BloEx - Journal
Britain International of
EXACT Sciences Journal
Publish: | January - May - September |
E-ISSN: 2686-1208
P-ISSN: 2686-1216
http://biarjournal.com/index.php/bioex

Survey on Knowledge and on some Cases of Monkeypox: A Zoonotic Disease Endemic to Ubangian Eco-region of Democratic Republic of the Congo

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Abstract:

The aim of this study was to investigate knowledge on Simian Orthopoxvirosis or Monkeypox in 180 people (129 males and 51 females) using the stratified probability sampling method. The majority of the respondents were (are): 35-50 years old (45.00%), with secondary education (43.33%), farmers (40.56%) and married (80.00%). The disease appears every year, thus demonstrating its endemic nature (98.33% of the respondents); 58.3% of the respondents said that the disease appears very often during the dry season, on the contrary, 40% of the respondents said that the disease appears during the rainy season. However, 1.7% of respondents said that the disease occurs every other season. The majority of respondents (81.1%) said that the cause of the disease is the consumption of bush meat, followed by wild vegetables (3.3%), fish (2.8%), livestock (2.2%) and caterpillars (1.7%) respectively. 65.2% of the respondents use Manihot esculenta to treat the disease locally, and followed by the leaves and wine of Raphia sese (13%), Morinda morindoides (13%) and Myrianthus arboreus (8.7%). Between January 17 and September 10, 2020, 40 cases of monkey pox were admitted to HGR of Businga (Maximum age: 42 years, minimum age: 1 year, average age: 13.3 years). 28 patients were male and 12 female. It is therefore advisable that surveillance be organized in wild animals and bush meat exposed on the market to ensure that they are not contaminated with Monkeypoxvirus. It is thus needed to establish a veterinary laboratory in Nord-Ubangi Province.

Keywords:
monkeypox; Ubangian eco-region; Businga health zone; bush meat; monkeys; squirrels

I. Introduction

In the Democratic Republic of Congo (DRC), emerging and re-emerging diseases have been observed for some time now, especially at the interface of human-wildlife contact. These are very often diseases that originate in the wild and to which humans are susceptible. These diseases are known as zoonotic diseases, including Monkeypox (MPX) or monkey pox (Arita,

1985). The mortality rate from this disease is about 14% and when the patient does not die, indelible scars remain on the whole body including the face, palms and soles of the feet (Rogers, 2008; Quiner, 2017).

Monkeypox is a zoonosis caused by Monkeypoxvirus: an orthopoxvirus of the Poxviridae family (Faye, 2018). This is one of the largest viruses, about 200 mm in diameter, with an enveloped double-stranded DNA genome. The incubation period is 4-24 days, with an average incubation period of 14.5 days (Chastel, 2009). Human-to-human transmission can also occur: Potential routes of transmission between people include contact with skin lesions or infectious body fluids, or aerosol transmission during face-to-face contact (Boumanduki, 2005). Monkeypox' complications consist of corneal ulcerations that can lead to blindness, variolic scarring and death (Ministère de la Santé Publique (RDC), 2017).

The Businga area located at North Ubangi' Province in western Democratic Republic of Congo is an endemic place for the outbreak of Monkeypox (Ngbolua, 2020a), and like the whole of North Ubangi Province is located in the Ubangi ecoregion, a subgroup of the North eastern Congolian forests (North eastern Congolian lowland forests). This ecoregion is one of the 200 global terrestrial priority ecoregions known as the 'G200' (Ngbolua, 2020a; Ngbolua, 2019a; Ngbolua, 2020b). The general objective of this study was to assess the Businga population's knowledge of that zoonosis. The specific objectives of this study were to determine the socio-demographic characteristics of the respondents as well as the frequency and period of disease occurrence, the causes of the disease and the animal species consumed in the region as bushmeat.

II. Research Methods

This study was carried out in the Businga Territory in DRC (3° 19' 60" North latitude and 20° 52' 0" East longitude, mean altitude: 370 m in accordance with the principles set out in the Helsinki Declaration (free consent of respondents, etc.). The stratified probability sampling method (stratified proportional random sampling) was used. It consists of dividing the study area into three different strata represented here by three sectors (Businga, Mongala and Monzamboli) and associating the same number of respondents. For this study, 180 people were interviewed (60 people per sector) (Ngbolua, 2020).

The interview was conducted in Lingala, one of the four national countries' languages, and the survey forms designed in French were used as a basis for the interviews. The survey sheets, designed in French, were used as a basis for the interviews. The questions concerned information on socio-demographic characteristics (gender, age, and socio-cultural group, level of education, marital status and occupation) and data on Monkeypox (knowledge of the disease, frequency and period of occurrence, causes of the disease and animal species consumed in the region as bush meat). For data processing, a data entry mask was first designed using Microsoft Excel package software (version 2010). This tool was used to record the data collected in the field. IBM SPSS statistics version 20 and Origin version 8.5 Pro were used for data analysis. In order to differentiate between monkeypox and varicella in the absence of molecular and/or biochemical tests, the patient records were analysed on the basis of the criteria developed by (Laudisoit, 2016): three specific signs (rash on the soles of the feet, rash on the palms of the hands, presence of at least five lesions/scars resembling smallpox) and four non-specific signs (lymphadenitis, general maculopapular rash, ocular lesion). The presence of a specific sign is graded 1 and its absence is graded 0. On the other hand, for the non-specific sign, 0.5 means that it is present while 0 means that it is absent.

Referring to ethical considerations, parents or tutors of the children have given a written consent for publishing the pictures of the patients in order to attract researchers and donators attention on that illness situation in the Nord-Ubangi province.

III. Discussion

The socio-demographic characteristics of the respondents are presented in Table 1. It emerges from this table that the majority of respondents are men (71.67%) compared to women, who represent 28.33%. The majority of respondents are between 35-50 years of age (45.00%). This is followed by those aged 18-35 years (42.22%) and finally those aged over 50 years (12.78%). The majority of respondents are Ngbaka and Ngombe tribes, who make up 26.11%, followed by Ngbandi (22.78%), Mbanza (12.78%), Pakabete (8.33%) and the Budja come last with 3.89% (Figure 1). The majority of respondents have a secondary education level (43.33%), followed by primary education level (35.56%), illiterates (15.00%) and finally academics represent 6.11%.

The majority of respondents are farmers (40.56%), followed by hunters (27.22%), teachers (13.89%), fishermen (12.22%), students (3.89%) and traders (2.22%). The majority of respondents were married (80.00%), followed by single people (15.00%), widowers (3.89%) and divorced people (1.11%).

Table 1. Socio-Demographic Data

Socio-demographic parameters		ni	Frequency (%)
1. Sex			
	Male	129	71,67
	Female	51	28,33
	TOTAL	**180**	**100**
2. Age			
	18-35 years old	76	42,22
	35-50 years old	81	45,00
	>50 years old	23	12,78
TOTAL		**180**	**100**
3. Education level			
	Primary	64	35,56
	Secondary	78	43,33
	Academic	11	6,11
	Illiterate	27	15,00
	TOTAL	**180**	**100**
4. Profession			
	Farmer	73	40,56
	Hunter	49	27,22

	Trader	04	2,22
	Teacher	25	13,89
	Student	07	3,89
	Fisherman	22	12,22
	TOTAL	**180**	**100**

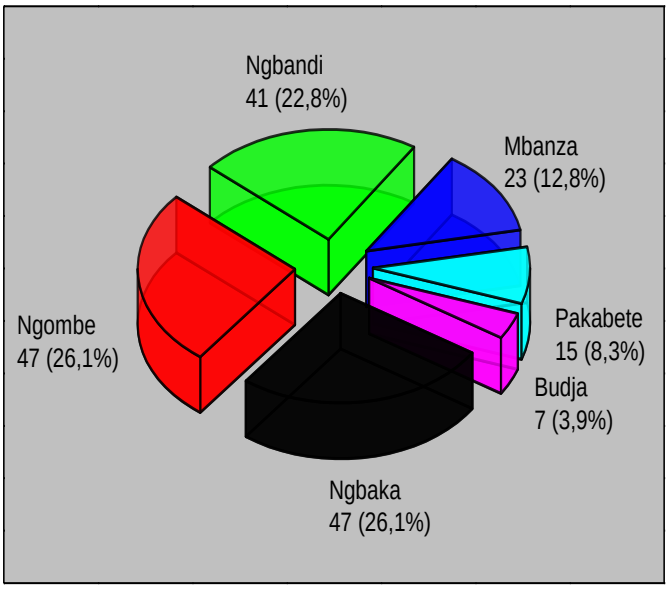

Figure 1. *Respondents' Distribution by Socio-cultural Group*

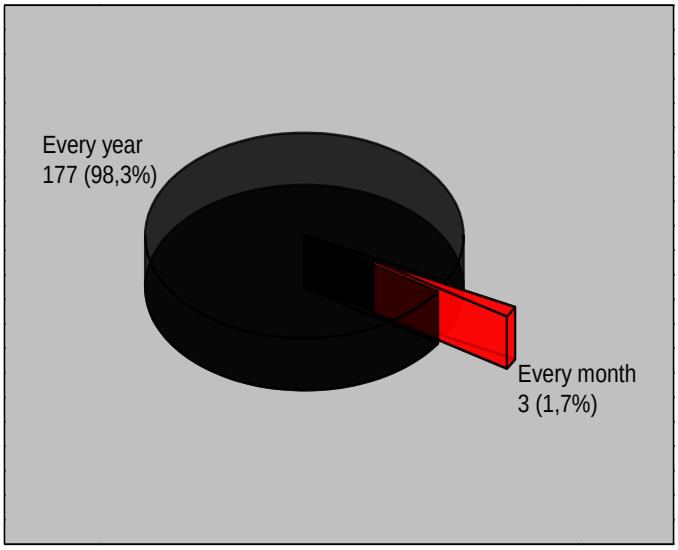

Figure 2. *Respondents' Distribution on the Frequency of Disease Occurrence*

Figure 2 shows the distribution of respondents on the frequency of disease occurrence

Figure 2 shows that the majority of respondents (98.33%) say that the disease appears every year, thus demonstrating its endemic nature.

Figure 3 shows the opinion of the respondents according to the period/time of disease onset.

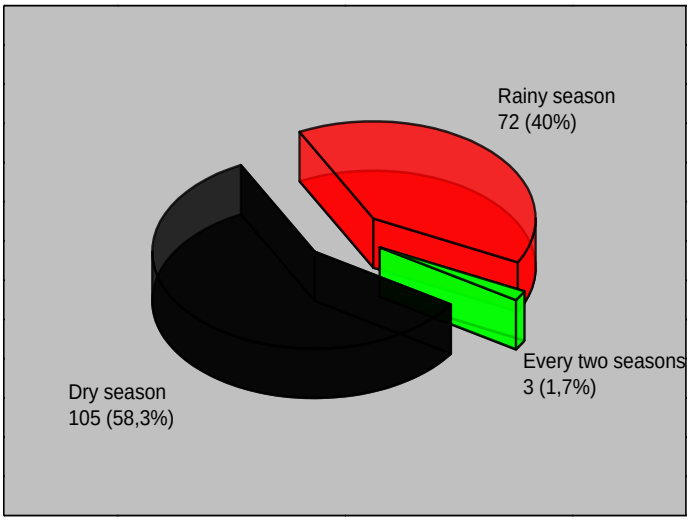

Figure 3. *Respondents' Opinion by Time of Disease Onset*

It can be seen from this figure3 that the majority of respondents (58.3%) state that the disease appears very often during the dry season, 40% of respondents state on the contrary that the disease appears during the rainy season, and 1.7% of respondents state that the disease appears every two seasons.

Figure 4 shows the respondents' opinion on the cause of the disease.

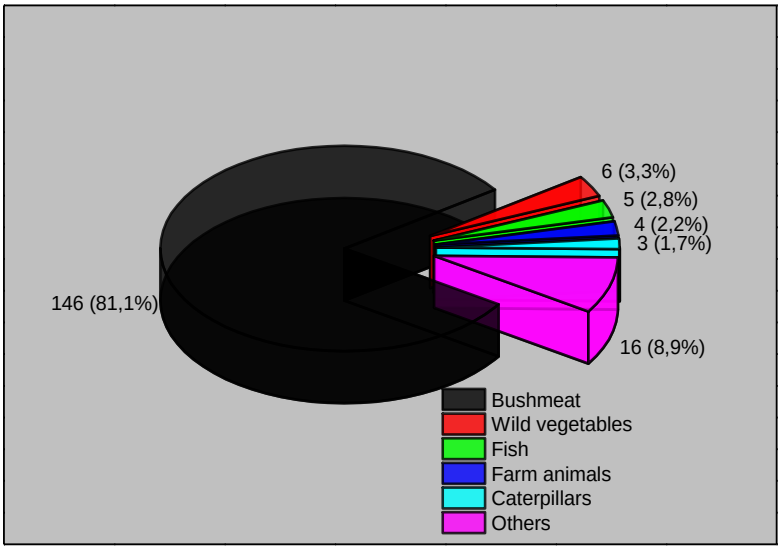

Figure 4. *Respondents' Opinion on the Disease' Cause*

It can be seen from this figure4 that the majority of respondents (81.1%) stated that the cause of the disease is the consumption of bushmeat, followed respectively by wild vegetables (3.3%), fish (2.8%), domestic animals (2.2%) and caterpillars (1.7%).

The monkey pox reservoir is not yet known. Undoubtedly, these could be animal species used by man for his food as bush meat. Researchers therefore assume that people in

endemic areas contract the disease by handling and eating bush meat. Thus, the need for a rapid and reliable test such as PCR (Polymerase Chain Reaction) to detect monkeypox in that area, which is located far from the good veterinary laboratories. PCR is not only much faster, but also has a very high sensitivity and specificity compared to ELISA (Enzyme Linked Immunosorbent Assay). This means that diagnosis by PCR determines true positives and is able to eliminate false negatives (Falanga, 2009).

The Table 2 lists the animal species recorded in the region and exploited as bush meat.

Table 2. List of Wild Animals Recorded in the Region and Exploited as Bush Meat

Scientific accepted name	Vernacular name	Class (Order, Family)
Allenopithecus nigroviridis (Pocock, 1907)	Kelele (Ngbandi)	Mammalia (Primates, Cercopithecidae)
Cercopithecus ascanius (Audebert, 1799)	Mbesa (Ngbandi)	Mammalia (Primates, Cercopithecidae)
Cercopithecus milis (Wolf, 1822)	Mbida (Ngbandi)	Mammalia (Primates, Cercopithecidae)
Cercopithecus neglectus (Schlegel, 1876)	Funga (Ngbandi)	Mammalia (Primates, Cercopithecidae)
Colobus guereza (Ruppell, 1835)	Yogo (Ngbandi)	Mammalia (Primates, Cercopithecidae)
Funisciurus anerythrus (Thomas, 1890)	Seke (Ngbandi)	Mammalia (Rodentia, Sciuridae)
Funisciurus pyrropus (Ruppell, 1835)	Biakangba (Ngbandi)	Mammalia (Rodentia, Sciuridae)
Heliosciurus rufobrachium (Ruppell, 1835)	Bo (Ngbandi)	Mammalia (Rodentia, Sciuridae)
Paraxerus boehmi (Ruppell, 1835)	Seke (Ngbandi)	Mammalia (Rodentia, Sciuridae)
Philantomba monticola (Thunberg, 1789)	Mboloko (Lingala) Ba (Ngbandi) Cephalophe bleu ou Gazelle (French)	Mammalia (Cetartiodactyla, Bovidae)
Syncerus caffer caffer (Sparrman, 1779)	Pakasa (Lingala) Ngba (Ngbandi) Buffle (French)	Mammalia (Cetartiodactyla, Bovidae)
Kinixys erosa (Schweigger, 1812)	Koba (Lingala) Nako (Ngbandi) Tortue articulée d'Afrique (French)	Reptilia (Testudines, Testudinidae)
Sylvicapra grimmia (Linnaeus, 1758)	Kulupa (Lingala) Ngandi (Ngbandi) Céphaliphe de Grimm (French)	Mammalia (Cetartiodactyla, Bovidae)
Thryonomys swinderianus (Temminck, 1827)	Simbiliki (Lingala) No/Tope (Ngbandi) Aulacode (French)	Mammalia (Rodentia, Thryonomyidae)
Pan troglodytes (Blumenbach, 1799)	Mokomboso (Lingala) Nvo (Ngbandi) Chimpanzé (French)	Mammalia (Primates, Hominidae)
Cricetomys emini (Wroughton, 1910)	Mopute (Lingala) Nve (Ngbandi) Rat géant d'Emin (French)	Mammalia (Rodentia, Nesomyidae)
Sus scrofa (Linnaeus, 1758)	Sombo (Lingala) Mbenge (Ngbandi)	Mammalia (Cetartiodactyla, Suidae)

	Porc sauvage/Sanglier (French)	
Python regius (Shaw, 1802)	Nguma (Lingala) Nkwan (Ngbandi) Python (French)	Reptilia (Squamata, Pythonidae)
Mecistops cataphractus (Cuvier, 1825)	Lokekele (Lingala) Ngunde (Ngbandi) Faux gavial (French)	Reptilia (Crocodylia, Crocodylidae)
Varanus niloticus (Linnaeus, 1766)	Mbambe (Lingala) Nzanga (Ngbandi) Varan du Nil (French)	Reptilia (Squamata, Varanidae)
Nandinia binotata (Gray, 1830)	Gambala (Lingala) Ganvana (Ngbandi) Civette (French)	Mammalia (Carnivora, Nandiniidae)
Genetta victoriae (Thomas, 1901)	Mosole (Lingala) Solo (Ngbandi) Genette géante (French)	Mammalia (Carnivora, Viverridae)
Phataginus tricuspis (Rafinesque, 1821)	Kakolo (Lingala) Kan (Ngbandi) Pangolin (French)	Mammalia (Pholidota, Manidae)
Perodicticus potto (P.L.S. Muller, 1766)	Ebeya (Lingala) Ga mbowa (Ngbandi) Potto de Bosman (French)	Mammalia (Primates, Lorisidae)
Atherurus africanus (Gray, 1842)	Mboke (Lingala) Kumba (Ngbandi) Porcépic (French)	Mammalia (Rodentia, Hystricidae)
Eidolon helvum (Kerr, 1792)	Lingembu (Lingala)	Mammalia (Chiroptera, Pteropodidae)

Of these animals, monkeys and squirrels (figure 5) are suspected by the population as possible vectors/reservoirs of the Monkeypoxvirus in the Businga health area.

Figure 5. *Potential Reservoirs of the Monkeypox Virus (Monkeys and Squirrels)*

Recent findings revealed that a variety of animals can be infected by Monkeypox virus, and this is why epidemiological studies and educational campaigns should focus on animals

that people are regularly contacting, including larger rodents used as protein sources (Doty, 2017).

Figure 6 gives the respondents' opinion on anti-monkeypox phytotherapy in Businga.

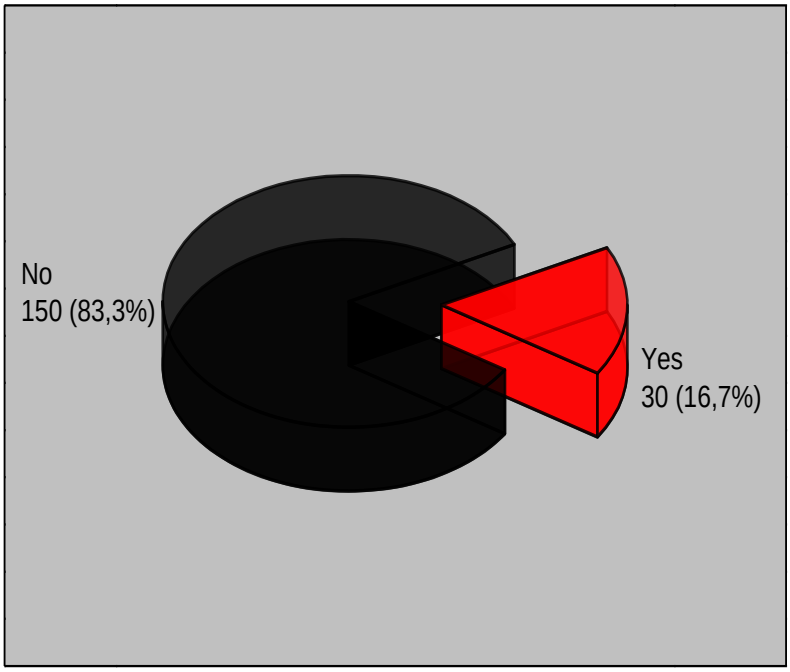

Figure 6. *Respondents' Opinion on Anti-monkeypox Phytotherapy*

It can be seen from this figure6 that the majority of respondents (83.3%) do not know about plants that cure the disease, while 16.7% of respondents know about a few plants that cure the disease.

Figure 7 lists the plants used to treat monkey pox in Businga

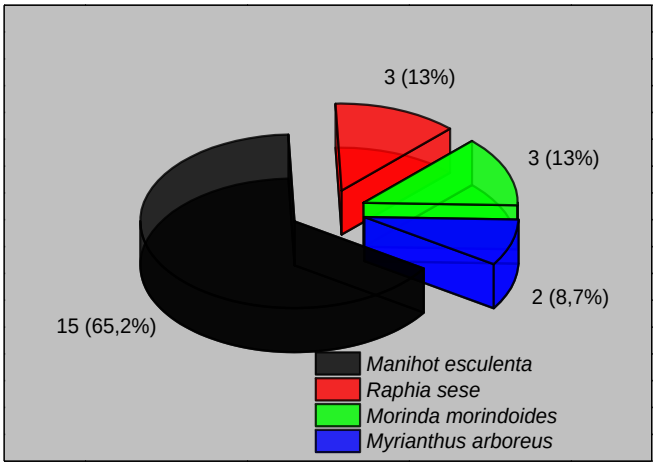

Figure 7. *List of Plants Used in the Treatment of Monkey Pox*

It can be seen from this figure7 that the majority of respondents (65.2%) use *Manihot esculenta*, followed by *Raphia sese* leaves and wine (13%), *Morinda morindoides* (13%) and *Myrianthus arboreus* (8.7%).

A cross-sectional epidemiological survey carried out in September 2020 at the General Reference Hospital (HGR) in Businga (for the nine months from 17 January to 10 September 2020) identified 40 cases of monkey pox (maximum age: 42 years, minimum age: 1 year, average age: 13.3 years). Twenty-eight of the patients were male, compared to 12 who were female. Regarding the outcome of the treatment, 39 patients were cured while 09 others had died. In 38 patients, complications were observed and only two patients did not experience these complications. There is no PCR, as the diagnosis is mainly based on the symptoms (pustular rashes scattered over the skin and mucous membranes, palms and soles, pruritus and headache) (figures 8 & 9). The treatment was based on ceftriaxone injection, ampicillin injection, dexamethasone injection, Potassium Permaganate bath, aspergic, gentamycin ampoule and promethasine injection. Sciuridae and Cercopithecidae (figure 5) were the most frequently cited animals as potential agents of the disease in the area.

Figure 8. *Pustular skin rash spread on the skin of a patient in Businga Hospital*

Figure 9. *Other Specific Signs of Monkey Pox in Patients in Businga*

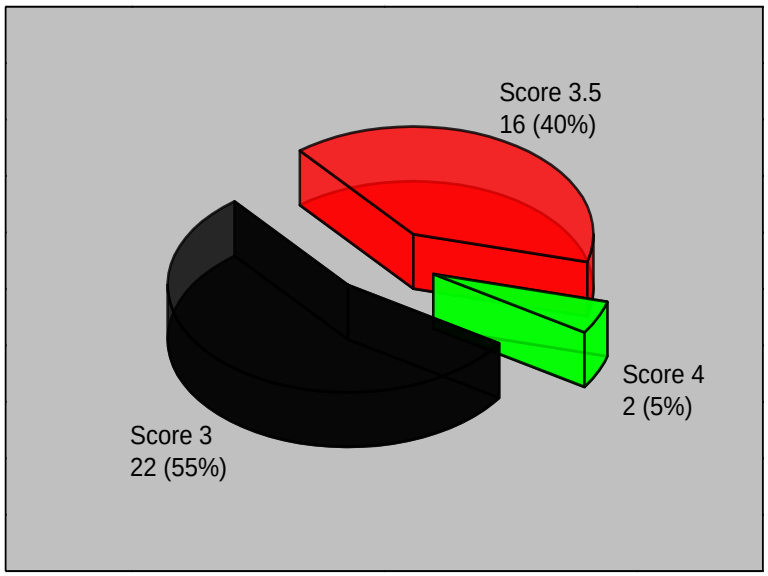

Figure 10. *Score of Laudisoit et al. 2016*

Figure 10 shows that no patient has reached the score >4.5 which, according to Laudisoit et *al.* (2016), confirms the presence of Monkeypox. However, all patients showed at least two of three specific signs of the disease in addition to the non-specific signs. To the light of the present survey, there is a ground to reconsider the interpretation of the score of Laudisoit et *al.* (2016). So, a LS (Laudisoit score) ≤ 2 correspond to chickenpox while a LS ≥ 3 correspond to the smallpox of monkey. It is thus desirable that a molecular study be carried out to identify and confirm the presence of this viral zoonosis. This confirmation will make it possible to set up an epidemiological surveillance strategy for the virus at the human-animal interface in this eco-region.

IV. Conclusion

The aim of this study was to assess the population's knowledge of Simian Orthopoxvirosis or Monkeypox, a zoonosis endemic in Businga and its surroundings. The study showed that the disease appears every year, thus demonstrating its endemic nature. The majority of respondents stated that the disease occurs very often during the dry season. The majority of respondents stated that the cause of the disease is the consumption of bush meat, followed by wild vegetables, fish, domestic animals and caterpillars, respectively. Manihot esculenta, Raphia sese, Morinda morindoides and Myrianthus arboreus are all plants used to treat the disease locally. Forty cases of monkey pox were admitted to HGR Businga between 17 January and 10 September 2020.

It is therefore advisable that surveillance be organised in wild animals and bushmeat exposed on the market to ensure that they are not contaminated by the MPX virus; Hence the need to set up a veterinary laboratory in the Nord Ubangi' province.

Acknowledgements

The authors would like to thank the population of Businga for their free consent to participate in this study. They also thank the medical staff members of the Businga General Reference Hospital for their valuable collaboration.

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