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ORIGINAL RESEARCH

Conduct of pigs and prevalence of Cysticercosis (Cysticercus Cellulosae) in the urban breeding's of N'Djamena (Chad)

Authors:
Mopaté Logténé Youssouf[1], Ban-bo Bebanto Antipas[2] and Kaboré-Zoungrana Chantal-Yvette[3]

Institution:
1. Institut de Recherche en Elevage pour le Développement (IRED) ex Laboratoire de Recherches Vétérinaires et Zootechniques de Farcha, B. P. 433 N'Djaména, Tchad).

2. Faculté des Sciences Exactes et Appliquées (FSEA), Université de N'Djaména, Tchad

3. Laboratoire d'Etudes et de Recherches des Ressources Naturelles et des Sciences de l'Environnement (LERNSE), Université Polytechnique de Bobo-Dioulasso (UPB), Burkina Faso

Corresponding author:
Ban-bo Bebanto Antipas

Email Id:

bbantipas@yahoo.fr

ABSTRACT:

The purpose of the study was to know the conduct of pig farms, the state of cysticercosis and its consequences on the quality of production of pigs in N'Djamena, Chad. Three methods were used: (i) the transverse and retrospective survey for information related to the conduct and hygiene in 64 farms sampled in eight blocks belonging to three districts, (ii) the langueyage to observe cysts and (iii) documentary investigation for total seizures in the slaughter house over six years. All farms had barns which were considered in good condition (66%). However, most of the farms (91%) did not practice permanent confinement. The majority (81%) accounted for two per day of food distributions to pigs against three for the minority (19%). According to 64% of the farmers, 50% of citizens of their respective square have latrines. Of 861 pigs identified, 20% were examined and 9.7% were carriers of cysts. Carcasses at slaughter percentage seizures ranged from 2.5% to 5% depending on the year; an average of about 4% over six years. The prevalence of infestations remained generally lower than those observed in some cities of northern Cameroon. Losses were estimated to average 5,31,900 FCFA / year. Knowledge and practice of screening techniques for this disease by producers would minimize economic losses, improvement of production quality and avoiding human contamination. Further investigation seems necessary to highlight the animal health status and quality of pork production in this area.

Keywords:
Cysticercosis, pig breeding, carcass, prevalence, disease status, N'Djamena (Chad)

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INTRODUCTION

Cysticercosis is due to accidental infestation of man by the larva (Cysticercus cellulosae) *Taenia solium* by ingesting pork (or boars), undercooked, contaminated with cysticercus cysts. The cysticercus is a cystic larva from, 5 to 15 mm in diameter, comprising a head or scolex, a body connecting the head to a caudal bladder filled with fluid. The larvae pass through the stomach wall and then through the blood, reach the eyeballs and then the nervous system; more rarely the skin and muscles. They will then form cysts and calcify (a form of natural healing).Cysticercus is mostly located in the subcutaneous tissue of the tongue pig muscles. Symptoms appear when the larvae develops, a minimum of 60 days after infestation. Described as the under developed disease, cysticercosis appear where promiscuity between pigs and humans are associated with poor breeding conditions and faecal hygiene.

In South Saharan Africa (SSA), cysticercosis is a public health problem (zoonosis) relatively unknown in many of these countries and also economic problem resulting in carcasses seizures and poor sales of pigs (Graber and Chailoux, 1970; Geerts, 1993, 1995; Tsang and Wilson, 1995). In countries of SSA where traditional pig farming is still dominant, some data on this infestation have been reported: 6106 pigs were inspected at Fort Lamy (now N'Djamena) in Chad from 1964 to 1968, of which 414 were recognized as cyst carriers including 340 with total seizures. In which, 74 (18%) are with partial seizures, 15% with concerned langueyage, 40% heart and 45% liver (Graber and Chailoux, 1970). In 17 years (1982 to 1998), 95% of carcasses seized in N'Djamena were due to cysticercosis (Djoret, 2001). A prevalence of 20% was observed in the slaughter houses of Enugu State in Nigeria (Onah, 1995) and 13% in three municipalities of Tanzania (Boa *et al*., 1995). In northern Cameroon, 12% of 750 inspected carcasses at slaughter Garoua (Awa *et al* ., 1999) were lepers. A study in northern Cameroon and in the south-western part of the Mayo-Kebbi in Chad has established a prevalence of around 21% by the langueyage (852 pigs examined) in farms and 16% in local slaughter houses (Assana *et al*., 2001). Serological test for the detection of circulating antigens cysticerci was performed and it was higher than 40%. A prevalence of about 25% was observed in langueyage rural area of western Cameroon (Zoli *et al*., 1987). The driving mode and rearing environment influence this infestation. Small family farms, not very concerned of guarding pigs are the most victims. The purpose of the study is to know the conduct of pig farms to determine the prevalence of cysticercosis and its consequences on the production quality in N'Djamena.

MATERIALS AND METHODS

Study Site

The study was performed in the urban area of the city of N'Djamena, the capital of Chad. Geographic coordinates of the city, identified by Global Positioning System (GPS) are 12° 11 '30' 'North and 15 ° 04' 91 " East. Pig farming was introduced in Chad since 1918 and has developed into the Fort Lamy area now at N'Djamena and the Sudan zone which constitutes the two main production areas (Mopaté *et al*., 2006a). The non-muslim population of this city produces and consumes pork (Mopaté *et a* ., 2006b).

Sampling and data collection methods

The data was selected randomly from the three districts, 8 neighborhood producers of pigs and 64 farms representing approximately and 8% of the units listed in N'Djamena. The study employed three methods of investigation. The cross-sectional and retrospective survey for information related to the conduct of farms: pigs' acquisition modes, monitoring (responsible and time spent), security patterns, presence and state of pigsties and food distribution frequency daily were analyzed. The direct detection of cysticercus cysts on live pigs through the practice of langueyage has been

applied by many previous authors (IEMVT, 1989; Assana *et al.*, 2001; Nguekam, 2003). In the contentionner pork, mouth was wide open and maintain the state by introducing a piece of wood to access at the langueyage ; allowing to observe and / or to palpate the cysts in the muscles of the body. To determine the number of pigs to be examined by breeding, three age groups were selected (3-12 months, 13-22 months and over 22 months). In each class, a pig was examined at random. 174 pigs were examined instead of 192 because of the absence of animals in some classes. The number of herds, pigs sold and consumed in a year, the practice of langueyage for family slaughtering and by the customers in farms visited, the number of positive pigs refused to buy, their futures and the presence of latrines in the surveyed areas were sought. The third method involved a literature survey of the annual reports of the Ministry and those of the Refrigerating Abattoir of Farcha (AFF) in N'Djamena from 2000 to 2005, to assess the importance of total seizures because of stinginess.

Data Analysis

The data collected was entered in "Excel" and transferred to SPSS (2009) for processing. Analysis of variance was conducted to search for differences in the average at the 5% level. For the calculation of economic losses from global seizures, the average price per kilogram carcass meat from the slaughterhouse in N'Djamena, 900 CFA (1USD=500FCFA) has been applied.

RESULTS

Driving practices and infestations observed

In the 64 farms surveyed, most of the farmers were owners of their animals acquired mainly by purchase to the creation of farms. These breeders have mostly piggeries in good condition and have ensured mainly two food distributions (Table 1). Those responsible for guarding (or monitoring) pigs spent an average of 3 hours 40 minutes / day. That time did not vary significantly according to the nature of the charge, but depending on how the penning of pigs ($p < 0.001$).

Overall, 23% of farms had at least a cyst carrier pigs. Among them, 80% were men who bought pigs to start the farms and only 20% of women who received donation pigs. The average cyst carrier pigs (1.33 ± 0.58) in men was significantly higher ($P < 0.05$) than women (1.00 ± 0.00).

In 15 farms where 16 pigs were considered as positive, 15 were in 14 farms where pigs are not in permanent confinement. There is only the average of

Table 1 : Characteristics of the conduct of pig farms investigated in N'Djamena (Chad)

Event	Modality	Frequency (%)	Mean change (time) / fashion parking
Property herd	Single	98	
	Collective	12	
Acquisition mode	Purchase	86	
Pic creation	Gift	09	
	Heritage	05	
Head guard	Man	80	
	Child	14	
	Woman	06	
Food distribution	Twice / day	81	
	Three / day	19	
State pigsty	Good condition	66	
	Disrepair	24	
Housing mode/	Released a few hours / day	73.4	3.64 ± 0.64 [a]
Pigs parking	Locked night	17.2	2.36 ± 0.92 [b]
	Permanent confinement	09.4	3.50 ± 0.84 [c]

Mean columns with different letters are significant ($p < 0.001$)

Table 2 . Distribution of employees identified, investigated and reported as positive in the quarters of the districts visited in N'Djamena (Chad)

Districts and neighborhoods	Staff identified	Considered effective	Positive workforce	% Positive	Number of breeding
1 st (Madjorio)	178	33	4	12	11
7 th (Chagoua, Abena, Tron)	362	66	6	9	24
9 th (Walia Karwaye, Bodore, Ngueli)	321	75	6	8	29
Total	**861**	**174**	**16**	**9.66**	**64**

positive pigs in farms in confinement (1.00 ± 0.00) was low compared to that of the second (1.07 ± 0.3) with no significant difference.

Infestations in the boroughs and practice langueyage in farms

In about 861 pigs on farms identified, 20% were considered and about 9.7% cyst carriers detected. In next borough neighbourhoods, these percentages varied between 8% and 12% (Table 2).

Table 3 . Distribution of farmers according to their impression on the presence of latrines in the squares of the districts visited in N'Djamena (Chad)

Districts and neighborhood	Presence of latrines in the districts			Many breeders
	Majority	Half	Very little	
1 st (Madjorio)	4	7	0	11
7 th (Chagoua, Abena, Tron)	9	14	1	24
9 th (Walia Karwaye, Bodore, Ngueli)	0	20	9	29
Total	**13**	**41**	**10**	**64**

Langueyage practice was common in the majority of farms visited. Thus, 72% were implemented at family slaughters and 73% said that customers systematically practiced before purchasing their animals.

A total of 434 pigs were sold in 55 farms in a year or an average of 7.9 ± 7.3 pigs. The poor sales due to cysticercosis were 14 pigs in nine farms. Of these, 12 belonged to 8 farms where pigs have not always been locked. In five farms, unsold 8 pigs were subjected to a traditional treatment using table salt in the diet. Six pigs in four farms were left to their fate.

The effective and self-consumed in the same period were 91 pigs in 33 farms with an average of 2.8 ± 1.4 pigs. In 30 farms practicing langueyage at family slaughters, 81 pigs were consumed with an average of 2.7 ± 1.4 animals. In three other units where the practice of langueyage did not exist, only 10 pigs were consumed with an average (3.3 ± 1.5) higher, but not significant.

Hygiene practices through latrines in the districts

According to the surveyed farmers, half of the people of the neighbourhood had a latrine (Table 3); these breeders, about 91% have not always confined pigs. The 9th borough recently integrated urban perimeter enclosed alone about 49% of the farmers.

Quality of Pigs slaughtered at the abattoir and estimation of losses

The percentage of total seizures ranged from 2.5% to 5% depending on the year with a six-year average of about 4% (Table 4).

The financial losses caused by the total seizures were significant in 2001 followed by 2004 (Table 5). The average amount of losses due to the seized carcasses were 5,31,900 FCFA per year.

DISCUSSION

The study was done to know the behavior of pigs by the surveyed farmers and highlight the swine infection rate in these farms. In terms of livestock management, similarity emerged in view of the observations made by some authors in Sub-Saharan

Table 4. Evolution of controlled slaughtering and total seizures in refrigerated slaughterhouse Farcha, N'Djamena (Chad)

Year	Controlled slaughter	Total weight (kg)	Weight (kg) Average	Total seizures	Equivalent (kg) carcass entry	% Total Entering
2000	220	9240	42	08	336	3.6%
2001	391	11654	29.8	17	942	4.3%
2002	281	8149	29.0	07	301	2.5%
2003	185	5807	31.4	09	552	4.9%
2004	305	15600	51.2	15	855	4.9%
2005	483	16905	35	16	560	3.3%
Total	**1865**	**67355**		**72**	**3546**	**3.9**

Source : DSPS (2004) and data from the Abattoir Refrigerating Farcha, 2004 and 2005

Africa (SSA) (Muhanguzi *et al.*, 2012; Obonyo *et al.*, 2013; Kiendéobeogo *et al.*, 2014). The results of langueyage constitutes new evidence for this area, contributing to further assessment of the situation in urban farms. However, a detailed study by serology on a larger sample would better assess the degree of infestation of pigs.

The annual prevalence (2.5 to 5%) to the slaughter of N'Djamena or the average (4%) during the six years were lower than earlier observations by 7% (Graber and Chailoux, 1970). Compared to 20% of the state of Enugu (Onah 1995) and 17% of Kwara (Aiyedun *et al*., 2014) in Nigeria and in three municipalities (13%) of Tanzania (Boa *et al*., 1995), those obtained in N'Djamena were 2-4 times lower. It is the same to the slaughter of Taraba State (6.25%) in Nigeria (Karshima *et al*., 2013) that of Garoua (12%) in Cameroon (Awa *et al*., 1999), slaughter houses urban centers (16%) (Assana *et al*., 2001) of the country. Our rates for slaughter has been lower than that obtained by langueyage in farms . In Cameroon, the prevalence of langueyage obtained by Zoli *et al*. (1987) and Assana *et al*. (2001) are also higher than those resulting inspections at slaughter houses. These observations indicate that low slaughter houses would likely be related to the ownership of langueyage by operators in the pig industry in Cameroon and Chad. The increase in demand for pork in the last two decades has been a factor that contributed to this appropriation. Indeed, the operators of the sector (traders and butchers transformers) practiced systematically the langueyage before buying animals to ensure the relative quality of acquired pigs (Koussou, 1999; Koussou and Duteurtre, 2002; Mopaté and Koussou, 2003). This practice allows them to eliminate some of the cyst carrier pigs at the collection areas. However, there are risks by sense that it is only in case of massive infestation that cysts occur in the muscles lingual (UAM, 2000). This has been demonstrated by Assana *et al*. (2001) with 16% negative pigs' langueyage lepers that were reported after slaughter and carcass inspection. Furthermore, the percentages of partial seizures weak organs for the language (Graber and Chailoux, 1970) reflect this fact.

Table 5. Economic losses caused by the total seizures of stingy pig carcasses at the slaughter house Refrigerating of Farcha, N'Djamena (Chad)

Year	Equivalent (kg) carcass entry	Average price / kg carcass	Financial losses (CFA)
2000	336	900	302400
2001	942	900	847,800
2002	301	900	270,900
2003	552	900	496,800
2004	855	900	769,500
2005	560	900	504,000
Total	**3546**		**3191400**

Slaughter house data were previously the only indicators of the level of infestation of pigs in farms (Graber and Chailoux, 1970; Djoret, 2001). The study used the langueyage in the surveyed farms and from the total seizures at the slaughter house. This simple technique to manipulate allowed producers to

appropriately and to know the rate of porcine cysticercosis infestation in the urban area of N'Djamena. Screening by langueyage contributes to lower contamination and loss reduction merchants. The study also link the results to management practices (security, housing) in farms, to show their influence on the appearance of this infestation. However, the low number of positive pigs found failed to statistically confirm the importance or influence of certain driving factors. In Taraba State (Nigeria), a significantly different rate of 5.32% in pigs from traditional breeding and 0.94% improved breeding was observed in 4380 inspected animals (Karshima *et al*., 2013). The pipe, faulty farming conditions and poor hygienic practices of the population greatly influence the infestation of pigs by *Taenia solium* (Graber and Chailoux, 1970; Zoli *et al*., 1987; Preux *et al*., 1996; Assana *et al*., 2002; Murrell, 2005; Pawlowski *et al*. 2005; Gweba *et al*., 2010 ; Aiyedun *et al*., 2014). The driving practices and hygiene through the appreciation of farmers on lack of latrines in their area contribute to perpetuating infestations of pigs. Indeed, although the urban hygiene conditions are relatively better compared to rural wasteland frequented by free-ranging pigs in the day can be used by citizens to defecate. The prevalences observed by Zoli *et al*. (1987) about 25%, Assana *et al*. (2001) of 21% and Eshitera *et al*. (2012) of 32.8% in rural areas prove our findings. Cysticercosis is the main zoonosis in pigsties which must be stopped by good livestock practices and good hygiene producers (Aiyedun *et al*., 2014).

CONCLUSION

This study was conducted to know the infection rate in pigs in N'Djamena. The adoption of langueyage by industry plays far from a guarantee, does nonetheless to constitute a major positive. This indicates an awareness for the need to reduce infestations (man and pork) and economic losses that result due to cysticercosis. This reduction is a prerequisite for better conduct of pig farms. The langueyage in farms and seizures of carcasses at slaughter prove certainly possible to get an idea of the quality of pigs produced in the urban areas. But further investigations are needed with laboratory techniques to detect circulating antigens cysticerci. In addition, an extension of the surveys in the main peripheral areas supplying the city is essential to better clarify the situation in N'Djamena area.

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