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Zoonotic risk practices in rural households: an analytical cross-sectional study in the Penka-Michel Health District, West Cameroon Region

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Abstract

Introduction: *zoonotic diseases are a public health problem contributing to the economic burden. The objective of our study was to investigate zoonotic risk practices in rural households in the Penka-Michel Health District of Cameroon.* ***Methods:*** *a descriptive cross-sectional study was conducted from December 2020 to October 2021, i.e. 11 months, among 200 heads of households in Penka-Michel selected through a two-stage survey. Descriptive statistical analysis was done using SPSS version 23.0 software.* ***Results:*** *up to 74% of household heads thought that animals can transmit diseases. Many households owned poultry (98%), pig(s) (50%), dog(s) (57%) of which 48% were vaccinated against rabies, and cat(s) (52%). Urban rats, bush animals and dogs were consumed by 74%, 61% and 18% of households respectively. In addition, 25% of households slaughtered sick animals for consumption and 27% ate dead animals. The slaughter of animals was mostly carried out within the household (97%), rarely preceded by a veterinary inspection (6%). Traditional rites with animal blood were practiced in 87% of households, 65% shared the same habitat as their animals, 41% did not systematically wash their hands after handling animals.* ***Conclusion:*** *many zoonotic risk practices in households have been identified. Concerted awareness-raising actions are needed among the rural population*

Introduction

Zoonotic diseases are a public health burden causing an estimated one billion cases of disease annually, with an estimated several million deaths each year [1]. According to the World Health Organization, 75% of emerging infectious diseases in human populations are of animal origin [2]. Furthermore, taking into account the costs of zoonotic disease control and the loss of productivity that it causes, the economic burden imposed by these diseases over the last two decades has been in excess of USD 100 billion [3]. However, this figure is underestimated due to insufficient data from developing countries [4]. Due to their low socio-economic status, these countries are the most affected by the emergence of a zoonotic disease [5]. Aware of this alarming situation, the international community, through the World Organisation for Animal Health (OIE), recommends that epidemiological studies be carried out in each geographical area to better understand the dynamics of mutual transmission of diseases between wildlife, domestic animals and humans [6]. In fact, in developing countries such as Cameroon, public awareness of zoonoses is low and is only increased during health crisis episodes [7]. Following the 2006 avian flu epidemic, which caused the poultry industry to lose about 3 billion CFA francs, Cameroon has developed several national programmes to protect itself against zoonoses, the main one being the National Programme for the Prevention and Control of Emerging and Re-emerging Zoonoses, which has been developed since 2012 in line with the national "one health" strategy, which considers rural populations to be priority beneficiaries [8,9]. Currently estimated at more than 22 million inhabitants, the Cameroonian population is constantly increasing and about 48% of it lives in rural areas where the economy is driven by agriculture and livestock [10,11]. Indeed, livestock are precious to farmers; they represent both a bank in financial emergencies and an important socio-cultural element in traditional rites. The proximity created between humans and animals increases the level of zoonotic risk for rural populations that are strongly attached to animals in the West Cameroon region [1]. These zoonotic risk households practices favour the transmission of zoonotic infections or diseases between human and animal and vice versa in a household [6]. The main objective of our study was to investigate zoonotic risk household practices in the Health District (HD) of Penka-Michel (PM) and more precisely to describe the socio-economic and demographic characteristics of rural households of the Penka-Michel Health District; to determine zoonotic risk practices in rural households in the Penka-Michel Health District and to identify

predisposing factors to zoonotic risk practices in rural households in the Penka-Michel Health District.

Methods

Study design: this cross-sectional analytical study was conducted to determine socio-demographic and economic characteristics of population, zoonotic risk household practices and sanitary status of households in the Penka-Michel HD.

Study setting and population: Penka-Michel HD belongs to the West region of Cameroon. This region is a large agropastoral cash crop and subsistence basin with a high population density, 114 inhabitants per Km² [8] and a surface area of 1,892 km² with a population of 2,327,807 inhabitants [12]. The PM district includes 13 health areas (HAs). The survey was conducted from June to September 2021 (4 months) and households included in the survey met the following criteria: being located at least one kilometre from the main paved road, raising various livestock species in a traditional way (or extensive system), having interactions between humans and domestic animals or wildlife, having at least one adult person (or head of household) able to answer the questionnaire and having regularly stayed in the PM HD during the last 12 months prior to the survey. Dwellings consisting of several households or flats (excluding traditional chiefdoms) were not included in this study.

Variables: household practices at risk of zoonosis (practices that can facilitate the transmission of zoonosis from animal to human and vice-versa), socio-professional category of the head of household, level of education of the head of household, level of household income, perception of animals as being able to transmit diseases, knowledge of zoonoses, farming practice, slaughter of animals in the household, type of household accommodation, consumption of dog meat and consumption of bushmeat were the variables in our study. The household practices at risk of zoonosis explored in this study were defined according to literature.

Data resource and measurement

Data collection tool: a semi-structured organized in several sections (socio-demographic and economic characteristics of the study population, zoonotic risk household practices and sanitary status of the households). These data were chosen assuming that the transmission of zoonoses is influenced by several factors such as densities of reservoir and vectors population, contact between species, food consumption habits, etc.

Data collection: data were collected using the semi-structured, pre-tested questionnaire on 20 households in a locality close to the study area. The questionnaire was submitted to the heads of households in face-to-face interviews. The interviews were conducted in French language. In some rare households where the heads were unable to speak in French language, our guide person belonging to PM HD where the interpreter.

Sampling techniques and sample size: the sample for this study was drawn from the 2-stage survey presented in the methodological tool for the Fourth Cameroon Household Survey conducted in 2014 [13]. For this study, an initial draw was used to select 7 HAs from the 13 HAs in the PM HD. Then the number of households selected from each HA was proportional to the population size of that HA. The normal sample size according to ECAM4 was 105 households. But to maximise precision we used twice that number for a final size of 210 households. Within each HA, households meeting the inclusion criteria were selected on either side of the main road using the snowball technique. At the end of the interview, the head of each household was asked to identify the nearest household that met the inclusion criteria. This information enabled us to move from one household to the next until we had reached the sample size planned for each zone.

Statistical analysis: Excel version 2016 was used to enter the data and to summarise the results in the

form of tables. Statistical analysis of the data was done using IBM-SPSS version 26. A binary multiple logistic regression model was used to identify factors predisposing to zoonotic risk household practices. The dependent variable was the identified major zoonotic risk household practices. This binary variable was coded into two categories: one practice and more than one practice. This was done to determine the household's factors associated with the occurrence of zoonotic risk household practices. The significance level was 5%.

Administrative and ethical considerations: ethical clearance from the institutional research ethics committee (Ref: N°231/UY1/FMSB/VDRC/DAASR/CSD) of the Faculty of Medicine and Biomedical Science/Yaoundé 1 (FMSB/UY1) and administrative authorisations from the administrative and traditional authorities in the study area were obtained.

Results

Descriptive analyses

Practices with a major zoonotic risk: all households had at least one major zoonotic risk practice. More specifically, the practices found were traditional rites with animal blood (87%), sharing the same habitat as animals (65%), and the absence of systematic hand washing after handling live or dead animals (41%) (Table 1). In sum, 75% of households had more than one major zoonotic risk practice, compared to 25% who had only one.

Socio-economic and demographic characteristics of households in the PM HD: the average number of persons in the households was 6.2 ± 2.3 SD. Table 2 presents the socio-economic and demographic characteristics of households in the PM HD. It shows that the majority of survey participants were women (56%). The dominant socio-professional category was the informal private sector (53%). Secondary to their main occupation, the heads of household were engaged in agriculture (90%). The highest level of education of the heads of household was secondary in half of the cases (50%). For their agro-pastoral activities, 99% of households owned arable land, the dominant area of which varied from 500 to 1000 square metres (33%). On this land, 99% of households engaged in agropastoral activities, with the crops used for family consumption (93%). The monthly income of 72% of households was above 36,270 CFA F, corresponding to the guaranteed minimum wage. All households were built with permanent materials, 70% of which were made of unplastered breeze blocks or mud bricks. The open pit was the most common type of latrine (59%).

Household practices and human health/animal health: household practices and human/animal health are presented in Table 3, Table 3.1. A total of 14% of household heads thought that animals do not transmit diseases to humans and 12% did not know whether animals transmit diseases to humans. Only 17% of the heads of household had ever heard of zoonotic diseases. For drinking water, the borehole/well was the most used source (55%). In case of illness, households obtained medicines mainly from health facilities (88%), followed by the street (53%) and non-conventional medicines (6%). Hunting was rare (3%), although many households consumed bushmeat (61%) or dog meat (18%). Slaughtering of animals was carried out in 97% of households. In addition, 60% of heads of household caught rats in their homes. These rats were mainly consumed within the households (45%). The main animal species slaughtered were poultry (98%). These animals were slaughtered mainly at ordinary family meals (90%). Only 6% of households had veterinary inspection of the animals before slaughter and waste from slaughtered animals was mainly dumped in the fields (56%).

In addition, 14% of households took their animals to pasture for feeding, most of which did so every day (81%). With regard to animal management and the zoo-sanitary situation of households, the number of animals in households varied according to species. For poultry, 98% of households had at least one poultry. For pigs, 50% of households had at least one pig. No household in this study had

cattle, while 57% of households had at least one dog and 52% of households had at least one cat. Only 17% of households owned non-conventional animals. The supply of livestock was mainly from the local market (86%). All households had latrines, which were predominantly traditional (59%). The animals had access to them in 41% of households. When an animal was sick, 44% of households treated it without calling a veterinarian. When the animal died, 75% of households buried the corpse without treatment and 27% ate the corpse.

Regarding the monitoring of dogs, dogs were strays in 41% of households. In addition, 81% of the dogs had been vaccinated against rabies and this vaccination was more than one year old in 52% of the households. Similarly, stray dogs had access to most households (90%). In order to monitor the health of the animals, 55% of households had carried out at least one preventive treatment against infectious diseases during the 6 months preceding the survey. Manure from animal husbandry was mainly used in agriculture for soil fertilisation (88%). The housing or rearing system of the animals was mainly daytime roaming and a resting area at night (84%).

Finally, the most commonly used preventive treatment was deworming (68%) and the medicines used for these treatments were mainly from the veterinary pharmacy (57%).

Binary logistic regression analysis

Factors predisposing to household practices with zoonotic risks: Table 4 presents the factor predisposing to zoonotic risk household practices. The binary logistic regression (categorical dependent variable of the type "only one practice" and "more than one practice") allowed us to identify only one factor predisposing to zoonotic risk practices: the type of dwelling ($p<0.05$). This was the type of housing ($p<0.05$).

Discussion

This cross-sectional analytical study was carried out to determine zoonotic risk household practices and predisposing factors in the PM HD. Several household practices with zoonotic risks were identified. The participants in this study were predominantly women (56%) compared to men (44%). This distribution is different from the regional average in rural West Cameroon (46% women and 54% men) [13]. Regarding household practices with major zoonotic risk, 87% of households performed traditional rites with animal blood. Indeed, the animal has always been very important in most cultures and religions of the world [14,15]. Rituals using animals or their secretions may constitute zoonotic risks [16].

In addition, 65% of households shared the same habitat as the animals. This is similar to the situations described in Cambodia by Osbjer *et al.* in 2015. Here, 28% of households kept animals near bedrooms [17]. This is because rural dwellings rarely provide separate accommodations for their animals, yet this proximity is a significant zoonotic risk [8,11]. In household practices and human health, 74% of household heads thought that animals can transmit diseases, 14% thought the opposite. This is quite similar to the situation described in Mongolia by Barnes (2020), who stated that most households (74%) had knowledge about the risks of zoonotic transmission. These results show that rural people are aware of zoonotic risks although their practices are slow to improve.

Many households consumed bushmeat (61%) compared to dog meat (18%). Indeed, although the practice of hunting in rural areas is no longer very common according to several studies, Osbjer *et al.* (2015) in Cambodia reported that 8% of rural households captured and slaughtered wild animals for consumption [17]. Bushmeat, although feared by public health professionals because of the zoonotic risks it may entail, remains popular with rural consumers [18]. The slaughter of domestic

animals was also carried out within households (97%) and only 6% of households used veterinary inspection of the animals before slaughter. This result is similar to that of Fèvre *et al.* (2017) in Kenya, where in 15% of households, the slaughter of animals was carried out at home by inexperienced people [19]. This could be due to the absence of clear regulations requiring that slaughtering should be systematically carried out in approved abattoirs [20-22]. In Penka-Michel Health District, 60% of households had at least one dog that was either stray (41%), chained (37%), or chained during the day and stray at night (21%). Stray dogs had access to most households (90%). This is because stray dogs can transmit tetanus or rabies through biting/scratching/shooting [23] or cystic echinococcosis through oocysts in its faeces [23-25].

In order to monitor animal health, 55% of households had carried out at least one preventive treatment mainly from the veterinary pharmacy (57%) and the street (50%). This result is lower than that obtained in Bangladesh by Roess *et al.* (2015), according to which 60.1% of treatments were proposed by household members and only 25% of households used animal health staff to monitor animals [26]. Thus, the street drug phenomenon remains a serious public health problem increasing the burden of disease in communities and the emergence of antimicrobial resistance [27-29]. This situation was also aggravated by the fact that the doctor of medicine (MD) of PM did not yet have a permanent veterinary doctor to look after the animals in the locality. When an animal became sick, 25% of households slaughtered it for consumption, 4% sold the sick animal. These results are similar to those of Osbjer *et al.* in Cambodia, where 28% of households consumed meat from sick animals [17]. The precariousness that exists in rural areas sometimes forces farmers to eat sick animals so as not to lose them permanently if they die [1,28,30,31].

When the animal died, 27% ate the corpse. This result supports that obtained by Osbjer *et al.* (2015) in Cambodia where 28% of households consumed meat from dead animals [17]. This practice is justified by the poverty existing in rural areas and only the death of an animal sometimes offered the opportunity for children to consume animal protein [13,27,32]. The only factor predisposing to zoonotic risk practices was the type of housing ($p<0.05$). Thus, households with unplastered cinder block or mud brick dwellings were more predisposed to zoonotic risk practices than households with plastered cinder block or mud brick dwellings. This may be due to poverty, which prevented heads of households from building separate housing for animals and sleeping under the same roof as the animals.

Limitations of this study consist of some difficulties such as untimely rains and traditional ceremonies held during the last week of data collection that compromised the completion of the sample size (210 households) for this study. Due to the fact that the survey was made during the rainy season, it is possible to have some variations in zoonotic risk practices such as the source of drinking water or habitat sharing between humans and animals for example.

Conclusion

At the end of this study, which aimed to identify zoonotic risk household practices in the Penka-Michel Health District, it was found that zoonotic risk practices exist in the PM HD and are diversified. In addition, the type of housing was the predictive factor for the occurrence of major zoonotic risk practices in the households. Better collaboration between the human health, animal health and environment sectors is needed to better control zoonotic diseases according to the "one health" approach.

What is known about this topic

- *Rural populations live close to domestic and wild animals;*
- *Rural populations are poor, neglected, and lack some basic hygiene measures.*

What this study adds

- *In PM HD, there are people still living in traditional households and sharing their houses with domestic animals;*
- *There is low awareness and knowledge of zoonotic risks in households and their consequences in the PM HD;*
- *There is lack of veterinary doctors for the management of animal health in the PM HD.*

Competing interests

The authors declare no competing interests.

Authors' contributions

Armand Fokeng Namekong: design of the study, data collection, analysis and interpretation, writing-original draft; Esther Voundi Voundi: conceptualisation, methodology, supervision, writing-original draft; Georges Bediang: conceptualisation, methodology, supervision, writing-review. All the authors proof read and approved the final version of this manuscript.

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Table and figures

Table 1: household major zoonotic risk practices

Table 2: socio-economic characteristics of households included in this study

Table 3: household practices and human/animal health

Table 3.1: household practices and human/animal health

Table 4: predisposing factors for zoonotic risk practices (n=200)

Figure 1: distribution of major zoonotic risk practices

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Table 1: household major zoonotic risk practices

Practices	**n (%)** **N=200**
Performing traditional rites with animal blood	175 (87)
Sharing the same habitat as the animals	130 (65)
Do not systematically wash hands after handling live or dead animals	83 (41)
Eating raw or undercooked meat	3 (1)

Table 2: socio-economic characteristics of households included in this study

Features	**n (%)** **N=200**
Gender of head of household (Female)	112 (56)
Socio-professional category of the head of household	
Informal private sector	106 (53)
Unemployed	36 (18)
Public sector	30 (15)
Formal private sector	17 (9)
Student	11 (6)
Secondary occupation of head of household (agriculture)	180 (90)
Level of education of the head of the household	
No formal training	18 (9)
Primary	67 (34)
Secondary	99 (50)
Superior	16 (8)
Ownership of cultivable agropastoral land	198 (99)
Area of these agropastoral lands	
Less than 500 m2	64 (32)
500 to 1000 m2	66 (33)
1001 to 5000 m2	43 (22)
More than one hectare	19 (10)
Agricultural practice on these agropastoral lands	198 (99)
Family consumption of agropastoral crops	186 (93)
Monthly household income < 36 270 CFA F	56 (28)
Type of household accommodation	
Unplastered cinder blocks or mud bricks	141 (70)
Plastered cinder blocks or mud bricks	59 (30)
Type of latrine (open pit)	118 (59)

N = total number of households responding; n = number of households for each modality or response; % = percentage for each modality

Table 3: household practices and human/animal health	
Features	**n (%)**
Number of pigs	
0	100 (50)
1 à 5	76 (38)
6 à 10	19 (10)
Number of cattle: none	200 (100)
Number of dogs	
0	85 (43)
1 à 5	113 (56)
Number of cats	
0	95 (48)
1 à 5	103 (51)
Possession of non-conventional animals	34 (17)
Sources of supply of farmed animals	
Local market	171 (85)
Farmers from neighbouring villages	20 (10)
Farmers from the same village	48 (24)
Defecation in latrines	200 (100)
Animal access to latrines	82 (41)
In the presence of sick animals	
Calling in a vet	78 (39)
Slaughter for consumption	47 (23)
Selling sick animals	8 (4)
Treating sick animals	89 (44)
Do nothing	31 (15)
In the presence of dead animals	
Eating the meat of the dead animal	55 (27)
Treating the remaining animals	42 (21)
Sell the remaining animals	28 (14)
Burying the corpse without treatment	150 (75)
Slaughter the remaining animals	7 (3)
	N=121
Level of freedom of the dog	
The dog is a stray	50 (41)
The dog is chained	45 (37)
The dog is a stray by night, chained by day	26 (21)
The dog is vaccinated against rabies	98 (81)

Table 3.1: household knowledge or practices and human/animal health	
Features	**n (%)**
	N=200
Access of stray dogs in the household	179 (90)
Preventive treatments for animals	111 (55)
Fate of manure from the farm	
Soil fertilisation	175 (88)
Thrown in the bin	25 (12)
Animal housing system: mixed	168 (84)
	N=117
Type of treatment	
Dewormer	79 (68)
Vaccine	58 (50)
Antibiotic	40 (34)
	13 (11)
Origin of the medicine	
Veterinary pharmacy	66 (57)
Street	59 (50)
Plants (bush)	9 (8)
N = total number of households responding; n = number of households for each modality or response; % = percentage for each modality	

Table 4: predisposing factors for zoonotic risk practices (n=200)				
Factors or characteristics of households (independent variables)	**p-value**	**Odds Ratio (OR)**	**Confidence interval of the 95% OR**	
Socio-professional category of the head of household	0,547	1,104	0,799	1,526
Level of education of the head of the household	0,775	0,929	0,561	1,539
Agricultural practice	1,000	0,000	0,000	-
Monthly household income	0,132	1,851	0,831	4,122
Thinking that animals can transmit diseases	0,425	0,764	0,395	1,478
Knowledge of zoonoses	0,532	0,748	0,300	1,862
Bushmeat consumption in the household	0,617	0,838	0,420	1,673
Consumption of dog meat in the household	0,870	0,932	0,399	2,174
Type of housing: unplastered cinder blocks or mud bricks	0,022*	0,421	0,200	0,884
Number of practices with major zoonotic risk (dependent variable) One practice = 25%; More than one practice = 75%. *significant values; n = 200; α = 0.05; CI = confidence interval				

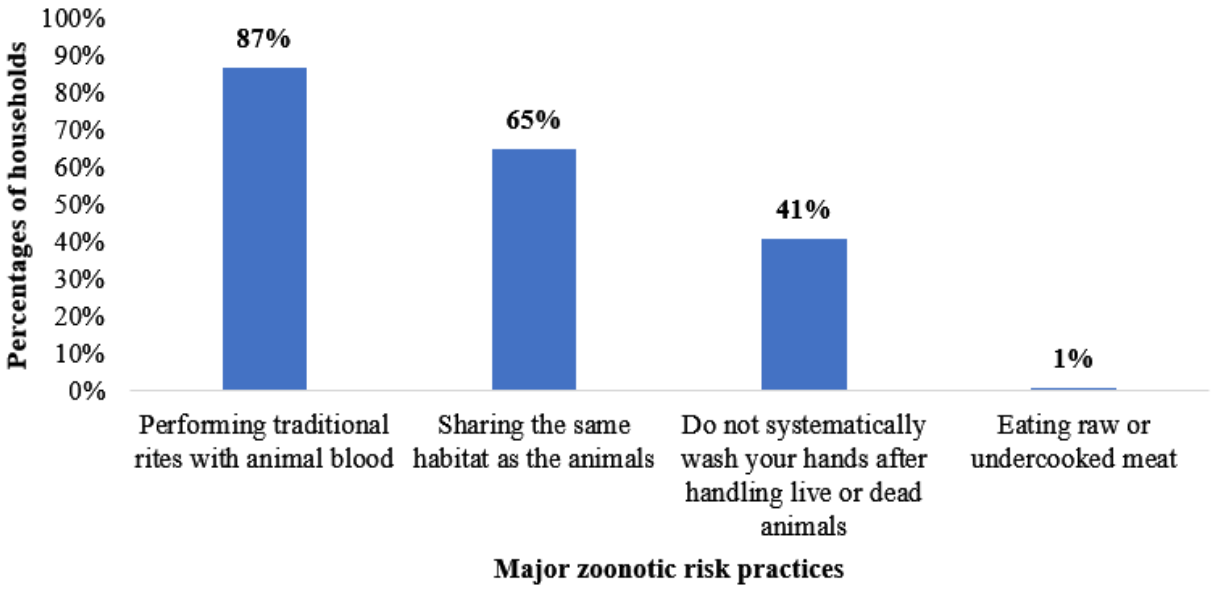

Figure 1: distribution of major zoonotic risk practices