviewed belong to 03 ethnic groups: Haussa (88%), Peulh (10%) and Touareg (2%). Their average age is 49+/-13-year-old (ranging from 19 to 80). Moreover, the breeder’s donkey is made up more of adults than of old and young people in the study area, in the 36-65, 66-plus age brackets and 19-35 respectively (figure 2.)

**Figure 2:** Number of donkeys by age of breeder

* 1. **Professional experience of surveyed breeders**

The breeders surveyed had varied profiles in terms of donkey breeding experience. Experience ranged from 2 to 60 years, with an average of 21±13 years. Those with between 11- and 20-years’ experience owned more donkeys (30%) than the others. Numbers decrease as experience increases.

* 1. **Gender and marital status**

The majority of farmers surveyed were male (98%). Married people accounted for 98.6%. There was no significant difference (p =1.00) in the number of donkeys, whatever the status of the head of household**.**

* 1. **Level of education and activities practiced by respondents**

For this study, only farmers who had been to school and those who had benefited from formal education were considered literate. The latter represented 20% of the herders surveyed. There was no significant difference (p = 0.84) in the number of donkeys raised, regardless of the breeder's level of education. The main activities practiced by donkey owners are farming and breeding. Farming as the main activity is practiced by 88% of them.

* 1. **Household members, working people and number of donkeys owned by household members**
		1. **Household members and number of working persons**

The people in the households under the control of the heads of households surveyed include both working and non-working people. Whatever the profile of these people, they are male and/or female. The average number of people per household is 11±6,59% of whom are active. There is no significant difference for these 2 sexes at departmental, agro-ecological zone or ethnic level. However, at commune level, there was a significant difference in the number of men per household between the communes of Bermo and Gadabédji (p<0.05) (4.09±2.14 vs 5.91±3.16). In terms of the number of women, the communes of Dakoro and Bermo had significantly fewer than the communes of Gadabédji and Birnin Lallé (p<0.05). In terms of active people, the commune of Dakoro has a significantly lower number of people of both sexes (2.49±1.54 men and 2.44±1.85 women) than the commune of Gadabédji (4.28±2.261 men and 4.84±3.82 women) (table 1).

**Table 1:** Household members and economically active persons by municipality

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Municipalities** | **Men housekeeping** | **Housekeeping women** | **Household members** | **Active men** | **Active women** | **Total active people** |
| Sabon Machi | 4.54 abc ±2.65 | 6.10 ab ±3.63 | 10.64 ab ±0.26 | 3.11 ab ±2.08 | 3.13 ab ±1.73 | 6.24 abc ±3.37 |
| Dangoulbi | 5.32 abc ±2.80 | 6.03 ab ±3.27 | 11.34 abc ±5.06 | 3.22 abc ±1.92 | 3.25 ab ±2.173 | 6.39 abc ±3.30 |
| Adjekria | 5.25 abc ±3.21 | 6.07 ab ±3.30 | 11.33 abc ±4.90 | 3.75 bc ±2.75 | 3.12 ab ±2.20 | 6.87 bc ±3.94 |
| Mayara | 5.57 abc ±4.56 | 5.88 ab ±3.24 | 11.45 abc ±6.59 | 3.93 bc ±3.06 | 3.31 ab ±2.32 | 7.24 bc ±4.67 |
| Kornaka | 4.57 abc ±2.52 | 6.63 ab ±4.03 | 11.20 abc ±5.40 | 3.37 abc ±2.08 | 2.89 ab ±1.94 | 6.26 abc ±3.26 |
| Roumbou | 5.61 bc ±3.54 | 5.63 ab ±3.59 | 11.24 abc ±6.47 | 3.67 bc ±2.14 | 3.08 ab ±3.08 | 6.75 bc ±4.06 |
| Azagor | 5.65 bc ±3.26 | 5.91 ab ±3.17 | 11.57 abc ±5.16 | 3.52 abc ±2.07 | 3.61 b ±2.10 | 7.13 bc ±3.46 |
| Tagriss | 4.33 ab ±2.57 | 6.28 ab ±2.88 | 10.60 ab ±4.67 | 3.16±1.81 | 3.09 ab ±1.92 | 6.26 abc ±3.44 |
| Goula | 4.46 abc ±2.46 | 5.93 ab ±4.41 | 10.39 a ±6.42 | 2.95 ab ±1.81 | 2.98 ab ±2.27 | 5.93 ab ±3.57 |
| Dakoro | 4.19 ab ±1.75 | 5.00 to ±3.20 | 9.23 a ±4.27 | 2.49 a ±1.54 | 2.44 a ±1.85 | 4.93 a ±2.74 |
| Korahane | 4.96 abc ±2.40 | 6.31 ab ±3.48 | 11.27 abc ±4.51 | 3.62 bc ±1.58 | 3.18 ab ±2.02 | 6.80 bc ±2.72 |
| Birnin Lallé | 4.89 abc ±3.14 | 8.33 c ±6.80 | 13.22 bc ±9.20 | 3.28 abc ±1.96 | 4.61 ab ±4.07 | 7.89 cd ±5.81 |
| Bermo | 4.09 a ±2.14 | 5.45a±3.22 | 9.55 a ±4.23 | 2.85 ab ±1.78 | 3.42 c ±2.31 | 6.27 abc ±3.54 |
| Gadabedji | 5.91 c ±3.16 | 7.42 bc ±4.01 | 13.33 c ±5.50 | 4.28 c ±2.26 | 4.84 c ±3.82 | 9.13 d ±5.12 |

*The difference in letters (a, b, c and d) indicated at the column level shows that there is a significant difference (p<0.05) between the arithmetic means.*

In terms of active people, the commune of Dakoro has fewer men and women, while Gadabédji has the most active people using donkeys.

* + 1. **Number of donkeys in surveyed households by commune/department/agro-ecological zone**

The number of total donkeys in the households surveyed comprises the donkeys owned by the heads of household, the donkeys owned by the women in the household and the donkeys owned by the children in the household. Variations by commune or department are shown in figure 3.

**Figure 3:** Variation in the number of donkeys per category of household member, by commune/department

The department Bermo, which represents the pastoral zone through its 2 communes (Bermo and Gadabédji), has more donkeys of both sexes than Dakoro (figure 3).

* 1. **Variation in donkey sex according to agro-ecological zone (or department)**

The variation in the sex of donkeys owned by household members according to agro-ecological zone is shown in figure 4.

**Figure 4:** Variation in donkey sex according to agro-ecological zone

Whatever the agro-ecological zone, female donkeys make up the majority of the herd (figure 4).

* 1. **Variation in workforce by ethnic group**

The variation of male and female donkeys by ethnic group is shown in figure 5.

**Figure 5**: Variation in the number of donkeys male and female by ethnic group

The Haussa and Touareg have fewer donkeys than the Peulh. The latter use donkeys culturally for transhumance. When gender is taken into account, female donkeys are more numerous in all ethnic groups (figure 5.)

1. **Household use of donkeys**

In the study area, donkeys are used for a variety of activities, including water extraction, cart pulling, harnessed cultivation, riding, transporting water from wells or standpipes to homes, borrowing, marketing and being given as gifts to brides by their families of origin (figure 6)

**Figure 6:** Roles or functions performed by donkeys in the study area

Of the eight (8) roles identified, transporting drinking water, drainage, carting and riding are the most important roles played by the donkey in the study area (figure 6.) In areas, agropastoral and pastoral in addition to the main roles played by this species, it is also used in marriage (gift to the bride by her family of origin).

1. **Donkey coats**

The main coats encountered in the study area are: uniform gray (Ehaou), light gray (Aourak), gray or white spotted black with black crucial band (Akaza), gray with dark lips and nose (Goho), gray spotted white (Tantabari), uniform bay dress (Janzomo), uniform black coat (baki) and uniform white coat (Fari) (Figure 7).

**Figure 7:** Different donkey dresses in the area

Generally speaking, the Ehaou donkey (57%) is the most widespread in the study area.

1. **Main donkey Pathologies by season**

The dominant diseases, in decreasing order of importance are internal parasites (25%), colic (21%), superficial and deep respiratory conditions (colds and coughs) (13%), external parasites (11%), heat stroke (10%), warts (9%), traumatic lameness (5%), traumatic wounds (4%) and anal prolapse (2%), (figure 8).

**Figure 8:** Main pathologies by season of the year

In the hot dry season, there is an exacerbation of ailments, led by internal parasites (21%), colic (20%) and external parasites (19%). In the cold dry season, respiratory ailments (45%) predominate. In the rainy season, internal parasites (44%) are the most frequent, followed by colic (35%) (Figure 8).

1. **Traditional treatments applied by breeders against certain donkey ailments**

This study enabled us to identify the plants used to treat the most common ailments of the donkey. So, breeders in the area make much greater use of *B. senegalensis (Anza)* to treat respiratory symptoms, *U. prophetarum (N'yamanya)* to treat digestive parasitosis, *L. pterocarpum (Garkoua Koussa)* to treat colic and *C. micranthum* (Guéza) to treat heat stroke.Table 2 gives more details.

**Table 2:** Plants used to treat the main donkey ailments

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Conditions or symptoms** | **Names of plants used for treatment in Hausa** | **Scientific names of plants used for treatments** | **Plant families used for treatments** | **Percentage of plant use by farmers** |
| Respiratory symptoms | *Anza*  | *Boscia senegalensis* | Capparidaceae | 96,90% |
| *Jiga* | *Maerua crassifolia* | Capparaceae | 3,10% |
| Digestive parasites  | *Adoua*  | *Balanites aegyptica* | Zygophyllaceae | 1,90% |
| *Madatchi* | *Khaya senegalensis* | Meliaceae | 2,40% |
| *Marké* | *Anogeissus leicarpa*  | Combretaceae | 39% |
| *N'yamanya*  | *Cucumis prophetarum* | Cucurbitaceae | 56,70% |
| Colic | *Bédi* | *Azadirachta indica* | Meliaceae | 3% |
| *Garkoua Koussa* | *Limeum pterocarpum* | Aizoaceae | 54% |
| *Madatchi* | *Khaya senegalensis* | Meliaceae | 5% |
| *Magaria* | *Ziziphus mauritiana* | Rhamnaceae | 35% |
| *Yamanya* | *Cucumis prophetarum* | Cucurbitaceae | 3% |
|  Stroke    | *Adoua*  | *Balanites aegytiaca* | Zygophyllaceae | 8,30% |
| *Guéza* | *Combretum micranthum* | Combretaceae | 91,70% |

**DISCUSSION**

**Characterization of donkey breeding in the area**

Due to its Sahelian climate, the study area is an ideal environment for donkey breeding. The heads of donkey-breeding households are 49+/- 13 years old. They are 98.6% married and 20% have received formal education. Their households consist of 11±6 people, 59% of whom are active. These results are similar to those obtained in the municipality of Kassena Nankana in South Africa, where donkey owners ranged in age from 32 to 50 years. The majority (76%) were married and had no formal education (58%). Their households consisted of 6 to 10 people (Braimah et al., 2013).

Donkey-breeding experience was 21±13 years for farmers in the area. Those with between 11- and 20-years’ experience owned more donkeys (30%) than the others. This is due to the fact that farmers with these years of experience are adults (more active). They have more socio-economic activities, and therefore more donkeys.

For the number of donkeys owned by households, a wide variation in numbers was found between departments, agro-ecological zones, communes and ethnic groups. The pastoral zone has the most donkeys, regardless of the sex of the animals (12.05±8.54 including 9.38±7.16 females). This is relative to the zone, which is Sahelo-Sahelian or donkey-breeding zone par excellence (Sow-AnGR, 2011). In agricultural and agro-pastoral zones, the donkey belongs to the head of household. In pastoral areas, on the other hand, donkeys are owned by women. Generally speaking, young people have a negligible number of donkeys. These variations are also due to the different roles played by donkeys in the production systems of different zones and ethnic groups. In the agricultural and agro-pastoral zones of the study area, the head of household is responsible for drainage and the use of the donkey cart. In pastoral areas, the housewife transports drinking water and uses the donkey to carry luggage during transhumance. These results corroborate those of Tapsoba (2012) in Burkina on his study of the socio-economic aspects of the donkey, who asserts that the roles played by donkeys’ merge with the socio-economic and cultural life of the people who keep them.

In the area, the donkey with a uniform gray coat, or Ehaou, is the most widespread. This breed is chosen by breeders because it is docile and has more stamina than other breeds. These results are similar to those of Roamba (2014) who reported that 65.7% of donkeys in Senegal were of this coat.

**Socio-cultural role of donkeys in the area**

Borrowing, giving a donkey to a bride by her family of origin, and providing a mount during transhumance are all important socio-cultural roles played by the donkey in the area. In the case of borrowing, it's a kind of community solidarity and mutual aid towards households that don't own a donkey, or have an insufficient number of donkeys. The donkeys are thus entrusted on loan to these third-party households to accomplish their daily tasks. This role is appreciated in the same way by herders in all agro-ecological zones. The gift of a donkey to the bride by her family of origin is a practice in pastoral societies. In these societies, the donkey is used to transport drinking water for the household, and as a mount during long journeys (or transhumance), and the woman is at the center of these 2 activities. Donkeys are used for transport, with or without carts. In landlocked areas, this service can be requested for animals and sick humans to health centers. Similar results have been reported in conflict and refugee resettlement zones, or in mountainous areas where donkeys provide ambulance service (Practical Action, 2010). In the field of education, donkey service is used in Eritrea (MoLHW/ UNICEF, 2011).

**Economic roles**

From an economic point of view, the donkey in the area is responsible for water drainage, transporting water for consumption, pulling carts and harnessed cultivation, and generates income when sold or marketed. In agropastoral and pastoral areas, the donkey plays 2 complementary roles: water extraction and water transport. In agricultural areas, on the other hand, the donkey mainly supplies water. This result is similar to that recorded in northern Ghana (Admassu & Yosep, 2011). In pastoral areas, water extraction is the donkey's primary role, followed by water transport. Water extraction is much more characteristic of a system based on transhumance, with herds moving at high or low amplitudes. The donkey is thus used to draw water for consumption by all the other animals in the herd and by humans (Sow-AnGR, 2011).

**Main diseases of donkeys in the area**

Throughout the year, donkeys can suffer from a number of ailments that vary according to the season. In the hot dry season, there is a drop in the quantity and quality of forage in the study area. As a result, animals fed on natural pastures lose weight and become weaker. This has led to the emergence of a number of ailments, including digestive parasitosis. These results are similar to those recorded in northeastern Nigeria, with repercussions on body condition score (BCS), the presence of colic (Saleh et al., 2016).

External parasitosis is dominated by disease-carrying ticks and lice. The main tick genera found on domestic animals are *Amblyomma Boophilus* and *Rhipicephalus* (Farougou et al., 2007). They are very present in the study area at this time of year. Their presence is linked to the weakened state of the organisms due to poor body score (or NEC). These results are in line with those reported in Mali (Baradji et al., 2015).

In the rainy season, digestive parasites dominate, followed by colic. The rainy season represents a period when climatic conditions are favorable for the development of parasite eggs. This contributes to the high prevalence of these parasites (Molla et al., 2022). As for colic, it is due to changes in food rationing or impaction (Lucie, 2012).

In the cold dry season, there is a high incidence of respiratory symptoms (colds and coughs). Several pathogens may be the cause. Strangles caused by *Streptococcus equi subsp equi* and equine influenza virus (EIV) have all been suspected as potential causative agents of several mortalities cold-season in 2018 in West African countries (Diallo et al., 2020).

**Treatments of donkey aliments based on pharmacological plants**

In the Sahel, medicinal plants used in animal health care or pharmacological plants are not sufficiently documented (Yahya et al., 2016). In the Dakoro and Bermo departments of Niger, which make up the study area, herders use plant-based remedies locally to treat the main ailments of donkeys. For respiratory ailments, 96.90% of farmers in the area use *Boscia senegalensis* (Capparidaceae) as a remedy. In Senegal, strangles, the main respiratory ailment of donkeys (49.3% of cases), is treated with *Euphorbia balsamifera (*Euphorbiaceae) (Diouf, 2003).

For asinine colic, 54% of farmers in the area use *Limeum pterocarpum* (Aizoaceae) as a remedy.

For digestive parasitosis, 56.70% of farmers use *Ucumis prophétarum* (Curcubitaceae family), followed by *Anogeissus leiocarpus* (Combretaceae) (39%). Similar results have been noted in Burkina Faso, where *Anogeissus leiocarpus* is the plant, most widely used in the treatment of digestive parasitosis, with 27.7% (Kaboré, 2009). In western Niger, the use of plants belonging to the Combretaceae, Meliaceae, Capparaceae, Fabaceae and Bombacaceae families in the treatment of digestive parasitoses has been reported (Garba et al., 2019).

**Conclusion**

This study has shown that donkeys are more popular among the elderly than the young. In agricultural and agro-pastoral areas, donkeys belong to the head of the household, while in pastoral areas, they belong to the woman. This ownership results from the socio-economic role played by this species in the life of households in these areas.

As far as ailments are concerned, the donkey suffers from numerous ailments throughout the year, depending on the season. In order of importance, these ailments are: digestive (internal parasites, colic), superficial and deep respiratory (colds and coughs), and external parasites. The study also identified the plants used in traditional treatments of asinine pathologies. On the one hand, this type of plant-based treatment or pharmacology is a valuable source of income for breeders who still do not have sufficient means to resort to modern treatments. On the other hand, it contributes to the fight against the phenomenon of resistance to microbial agents due to the use of chemical products.

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