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Analysis of Ethnobotanical practices and knowledge of rabbit farmers in the treatment of gastrointestinal parasitoses in rabbits in the Northern Sudanian zone of Burkina Faso

Barkwendé Jethro DELMA[1*]., Denté Fidèle TIANHOUN [1]., Gildas Marie Louis YODA[1]., Caleb OUEDRAOGO [2]., Nabèrè OUATTARA [2]., Adama KABORE[1]

[1]Laboratoire de Recherche en Production et Santé Animales (LaRePSA)/Institut de l'Environnement et de Recherches Agricoles (INERA)/Centre National de Recherche Scientifique et Technologique (CNRST), 04 BP 8645 Ouagadougou 04 Burkina Faso
[2]Université Daniel Ouezzin COULIBALY, Institut des Sciences de l'Environnement et du Développement Rural(ISEDR), BP 176 Dédougou Burkina Faso
*Corresponding author: Phone : +226 70 00 87 92 ; E-mail: *delmabjethro@yahoo.fr*

Abstract

This study aimed to analyze the practices and ethnobotanical knowledge of rabbit farmers in Burkina Faso regarding the treatment of gastrointestinal parasitosis and rabbit feeding. To this end, qualitative and retrospective surveys on the socio-professional characteristics of 65 rabbit farmers in the provinces of Kadiogo and Boulkiemdé, their feeding practices, and their management of rabbit breeding and health were conducted using individual semi-structured interviews. The results showed that 83.1% of the rabbit farmers surveyed were between 25 and 50 years old and had less than 5 years of experience (75.4%). The rabbit farmers surveyed used a wide range of feeds, including pellets (66.2%), green fodder (78.5%), and cereals (43.1%). The main diseases encountered were coccidiosis (60%) and mange (69.2%). The results of the ethnobotanical indices measured show that *Moringa oleifera* is the plant most commonly used by rabbit farmers to treat gastrointestinal parasites and to feed rabbits, with 1.05, 56.92%, 1.00, and 46.52% as Use Value (UV), Relative Frequency of Citation (RFC), Relative Importance Index (RI), and Level of Fidelity (LF), respectively. These indices vary according to the availability of the plant, its uses, accessibility, and the knowledge of the farmers. Base on these results, it is necessary to verify the assertions of the rabbit farmers surveyed to confirm their use of the plant by conducting subsequent in vitro and in vivo studies.

Keywords: Rabbit farmers, gastrointestinal parasitism, diet, Burkina Faso.

Introduction

Burkina Faso is an agro-sylvo-pastoral country. Livestock farming plays a major role in the economy and is practiced by more than 80% of households, which derive all or part of their income from livestock farming. In Burkina Faso, the average per capita annual meat consumption in 2009 was estimated at 17.9 kg (MRA, 2010), which is well below the international average of 100 g/day, or approximately 36.5 kg/year (FAO, 2008). Furthermore, faced with the problems of covering the population's needs foranimal-origin proteins that most Third World countries are experiencing, Burkina Faso should turn to the breeding of small, prolific, short-cycle animal species. In this situation, rabbit farming appears to be an alternative for resolving the constraints of production time, meat quality, and economic efficiency (Loucoumana, 1997; Djago and Kpodekon, 1999). Rabbit farming, which is mainly practiced in towns, enables the population to combat poverty (Sabbagh, 1983; Bognini, 2013) and diversify household dishes owing to its zootechnical characteristics. According to the 2019 National Livestock Survey, rabbit farming is practiced in all regions of Burkina Faso, with a national production of 110, 198 rabbits. Pathologies are known to be a limiting factor in rabbit farming, leading to huge economic losses due to morbidity and mortalityin the herd. Rabbits are particularly sensitive to drug treatments. The exponential development of drug-resistant species, which have become a major threat to animal production, has stimulated research into alternative control strategies to combat these parasites.

Thus, the discovery of a natural substitute that improves the growth of subjects with prophylactic and curative effects against these pathologies and is not dangerous to human health deserves consideration. The use of plant-based remedies to treat diseases is not a novelconcept. The study of plant substances as remedies holds great promise for the treatment of various diseases. In addition to reducing food production costs, plant substances could provide a therapeutic response that is adapted to the financial resources and sociocultural environment of livestock farmers. In this context, the present study was conducted to analyze the practices and ethnobotanical knowledge of rabbit farmers in the treatment of gastrointestinal parasitosis and rabbit feeding

Materials and Methods

Study area

The study was conducted in the northern Sudanian agroecological zone of Burkina Faso, specifically in the provinces of Kadiogo and Boulkiemdé (Figure 1). The Kadiogo province covers an area of 2,805 km² (Zida, 2009), and the Boulkiemdé province covers an area of 4,269 km² (Kabore*et al.,* 2009). The climate in the area is North Sudanian (Fontes and Guinko, 1995), with two seasons: a rainy season from May to October and a dry season from November to April. Temperatures are generally high throughout the year, with moderate temperatures during the rainy season (25-35°C). The average annual temperature is 28°C, with monthly highs of 40°C between March and April and monthly lows of 15°C in December. The average annual rainfall in the area varies from 700 mm to 900 mm.

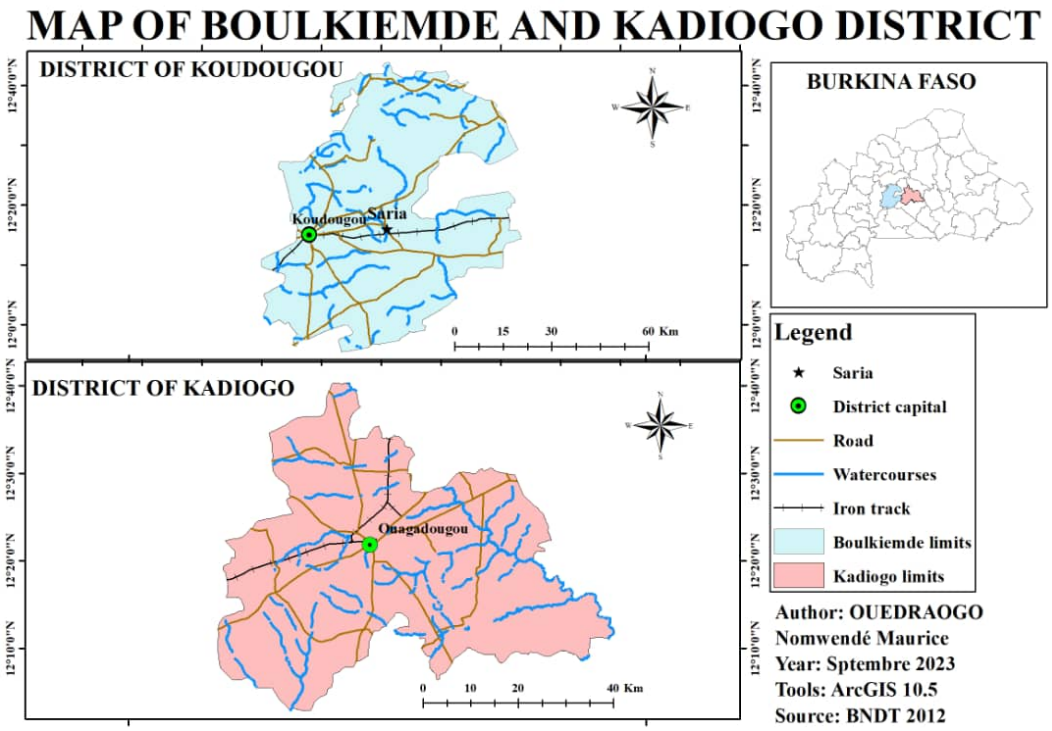

Figure 1: Study area

Sampling and data collection

An individual survey form was drawn up and sent to producers in the rabbit farming sector to collect the information required for this study.

The methodology used was a qualitative, retrospective survey of rabbit-rearing techniques regarding feeding and disease treatment. The questionnaire provided information on the identity of the respondent, feeding of these animals, actual management of the farm, gastrointestinal parasitic diseases encountered in these animals, their causes, and the traditional remedies based on medicinal plants usedfor treating these diseases. The breeders were selected based on their good knowledge of the use of phytomedicine in rabbit farming and their command of breeding practices. A total of 65 farmers were surveyedfor this study.

Calculation of indices

The ethnobotanical survey data were analyzed using various quantitative indices, including the relative frequency of citations (RFC), use value (UV), and relative importance index (RII), in order to evaluate significance of the recorded plant speciesand understand the degree of potential use of each species. Various diseases were recorded in this study. The level of fidelity (FL) and citation frequency (CF) were also considered.

The ethnobotanical indices were calculated using the following statistical formulas:

✓ Use value (UV)

For each species cited, the use value recommended by Phillips*et al.* (1994) was used. This value expresses the relative importance of each species in thesurveyed population (Ayantunde*et al.* 2009; Sopt*et al.* 2012).

$$UV = \frac{\sum U}{n}$$

Where U = number of citations per species; n = number of informants.

✓ Relative frequency of citations (RFC)

The Relative Citation Frequency (RCF) proposed and used by Tardio *et al.* (2008) was calculated to assess the local importance of each species. This frequency is calculated according to the formula: $FRC = FC/N$, with (0≤FRC≤ 1), where FC (Frequency of Citation) is the number of respondents who mentioned the use of the species, and N is the total number of respondents. A CRF of 1 indicates that all informants recognized the plant as medicinal and cited at least one use, whereas a CRF of 0 indicates that no informant cited a medicinal use for that plant.

✓ Relative importance index (RII)

Used by Tardio *et al.* (2008), based on the use categories for the species alone, the relative importance index (RII) does not consider the use sub-categories. It was calculated using the following formula:

$$RI_S = (RFC_{S(max)} + RUN_{S(max)})/2$$

where $RFC_{S(max)}$ is the relative frequency of citations compared to the maximum. The IRI theoretically varies from 0, when nobody mentions a use for the plant species, to 1 when the plant is most frequently mentioned as useful and in the maximum number of use categories.

✓ Fidelity level (FL)

The fidelity level (FL), as defined by Friedman *et al.* (1986), was calculated to identify the level of correspondence between informants regarding the medicinal plant species used for treating various pathologies. The equation applied was: FL (%) = (Np/N) × 100, where Np represents the count of use reports for a specific species mentioned in relation to a certain disease category, and N denotes the overall number of use reports recorded for that species.

Statistical analysis

Survey data were entered and coded using Microsoft Office 2013 Excel spreadsheets. A descriptive analysis of the data was performed using XLSTAT 2023 version 2.1414. Pearson correlation coefficients were calculated to quantify the nature of the linear and monotonic relationships between UV, and between RFC and RII. Statistical significance was set at P of less than 0.05.

Results and Discussion

Demographic characteristics of respondents

The survey results showed that rabbit farming is relatively recent in Ouagadougou and Koudougou. The age category of respondents corresponded to (83.1%) adults (25–50 years old) (Figure 2a). Most respondents were liberal profession (66.2%) (Figure 2b). In fact, 75.4% of the rabbit farmers surveyed stated that they had less than 5 years' experience (Figure 2c).

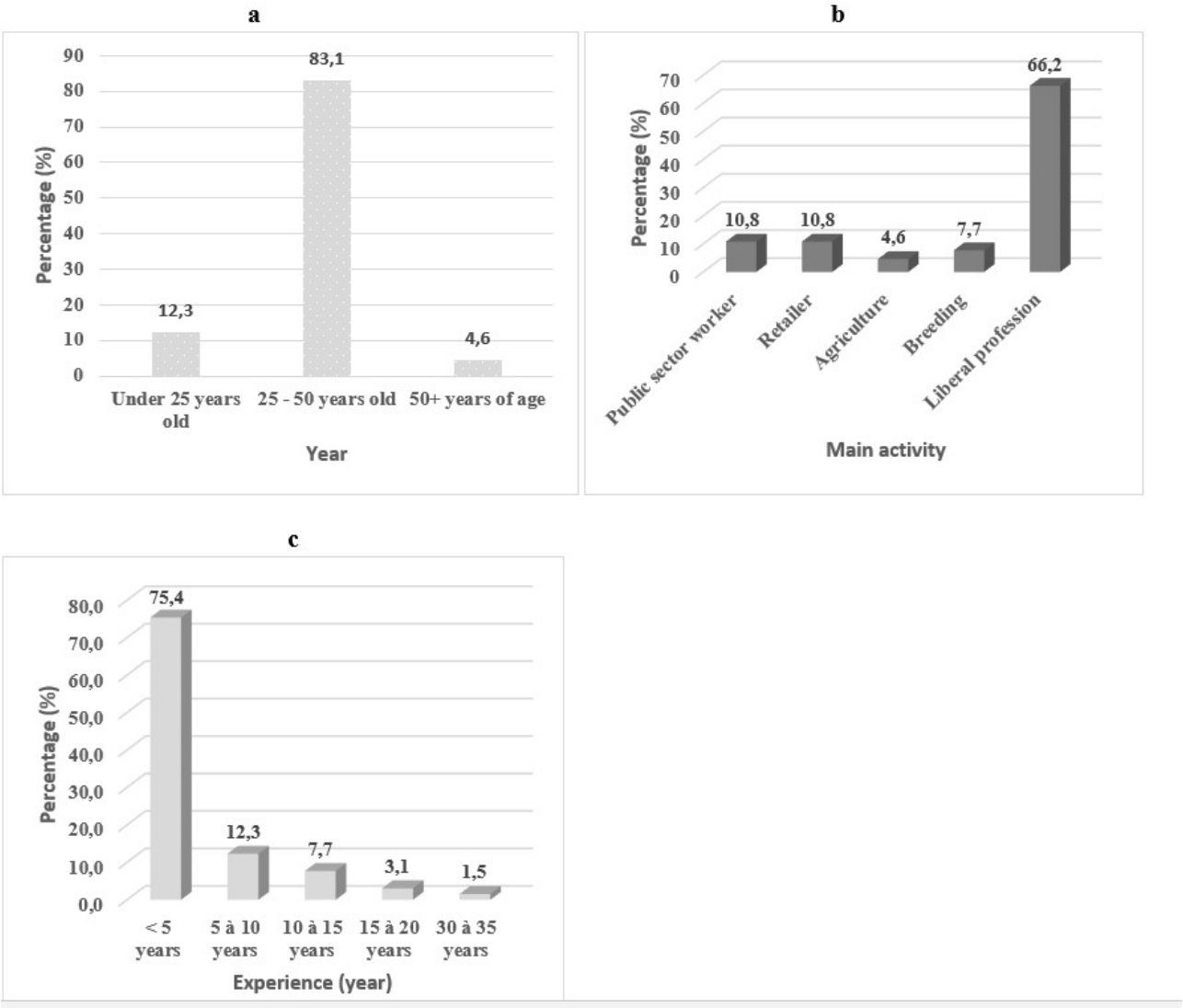

Figure 2: Characteristics of respondents: (a) Age of respondents; (b) Main activities of respondents; (c) Rabbit farming experience.

Livestock management

The survey results showed that 57.7% of the rabbit farmers had fewer than 20 rabbits. Most of the rabbit farmers surveyed (60%) opted for confined housing for their rabbits (Figure 3a). Approximately one-third of the respondents did not disinfect their cages, while 67% disinfected them weekly (15.4%), monthly (24.6%), quarterly (7.7%), or annually (1.5%) (Figure 3b). All respondents cleaned the rabbits' cages, and the majority (44.6%) did so every three days (Figure 3c).

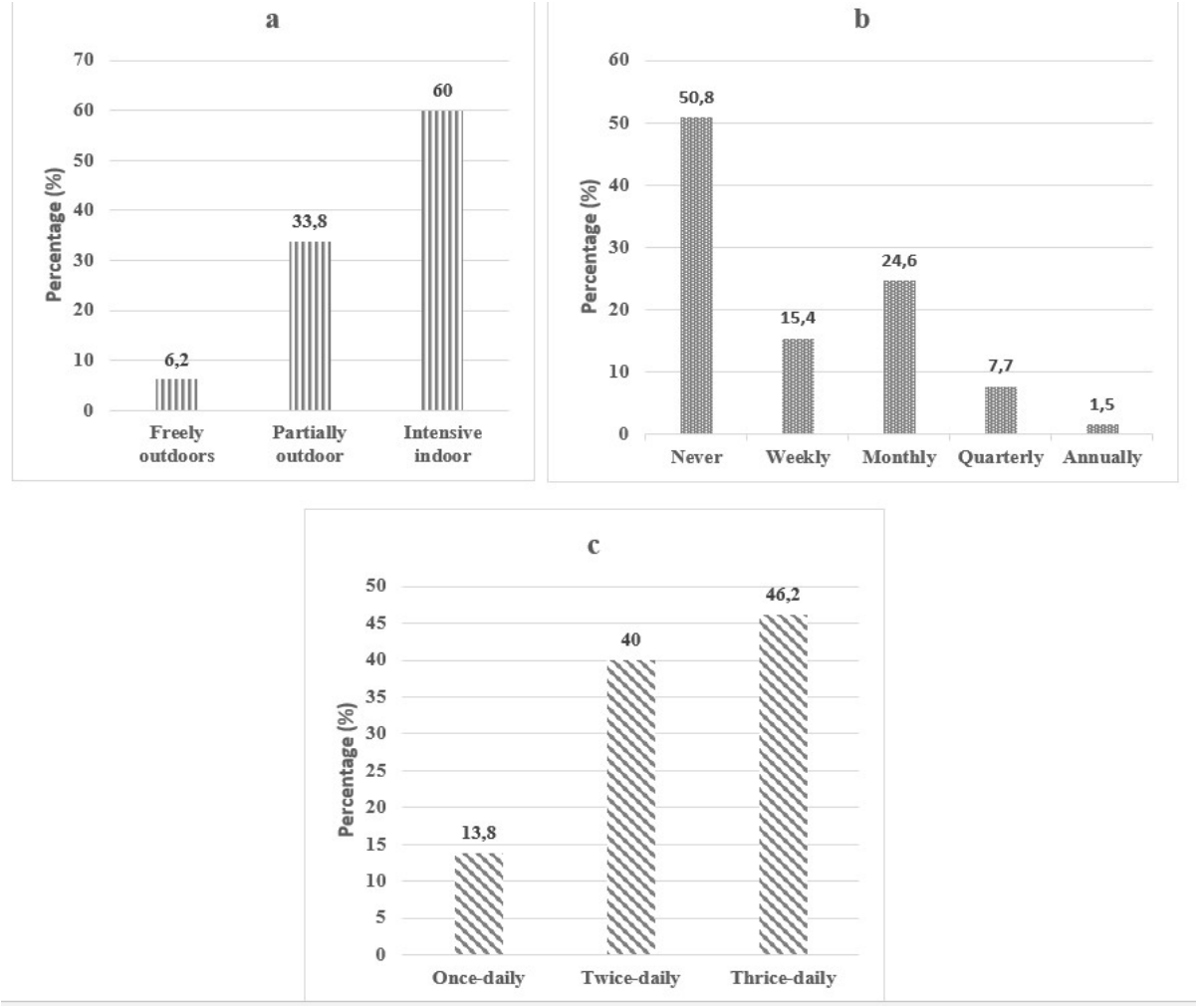

Figure 3: Rabbit farm management: (a) Rabbitry facilities; (b) Periodicity of rabbit cage sanitation;(c) Cleaning frequency.

Feeding the rabbits

The results show that the rabbit farmers surveyed used a diverse range of feeds to feed their rabbits. Pelleted feed (66.2% of respondents), green fodder (78.5% of respondents), and agricultural by-products (corn bran) were the main feeds used to feed the rabbits. Among the plants used by rabbit farmers as fodder are *Moringa oleifera* leaves (47.7% of rabbit farmers surveyed), *Vermonia amygdalina* leaves (21.5%), *Sida acuta* leaves (33.8%), and *Mangifera indica* L leaves (26.2%). The majority of rabbit farmers surveyed (46.2%) distributed three meals a day, whereas 40% of farmers did so twice a day and 13.8% once a day.

Health management

The majority of the rabbit farmers surveyed (93.8%) said that they had encountered diseases on their farms, particularly internal and external diseases. The internal diseases included coccidiosis (60% of rabbit farmers surveyed) and various types of diarrhea (40% of farmers). The external pathologies included mange (69.2%) and abscesses (15.4%). To treat these conditions, 49.2% of the rabbit farmers surveyed mainly used synthetic products (Figure 4), while the others (73.8%) opted for phytotherapeutic products. None of the farmers practiced vaccination to prevent these diseases. However, deworming was carried out (78.5% of rabbit farmers surveyed) in the case of internal pathologies, using a combination of synthetic molecules and phytotherapy as prophylactic measures.

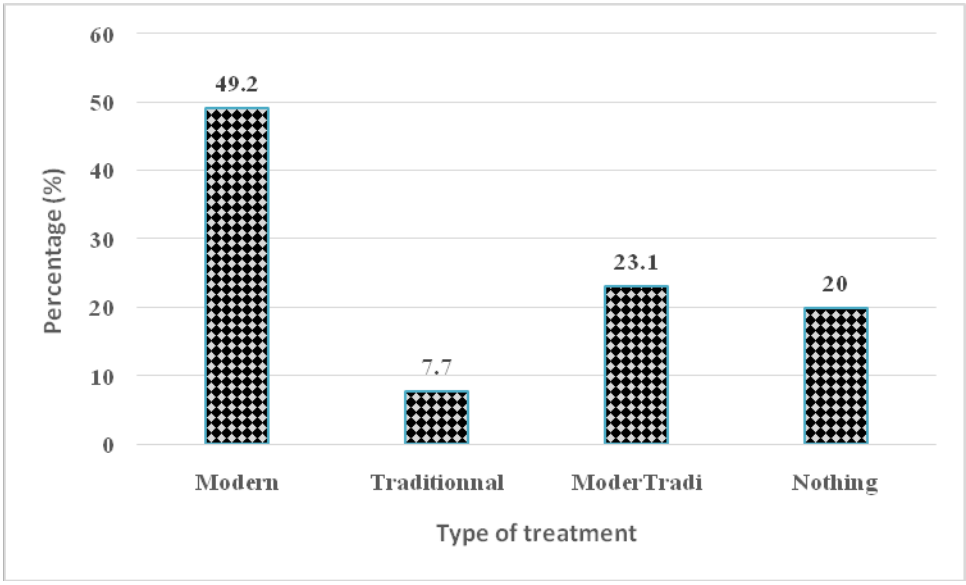

Figure 4 : Type of treatments used by the rabbit farmers surveyed

Medicinal plants used

In the provinces studied, thirteen (13) beneficial species of medicinal plants from 10 different botanical families were identified for treating internal rabbit parasitosis. The names of the plants, their botanical families, and the parts used are listed in Table I.

Values of the various ethnobotanical indices

✓ Use value (UV)

According to the survey results, the use values (UV) of the plants mentioned varied between 1.05 and 0.02. Based on these values, Moringa oleifera was the medicinal plant most commonly used by the farmers surveyed (1.05), with 37 reported uses, and had the highest use index. In contrast, *Ocimum basilicum*, *Zanthoxylum zanthoxyloides*, *Jatropha curcas*, and *Delonix regia* had the lowest indices (0.02) (Table I). These indices vary according to the availability of the plant, its uses, accessibility, and the knowledge of farmers in the region.

✓ Relative frequency of citations (RFC)

The coefficient of Relative Frequency of Citation (RFC) varied from 56.92% to 1.54%. *Moringa oleifera* had the highest RFC at 56.92%. This plant is used to treat various illnesses, including coccidiosis, scabies, abscesses, and diarrhea. *Carica papaya* (40%) and *Vernonia amygdalina* (23.08%) were also identified. In contrast, the lowest RFC levels were recorded for *Ocimum basilicum*, *Zanthoxylum zanthoxyloides*, *Jatropha curcas*, and *Delonix regia* (1.54% each).

✓ Relative importance index (RII)

Table I showed the Relative Importance Index (RII) of the medicinal plants identified at the study sites. The results show that *Moringa oleifera* had the highest IRI value (1.00), confirming its status as the most versatile medicinal plant used by livestock farmers in the two towns. This plant is widely used by local farmers, who have considerable knowledge of it, particularly for its use in the treatment of a wide range of pathologies, making it the most frequently used medicinal plant in the region. *Moringa oleifera* is followed by *Carica papaya* (0.54) and *Vernonia amygdalina* (0.42). In contrast, *Ocimum basilicum*, *Zanthoxylum zanthoxyloides*, *Jatropha curcas*, and *Delonix regia* (0.2) had the lowest Relative Importance Index (RII) values, indicating that they are less versatile in the areas studied.

Table I: Medicinal plants traditionally used with their ethnobotanical indices expressed by the rabbit farmers surveyed

Species	Families	Parts used	Diseases treated	CF (%)	RII	UV	RFC (%)	FL (%)
Moringa oleifera	*Moringaceae*	Leaves	Coccidiosis	37	1	1,05	56,92	46,52
Ocimum gratissimum	*Lamiaceae*	Leaves	Diarrhoea	2	0,04	0,03	3,08	0,1
Vemonia amygdalina	*Asteraceae*	Leaves	Coccidiosis	15	0,42	0,45	23,08	21,6
Carica papaya	*Caricaceae*	Leaves	Coccidiosis	26	0,54	0,40	40,00	27.32
Ocimum basilicum	*Lamiaceae*	Leaves	Coccidiosis	1	0,02	0,02	1,54	0.1
Zanthoxylum zanthoxyloides	*Rutaceae*	Leaves	Coccidiosis	1	0,02	0,02	1,54	0.1
Khaya senegalensis	*Meliaceae*	Leaves	Coccidiosis	4	0,08	0,06	6,15	2,5
Euphorbia hirta	*Euphorbiaceae*	Leaves	Diarrhoea	3	0,06	0,05	4,62	3,3
Jatropha curcas	*Euphorbiaceae*	Leaves	Coccidiosis	1	0,02	0,02	1,54	0.1
Psidium guaranas L	*Myrtaceae*	Leaves	Coccidiosis	2	0,07	0,09	3,08	1,7
Azadirachta indica	*Méliaceae*	Leaves	Coccidiosis	4	0,13	0,15	6,15	1
Mangifera indica L	*Anacardiaceae*	Leaves	Coccidiosis	3	0,19	0,31	4,62	5
Delonix regia	*Fabacées*	Leaves	Coccidiosis	1	0,02	0,02	1,54	0.1

✓ Fidelity level (FL)

In this study, the level of fidelity (FL) of the species reported in the study area ranged from 0.1% to 46.52%. *Moringa oleifera* is the plant with the highest level of fidelity (46.52%), followed by *Carica papaya* (27.32%) and *Vernonia amygdalina* (21.6%).

Discussion

Socio-demographic characteristics

Rabbit farming is common in the towns of Ouagadougou and Koudougou, although it is often practiced as a hobby by locals. It is practiced by both educated and uneducated people alike. The vast majority of rabbit farmers in the study area were men (95.4%) compared to women (4.6%). This finding is similar to that observed by Bocar (2011) in Dakar. Most farmers are adults, with 75.4% having less than 5 years of experience, and they represent various social strata, as observed in rabbit farming in Benin (YO et al., 2018). In terms of education, 43.1% of the rabbit farmers surveyed had secondary education, and the majority were self-employed (66.2%).

Feed used by rabbit farmers

The study showed that rabbit farmers use three (3) categories of feed to feed their animals: pelleted feed, forage, and agricultural by-products. Green fodder is widely used in rabbit farming and includes plants such as *Moringa oleifera*, *Sida acuta*, *Mangifera indica* L, *Ocimum gratissimum*, *Ocimum basilicum*, *Flueggea virosa*, and *Hyptis suaveolens*. These results corroborate the findings of by Adehan*et al.* (1994), who identified these plants as palatable to rabbits. Pellets are more commonly used in urban areas, where access to green fodder is limited, resulting in higher production costs than those in rural areas. The distribution of pelleted feed was recommended according to the results of Guindjoumbi (2007).

Rabbit diseases

Regarding the health of the rabbits, a large majority of the rabbit farmers surveyed (93.8%) mentioned the presence of diseases such as coccidiosis, diarrhea, scabies, pneumonia, and abscessesin their rabbits. Coccidiosis and scabies were identified as the most common diseases on rabbit farms, corroborating the findings of Licois (2010) regarding the frequency of these diseases in Africa. Coccidiosis and scabies are often attributed to a lack of hygiene and preventive measures on farms, consistentwith the observations of Akpo *et al.* (2011). The health problems observed could also be linked to the low level of vaccination, environmental stress, and lack of control over the feeding of young rabbits, particularly on floor farms, where the animals are exposed to infectious agents. These results are consistentwith the research by Bocar (2011), who highlightedthe impact of farmers' lack of knowledge on rabbit health. Rabbit farmers use both modern and traditional treatments to care for their animals. Traditional treatments include the use of plant-based products, such as *Moringa oleifera*, *Carica papaya*, and *Vernonia amygdalina*. Our results confirm those of Olounlade*et al.* (2021) in Benin, who demonstrated that the leaves and stems of *Moringa oleifera, Ocimum gratissimum*, and *Vernonia amygdalina* added to rabbit feed reduced the parasite load in naturally infected rabbits.

Medicinal plants used to treat gastrointestinal parasitosis

Thirteen (13) species of medicinal plants were cited by rabbit farmers as being used to treat rabbits, including *Moringa oleifera*, *Carica papaya*, and *Vernonia amygdalina*. These plants are used for various purposes, including deworming and treating of various ailments. Our results are in line with those of other authors (El Banna (2016); Tipu*et al.,* (2006)) who demonstrated the varied use of these plants in the treatment of pathologies in monogastric and polygastric animals. Our results are also in line with the work carried out by de Konmy (2021), who evaluated different extracts of these plants for their nutritional and antiparasitic effects on rabbits. Among these plants, *Moringa oleifera* stands out as the remedy most frequently used to

treat rabbit ailments, with a high use value (UV) of 1.05, relative frequency of citation (RFC) of 56.92%, relative importance index (RII) of 1, and a reliability level (FL) of 46.52%. Species such as *Carica papaya* and *Vernonia amygdalina*are also used in traditional medicine. The results of this study are consistent with those of Konmy (2021).

Conclusion

This study aimed to obtain traditional knowledge from rabbit farmers regarding local plants used to feed and treat rabbits. It provides information on socio-professional characteristics, feeding, husbandry management, and health management. In addition, the level of knowledge of the use of plants by rabbit farmers for treating various parasitic diseases was assessed in this study. This study revealed that rabbit farmers have endogenous knowledge that can improve the health of their animals. With this diversity of plant species identified in this study, three (3) species received particular attention based on the number of diseases they treat and their citation indices. The three plants were *Moringa oleifera*, *Carica papaya*, and *Vernonia amygdalina*. Further studies are required to consolidate this knowledge. Biological efficacy tests need to be carried out with these three plants if they are to be used appropriately by rabbit farmers.

Conflicts of interest

The authors declare no conflict of interest.

Declaration of authors' contributions

DBJ, TDF, and YGML participated in the design and planning of the study; DJB and OC collected the field data, performed the data analyses, and interpreted the data ; DJB, TDF, YGML, and OC drafted the first version of the manuscript; ON and KA revised the manuscript.

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