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Participatory Epidemiology of Cattle Diseases Among the Fulani Pastoralists in Bacita Market, Edu Local Government Area, Kwara State, North-central Nigeria

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Abstract

The Fulani pastoralists are the custodians of 90% of the Nigerian cattle population and represent a significant component of the Nigerian economy. Participatory epidemiology involves the systematic use of participatory approaches and methods to improve the understanding of diseases and provide options for control. We used focus group meeting, disease impact scoring, seasonal calendar and triangulation as participatory epidemiology methods to identify the most important cattle diseases that Fulani pastoralists encounter in Kwara state, North-central Nigeria.

Eight diseases/symptoms were collectively identified by the Fulani pastoralists during the focus group meeting and disease impact scoring exercise as most important affecting their cattle. These are: leptospirosis (*Gabi-Gabi*), FMD (*Chabo*), fasciolosis (*Hanta*), trypanosomiasis (*Samore*), haematuria (*Taki*), tick infestation (*Duce*), brucellosis (*Kwanejie*) and ear infection (*Kune*); local names in parentheses. The seasonal calendar created by the pastoralists described variations in disease occurrence and rainfall pattern over four seasons of the year. When rainfall patterns were compared with the state annual rainfall pattern, there were obvious differences in the early rainy and early dry seasons. This could be because pastoralists recognize the seasons from the amount of rainfall, rather than the calendar date.

Participatory epidemiology techniques were effective in gathering information from Nigerian Fulani Pastoralists that might inform control policy for livestock diseases.

Keywords: Fulani; Pastoralists; Nigeria; Kwara State; Participatory epidemiology; Focus group meeting; Seasonal calendar; Disease impact score

Abbreviation: PE: Participatory epidemiology; PRA: Participatory rural appraisal; LGA: Local government area; FMAWR: Federal ministry of agriculture and water resources; LNRBDA: Lower Niger River Basin Development Authority; FMD: Foot and mouth disease; OIE: Office International des Epizooties; TET fund: Tertiary education trust fund

Introduction

Fulani pastoralists are the custodian of 90% of the Nigerian cattle population [1-3]. They are a significant component of the Nigerian economy where more than 80% of the population depend on for meat, milk, ghee, cheese, hair, honey, butter, manure, animal blood, hides and skin [4]. The Fulani pastoralists are distributed all over West Africa [5] and are said to have arrived in Nigeria around the 13th and 14th centuries [6]. They have an estimated population of 50 million in Africa [7] of which about 12 million are located in Nigeria [8]. They

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often travel with large herds of cattle ranging from fifty to almost a thousand cattle. Cattle husbandry is a traditional custom passed from one generation to the next. They only sell off cattle that are old, barren or sick or in certain instances when they need money for domestic purposes such as payment of dowry during weddings or travelling to the “holy land” for religious pilgrimage. They are a united group of people with a leader known as the “Sarkin Fulani” or “Ojuros”. The major environmental limitation to Fulani pastoralist livelihoods is water and grass shortages [9]. In the arid and semi-arid zones, drought exacerbated water and pasture scarcity often necessitating cattle migration [4]. The main sources of water for livestock are from river, streams and irrigation areas [10]. Movement of pastoralists in Nigeria is from arid regions to humid areas in search of pasture. The movement expose cattle and humans to disease vectors such as the tsetse fly [*Glossina* sp.] that transmit trypanosomiasis and sleeping sickness [11]. The pastoralists are familiar with their livestock and have good knowledge of the diseases affecting them [12]. However, their knowledge of the epidemiology of these animal diseases is limited. For instance, they have often failed to link tsetse fly and trypanosomiasis [12].

There has been several development interventions geared towards livestock health and productivity of Fulani pastoralists [8,13]. For example, the African Union Pastoral Policy Initiative of 2011 was aimed at securing, protecting and improving the lives, livelihoods and rights of pastoral communities [8]. Also in Nigeria, there is the Grazing Reserve Laws of 1965 which has not been fully enforced and many pastoralist grazing areas have since been taken over by agricultural cultivation [14]. Lack of involvement of the pastoralists in the decision making process may have resulted in poor implementation of development interventions which consequently have limited impact [4].

There are several logistic and resource constraints that affects epidemiological surveys in Africa [15]. Among these constraints is the high mobility of pastoralists, inaccessibility of where the pastoralists live such as highland areas or areas cut off by flooding, hence conventional research approaches such as sampling animals in such places may be difficult. Developing countries may also lack animal population data relating to individual owners, holdings or even villages which are necessary to design epidemiological surveys. Gathering information at central location such as market may prove more useful [16].

Participatory rural appraisal (PRA) has been defined “as a family of multidisciplinary approaches and methods to enable rural people to share, enhance, and analyze their knowledge of life and conditions, in order to plan and to act” [17]. Participatory epidemiology [PE] is a form of PRA which involves the systematic use of these participatory approaches and methods to improve understanding of animal diseases and provide options for control [18-20]. It is a “bottom up” approach to development involving community participation in planning, evaluation and monitoring of disease control projects [20]. Its application in various African countries includes disease diagnosis [21-23]; participatory analysis [24] as well as disease impact and livelihood [25,26]. PE techniques is broadly categorized into informal interviews (semi-structured interviews, time line); visualization methods (participatory mapping, seasonal calendars, proportional piling) and ranking/scoring (simple scoring, matrix scoring) [20].

This study used participatory epidemiology techniques to identify the most important livestock diseases and management challenges that Fulani pastoralists encounter in North-Central Nigeria. This is important in order to identify gaps in knowledge, understand the most important challenges faced and guide resource allocation towards control of livestock diseases.

Materials and Methods

Study location and sampling

A participatory epidemiological study involving a combination of focus group meeting, disease impact scoring, seasonal calendar and triangulation was carried out in Bacita market within Edu local Government Area of Kwara State, Nigeria (Figure 1) located at latitude N 090 03.738’ and longitude E 0040 56. 956’. Edu Local Government was selected as it is one of the largest pastoralists area in the state according to the officials of the State Ministry of Agriculture. Secondly, Bacita market was chosen because it hosts a large market every five days that attracts the patronage of a large number of pastoralists from neighbouring villages and towns. They often converge at the market to buy drugs, as well as share local news about their livestock and other domestic issues. This central meeting point provided the

best opportunity to access a large number of the pastoralists from a wide catchment area. The study was conducted by a team made up of one of the authors [NE], the Divisional Veterinary Officer, and an indigenous private veterinarian resident in Bacita conversant with the local languages (Hausa and Nupe) who acted as the interpreter. Triangulation methods used to validate data from the PE included clinical examination of cattle in the study areas and laboratory diagnosis of *Fasciola* infection by coprological examination. The clinical signs reported for each mentioned disease was compared to those published in textbooks and peer reviewed literature. Before the study commenced, the *Sarkin Fulani* the local head of the pastoralists, was informed and gave permission for the research.

All Fulani pastoralists that visited the market on the day of study were identified by the *Sarkin Fulani* and requested to participate. All the 15 Fulani pastoralists present agreed to participate in the exercise. Data were entered into Microsoft excel for descriptive analysis.

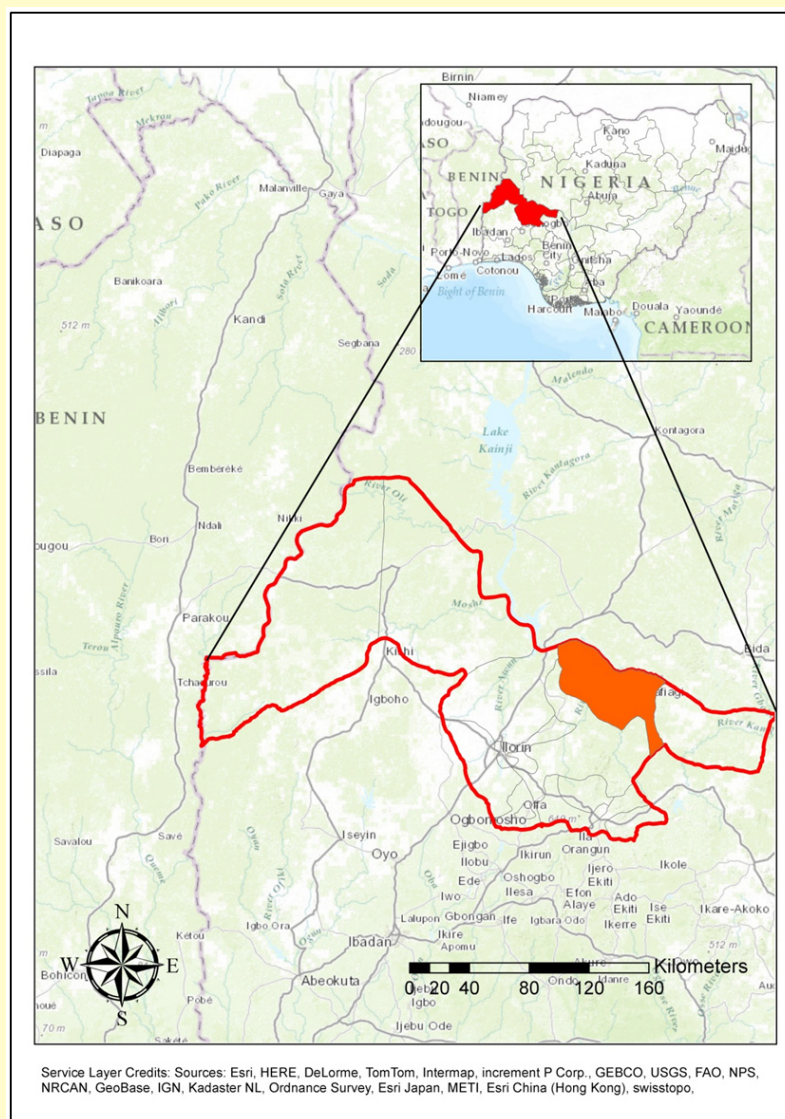


Figure 1: Map showing the location of Edu Local Government Area (shaded area) within Kwara State. The inset map shows Kwara State within Nigeria.

Focus group meeting

The focus group meeting was carried out by modifying the method described by Bellet., *et al.* [2012]. This involved introduction of the team to the pastoralists followed by careful questioning on the type of livestock kept and management challenges experienced (Figure 2). The pastoralists were then asked to list the most frequent disease encountered in the last year giving specific symptoms. The informants provided the local names and described the clinical signs associated with each disease mentioned. The interpreter assisted in identification of corresponding English disease names. They discussed amongst themselves until they agreed on a particular response, ensuring that they concurred before the response was recorded. Finally they were asked specific questions about the lifecycle and zoonotic importance of fasciolosis; this was to give the author baseline information for the subsequent trematode prevalence study carried out in the state.



Figure 2: Focus group meeting with Fulani pastoralists in Bacita market, Kwara State, North-Central Nigeria.

Disease Impact Scoring

Disease impact scoring was carried out with the list of diseases identified from the focus group meeting. This was conducted according to the method described by Bedelian., *et al.* [27] A grid was drawn on a sheet of cardboard with columns for the name of disease and impact score (Figure 3). Pastoralists were asked to split 20 stones between these diseases to cells of the grid under the impact score column in order to indicate the impact of diseases on health of their animals. The more important diseases were allocated the most stones.

Seasonal Calendar

A seasonal calendar exercise was conducted based on methodology used in similar studies in Sudan and Kenya [24,28]. It was used to identify the relative occurrence of the diseases mentioned over four seasons of the year - Early rainy, late rainy, early dry and late dry seasons (Figure 4). To construct the calendar, a line was drawn onto a sheet of cardboard to represent a 12-month calendar year split into four seasons. The four seasons were labelled appropriately. The informants were asked to represent the amount of rainfall in the four seasons by allocating all of ten stones to the respectively labelled section of the line. Subsequently, they were asked to state which of the different diseases occurred in each season and these were also scribed under the relevant line section.



Figure 3: Disease Impact Scoring with Fulani pastoralists in Edu Local Government Area, Kwara State, Nigeria.



Figure 4: Pastoralists indicating the diseases in the four seasons of the year using the seasonal calendar.

Results and Discussion

Focus group meeting

All the 15 respondents were male. This is a peculiarity with studies carried out with Fulani pastoralists as 100% male household head has been previously reported in Nigeria and Benin republic [29,30]. Men are usually those actively involved in cattle rearing however, the women are involved in taking care of sick cows, milking the cows and making cheese at home. Also, the market location of the study may have precluded women as culturally; women do not interact in public places with men in some northern communities in Nigeria. Cattle were the main livestock kept by the informants, with only a few keeping small numbers of sheep and goats. They were mainly semi-sedentary pastoralists. They move uphill away from the flood plains during the rainy season. And return downhill during the dry season in search of water and pasture.

Eight [8] diseases/symptoms were collectively identified by the Fulani pastoralists as the most important affecting their cattle. These included leptospirosis, foot and mouth disease (FMD), fasciolosis, trypanosomiasis, haematuria, tick infestation, brucellosis and

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ear infection. The eight diseases listed by the pastoralists are summarized in Table 1. Although the diseases reported were not confirmed by laboratory diagnosis (except for *Fasciola* sp infection that was confirmed during a concurrent prevalence study by the author- NE), the informants seemed to be aware of the clinical signs of the diseases reported. For some diseases, the clinical signs are distinct, such as the classical oral and foot lesions of FMD described by the respondents as “*chabo*”. FMD was reported to affect all ages of cattle and suckling calves feeding on the udders of affected cows were reported to become infected with the disease and die. There has been recent reported outbreak of FMD in cattle in Kwara State [10,31] with an overall high prevalence of up to 75.11% in trade cattle [31]. Despite the devastating nature of the disease there are no current indigenous FMD vaccines in Nigeria although limited vaccination is practiced with imported vaccines [32]. However, for effective vaccination against FMD, the vaccine must contain the viruses antigenically related to the virus circulating in the field due to lack of cross immunity between different serotypes [33].

The local name for trypanosomiasis by the Fulani community in Edu LGA is “*samore*” and is derived from Samorin®, the commercial name of a leading brand of the prophylactic trypanocidal drug, isometamidium chloride. Because of the significant impact of trypanosomiasis on cattle productivity there is widespread awareness on its diagnosis, treatment and control in sub-Saharan Africa. Moreover, the signs reported here for trypanosomiasis, including loss of weight, loss of tail hair, were similar to previous studies carried out in Kenya, Sudan and Tanzania [21,24,34].

Fasciolosis was also reported as a severe disease that often resulted in sudden death of animals. The local name reported “*hanta*” means liver in the Hausa language. The disease was described by the pastoralists by placing their hands across their chest mimicking where the animals often feel pain. The animals were said to tire easily and to be reluctant to move uphill, although becoming more active later in the day. These results are consistent with a concurrent work (in preparation), which revealed positive egg counts for *Fasciola* in the study area. A previous participatory epidemiology study in another area of Nigeria [35] also reported fasciolosis as an important cattle disease. Pastoralists claimed fasciolosis was due to eating of feed contaminated with faeces. This may reflect lack of understanding of the life-cycle of the parasite, and specifically the role of intermediate host (lymnaeid snails) which give rise to the metacercariae on infected herbage that are the source of *Fasciola* infection for cattle; indeed, when asked about the transmission and lifecycle of the disease, pastoralists were ignorant of the importance of snails. The snails themselves are infected by miracidium stages released from *Fasciola* eggs passed in cattle faeces, so the pastoralists understanding is not entirely flawed and they were able to confirm the presence of snails around watering areas. Pastoralists were also ignorant of the zoonotic risk of the disease thus revealing a further gap in their understanding of its epidemiology.

The clinical signs reported for brucellosis, namely abortion and swollen hock joints are commonly recognised in this condition in cattle. Brucellosis is an endemic disease in Nigeria [36, 37] and swollen hock joints were seen in some cattle herds by the corresponding author (NE) in the study area.

For the other diseases such as tick infestation and ear infection, they can be physically identified by the pastoralists during examination of their herds. The ear infection reported is as a result of ticks attaching to the cattle ear. Ticks are often manually removed from the animals by the pastoralists and this predisposes to secondary bacterial infection. Manual removal of ticks as practiced by cattle farmers in the present study has been reported over three decades ago in Nigeria [38] and is still in practice as confirmed by this study. Tick infestations reported in Nigerian cattle are mainly of three genera [*Amblyomma*, *Hyalomma* and *Rhipicephalus* spp] [38-40]. Relatively high tick load (up to 22) in cattle has been reported in central Nigeria [40] These ticks serve as vectors transmitting pathogens such as *Babesia*, *Anaplasma* and *Ehrlichia* spp. The ideal method of controlling ticks would be strategic spraying of cattle with acaricides twice weekly in the beginning of the rainy season [39].

The specific cause of haematuria described by the respondents could not be ascertained. It was described as blood in the urine of cattle which may be due to tick-borne fever (babesiosis) or bacillus diseases (anthrax). Babesiosis in cattle caused by *Babesia bigemina*

and *B. bovis* and is widespread in Africa [41] and reported in Nigeria [42-44]. This may be the probable cause of the haematuria reported considering the report of ticks in their herds.

Leptospirosis was also reported by the respondents, the clinical signs could not be confirmed for the disease. Although the local veterinarian associated leptospirosis to the clinical signs described, several other diseases could cause convulsion in cattle such as enterotoxaemia caused by *Clostridium perfringes* and hypomagnesaemia. Therefore the clinical sign of convulsion ascribed to leptospirosis could not be ascertained. Leptospirosis which is a common cause of abortion in cattle is often diagnosed by serology or bacterial isolation and has been diagnosed serologically in Zebu cattle in Nigeria [45].

Lack of pasture due to overgrazing and lack of traditional cattle routes as a result of land use change for farmlands were some of the challenges mentioned by the pastoralists. Information obtained by one of the authors (NE) from the State Ministry of Agriculture revealed that out of the seventeen [17] designated grazing reserves in Kwara State, only two of the reserves are in use. The rest have remained largely undeveloped. Also four identifiable linking stock routes (measuring about 495 km) are designated in the state. However, the stock routes have also been interrupted by cultivation of arable farms. Pastoralists passing through with their cattle graze on arable crops leading to conflicts and bloody clashes with the crop farmers. Clashes between cattle and crop farmers are a common feature during planting season in Nigeria.

Lack of efficacy of veterinary drugs was also a management challenge mentioned by the respondents. This is similar to a report in Nigeria where the Fulani pastoralists claimed drugs that previously used to work were no longer effective [46]. This may be attributed to poor quality of current veterinary products in the market as was similarly reported for anthelmintic drug in other part of Africa [47]. Another factor may be incorrect administration of drugs by livestock owners leading to treatment failure [46].

Disease impact scoring

The disease impact score revealed that of the eight diseases/symptoms mentioned, five ranked equally high with proportional weights of 15%, while ear infection and FMD had a lower, equal proportional weights of 10%, and leptospirosis was assigned the lowest weight of just 5% (Table 1). Respondents tend to ascribe high impact score to diseases associated with sudden death as with fasciolosis or diseases with obvious loss of condition such as abortion, haemoglobinuria or emaciation (trypanosomiasis, brucellosis and tick infestation). A previous study in southern Kenya has shown that scoring of pastoralist’s perceived impact of disease is affected by their ability to still enjoy continued benefits from their animals (such as meat and milk consumption). And in that study, anthrax was scored as disease with the highest impact (even though it rarely occurred) compared to malignant catarrhal fever [27].

Disease local name	Disease impact score (stones)	Disease impact score (%)	Disease associated name/symptom	Clinical signs described
Gabi-gabi	1	5	Leptospirosis	Convulsion Lack of urination Affects young animals
Chabo	2	10	Foot and Mouth Disease	Foamy salivation Sore in the mouth, legs and udder Hooves broken or removed Death of infant from feeding from infected udder
Hanta	3	15	Fasciolosis	Increased respiratory rate Reluctance to move uphill Sudden death Hard caked faeces
Samore	3	15	Trypanosomiasis	Watery eyes Emaciation despite feeding Black patches on muzzle Tail end peels off Watery smelling faeces
Taki	3	15	Haematuria	Watery eye (lacrimation) Haemorrhagic urine

Duce	3	15	Tick infestation	Ticks seen on the skin
Kwanejie	3	15	Brucellosis	Abortion Swollen hock joint in female Sterility in males
Kune	2	10	Ear Infection	Ear ache

Table 1: Diseases local names, impact scores and associated clinical signs described by respondents during the participatory epidemiology session in Edu, Kwara State, Nigeria.

Seasonal calendar

The seasonal calendar showed the distribution of the various diseases mentioned by the pastoralists across the four seasons of the year (Table 2). Diseases such as brucellosis and FMD were reported to occur all year round with no particular seasonality. This is similar to previous studies conducted on brucellosis in Southern Sudan [24] and FMD in Nigeria [10].

The rainfall data reported by the respondents in the present study were compared with those obtained from the Lower Niger River Basin Development Authority (LNRBDA) for Kwara State in 2011. Rainfall data in millimetres (mm) were aggregated into mean amounts for each of the four seasons and the proportions of total annual rainfall per season were calculated (Table 3). There were obvious differences in the early rainy and early dry seasons (Figure 5), which could have arisen because pastoralists recognised the seasons from the amount of rainfall, rather than the calendar date. The Food and Agriculture Organization of United Nations has previously noted that classification of climatic events into seasons varies considerably even within ethnic groups [12]. This might further explain the differences obtained in comparing the respondents data to the measured state rainfall.

	Early Rainy Season (Mar-May)	Late Rainy Season (June-Aug)	Early Dry Season (Sept-Nov)	Late Dry Season (Dec-Feb)
Rainfall Proportion [%]	••• (30)	••• ••• (60)	• (10)	(0)
Diseases	FMD Brucellosis Ear Infection Haematuria Tick infestation Leptospirosis	FMD Brucellosis Ear Infection Fasciolosis Trypanosomiasis	FMD Brucellosis Ear Infection	FMD Brucellosis Ear Infection

Table 2: Representation of seasonal calendar for rainfall and cattle diseases in Edu, Kwara state.

Seasons	Data from Seasonal Calendar		Data from the LNRBDA*	
	Rainfall Score with stones	Proportion of total annual score (%)	Mean rainfall (mm)	Proportion of total annual rainfall (%)
Early rainy (Mar-May)	3	30	62.5	12.9
Late rain (June-Aug)	6	60	248.8	51.5
Early Dry (Sept-Nov)	1	10	165.1	34.2
Late Rainy (Dec-Feb)	0	0	6.4	1.3

* Lower Niger River Basin Development Authority.

Table 3: Comparison of the rainfall patterns from the Seasonal calendar and the 2011 State rainfall data obtained from LNRBDA* in Edu, Kwara State.

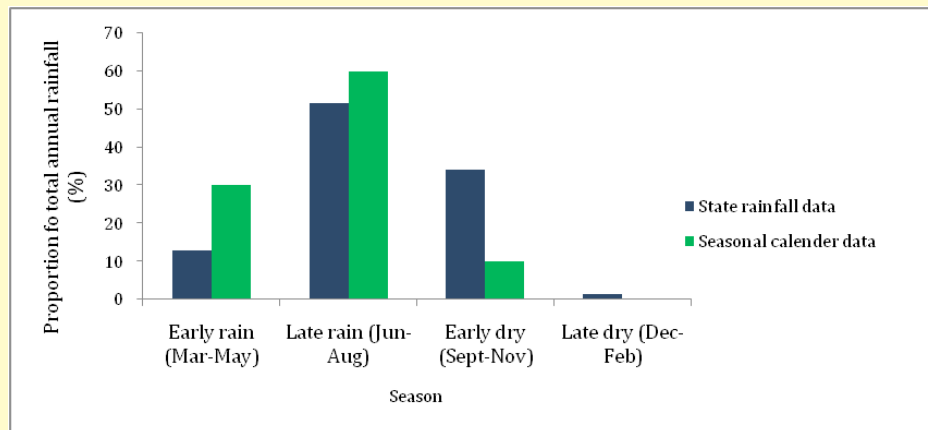


Figure 5: Comparison of seasonal rainfall pattern based on the proportion from seasonal calendar score and state annual rainfall data (2011) in Ilorin, the Kwara state capital.

Conclusion

Fulani pastoralists in North-central Nigeria consider brucellosis, fasciolosis, haematuria, tick infestation and trypanosomiasis as the five most important cattle diseases. Diseases were clearly described using clinical signs observed. Their ability in disease recognition may prove useful in investigating epidemics or during surveillance. For instance, recognition of FMD is important as it is on the list of trans-boundary diseases reportable to the World Animal Health Organisation (OIE). Hence incorporating pastoralists into national surveillance program for FMD combined with sero-typing of the viruses will assist in its control.

The respondents were ignorant of the lifecycle of transmission as well as the zoonotic risks of fasciolosis. This highlighted the existence of knowledge gaps in the epidemiology of this parasite which could be the case with other endemic diseases. There is therefore need to improve education of pastoralists by incorporating modes of transmission and risk to human during enlightenment campaign in order to help in the uptake of control strategies.

The seasonal calendar highlighted brucellosis, ear infection and FMD as occurring all year round, whereas fasciolosis, haematuria, leptospirosis, tick infestation and trypanosomiasis were only reported during the rainy season. The seasonality of disease occurrence is important for proper timing of intervention. The seasonal calendar created by the pastoralists also described variations in the rainfall pattern over 4 seasons of the year. When compared with the state annual rainfall pattern, there were obvious differences in the early rainy and early dry seasons. This could be because pastoralists recognise the seasons from the amount of rainfall, rather than the calendar dates. Participatory epidemiology techniques were effective in gathering information from Nigerian Fulani pastoralists that might inform control policy for livestock diseases.

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Conflict of interest

The author declares no conflict of interest.

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