

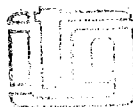
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TAENIA SOLIUM CYSTICERCOSIS IN WEST CAMEROON

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INTRODUCTION.

Porcine cysticercosis, caused by the larval stage of *T. solium*, is a highly important but under-recognized parasitic zoonosis in many developing countries and particularly in Africa (Geerts, 1993 ; 1995 ; Tsang & Wilson, 1995). It is a serious economic and public health problem because : 1°) the meat of infected pigs becomes unfit for human consumption and 2°) the ingestion of the ova of *T. solium* by human beings may cause human cysticercosis, the most important and serious form of which is neurocysticercosis, responsible for one or more of the following symptoms : i.a. mental disturbances, epilepsy, various localized syndromes and intracranial hypertension (Roberts et al., 1994).

The distribution of *T. solium* cysticercosis, contrary to Central and South America and Asia, is not well known in Africa. In Cameroon two short reports on human taeniasis-cysticercosis due to *T. solium* have been published by Marty et al. (1985 & 1986). Since there are several indications that *T. solium* cysticercosis might be a serious zoonosis in Cameroon and more especially in the West Province where pig-rearing is an important economic activity, two large surveys were undertaken in Menoua (Zoli et al., 1987) and in Bamboutos and Mifi (Nguekam, 1998) districts in order to study the prevalence of porcine and human cysticercosis in the area.

MATERIALS AND METHODS

Detection of *T. solium* cysticercosis in pigs.

Two surveys were carried out: the first one took place in the Menoua district in 1986 (Zoli et al., 1987), whereas the second one has been undertaken more recently during 1997 in the Bamboutos and Mifi districts (Nguekam, 1998).

Ante-mortem detection.

Ante-mortem inspection was carried out in pigs selected at random on 6 local markets in the Menoua district, and 8 in Bamboutos and Mifi districts. The total number of pigs examined for the presence of cysticerci by inspection of the inferior side of the tongue and the conjunctiva of the eyes were 607 and 1,295 in the first and second surveys respectively.

Post-mortem detection.

In Menoua 151 carcasses were inspected in the slaughterhouses by making incisions in the internal and external masseter muscles, the heart, the tongue, the diaphragm, the muscles of the fore legs and hindlegs and the psoas muscle (Zoli et al., 1987). In the second survey, 249 carcasses were examined by making only one incision in the external and the internal masseter muscles (Nguekam, 1998).

Serology.

In the first survey 200 serum samples were collected from pigs raised by smallholders and from some of the pigs examined at the slaughterhouses of the Menoua district. The sera were examined by ELISA for antibody detection and compared with the sera of 32 pigs originating from the farm of the University Centre of Dschang where pigs were raised according to modern husbandry practices, so that infection with *T. solium* was unlikely. The ELISA-test was performed essentially as described by Geerts et al. (1981). Briefly, *T. crassiceps* metacystode antigen (5 µg protein/ml) was incubated overnight at 4°C. Serum was diluted 1/200 and conjugate (RaSW IgG (H + L)-PO, Nordic) 1/500 in PBS-Tween 20 with addition of respectively 2 and 4% normal horse serum. Orthophenylenediamine was used as substrate.

In the second survey, 248 sera were collected from pigs slaughtered in Bamboutos and Mifi districts and tested by 1°) A monoclonal antibody-based ELISA for the detection of cysticerci circulating antigens according to the method used by Brandt et al. (1992) modified according to Van Kerckhoven et al. (1997), and 2°) by a classical ELISA for antibody detection using *T. crassiceps* metacystode extract as antigen.

Detection of *T. solium* cysticercosis in men.

A total of 764 serum samples were collected from healthy looking inhabitants of 7 villages (n = 673) in the Menoua district, some workers and

students of the University Centre of Dschang (n = 63) and some patients (n = 28) at the Divisional hospital of Dschang, who were not suspected for cysticercosis (Zoli et al., 1987).

There were 94.9% adults and 5.1% children, among whom 324 (42.4%) males and 440 (57.6%) females.

Twenty sera from black Africans without parasitic infections were used as negative controls for calculating the threshold value: {mean O.D. + (3 x S.D.)}. The ELISA-test was carried out using serum diluted 1/200 and conjugate {GaH IgG (H + L)/PO, Miles}, diluted 1/5,000 in PBS-Tween 20. A fraction (F1) of *T. crassiceps* metacestodes, prepared by gel filtration was used as antigen (5 µg protein/ml). All the positive sera were further tested against a battery of 7 different antigens as shown in table 5. To differentiate between filariasis and echinococcosis, absorption tests were performed as described by Speisser (1980). To confirm the true cysticercosis or echinococcosis cases, absorption was done with *T. crassiceps* metacestode or *E. granulosus* hydatid fluid antigens. An indirect haemagglutination test was carried out with the latter antigen using a commercial kit (Fumouze, France). A titre of 1/512 was considered as positive for hydatidosis.

RESULTS AND DISCUSSION.

Porcine cysticercosis.

Tables 1 and 2 show the results of the ante and post-mortem inspections of pigs in Menoua, Bamboutos and Mifi districts. It is clear that there is a high prevalence of pig cysticercosis in the Menoua district. The results of meat inspection are comparable to the highest figures (18.4%) found in Nigeria (Dada, 1980a & b) and are even higher than those found in some hyperendemic areas in Mexico (Velasco-Suarez et al., 1982). These values are about ten times higher than those observed during the second survey more than ten years later in two neighbouring districts. The difference between the ante-mortem results in Menoua and in Bamboutos & Mifi might be explained by the improved pig-raising practices in the latter districts, whereas the differences in the post-mortem results are at least partly due to the inspection technique used at the slaughterhouse. Indeed, it is important to note that in the second survey, only the masseter muscles have been incised in order to detect cysticerci, whereas in the first survey 7 different muscles were examined.

Table 1. Prevalence of *T. solium* cysticercosis in pigs of Menoua, Bamboutos and Mifi districts as detected by ante-mortem inspection.

District	Number of pigs examined	Pigs infected with <i>T. solium</i> metacestodes	
		Number	%
Menoua	607	149	24.6
Bamboutos	670	27	4.03
Mifi	625	3	0.48

Table 2. Prevalence of *T. solium* cysticercosis in pigs of the Menoua, Bamboutos and Mifi districts as detected by post-mortem inspection in the slaughterhouses.

District	Number of pigs examined	Pigs infected with <i>T. solium</i> metacestodes	
		Number	%
Menoua	151	30	19.9
Bamboutos	118	3	2.54
Mifi	131	2	1.53

Tables 3 and 4 show the serological results of 200 and 249 pig sera in Menoua and Bamboutos & Mifi districts respectively. As expected, both for antibodies and circulating antigens, these figures are higher than those from ante or post-mortem inspections. The difference between the antibody- and the antigen ELISA (36.38 vs 11.24%) might be explained by the fact that the latter detects only carriers of living cysts. According to these surveys it can be concluded that the figures of 24.6% and 2.31% of infected pigs as evidenced by ante-mortem inspection in Menoua and in Bamboutos & Mifi districts are certainly conservative and the real infection rates are probably much higher.

Table 3. Detection (ELISA) of antibodies against *T. crassiceps* metacestode antigen in pig sera of the Menoua, Bamboutos and Mifi districts.

District	Number of sera examined	Positive sera	
		Number	%
Menoua	200	106	53.00
Bamboutos	118	35	29.7
Mifi	130	22	17

Table 4. Detection (ELISA) of circulating antigens of *T. solium* metacestodes in The Bamboutos and Mifi districts.

District	Number of sera examined	Positive sera	
		Number	%
Bamboutos	118	18	15.25
Mifi	131	10	7.63
Total	249	28	11.24

Human cysticercosis.

A total of 115 (15.1%) sera from the 764 human serum samples were shown to be positive in ELISA test using fraction F1 of *T. crassiceps* metacestode antigen and a threshold level with 99.7% confidence limit {mean O.D. + (3 x SD)}. However a comparative evaluation against different parasite antigens and absorption tests with heterologous antigen identified the majority of these positive sera as cross-reactions. Table 5 shows that at least 2.4% (17) of the total number of sera tested can be considered as true positive for cysticercosis. Unfortunately these sera were no longer available for confirmation by immunoblot (Tsang et al., 1989).

This figure is similar to those from hyperendemic areas of Central America and some regions in the Far East. The results of this study confirm the observations made by Marty et al. (1986) on 95 people living in the same region of Cameroon. These authors detected antibodies against *T. solium* metacestodes in 2% of the examined population.

Table 5. Serodiagnosis of 115 human sera, positive for cysticercosis, after comparative evaluation against different parasite antigens in ELISA.

	<i>T. solium</i> Cysticer-cosis	Filariasis	Hydatido-sis	Ascariasis &/or Visceral larva migrans	Doubt-ful	Nega-tive
Antigens	<i>C. cellulosa</i>	<i>L. carinii</i>	<i>E. granulo-sus</i>	<i>A. suum</i> <i>T. canis</i>		
Number of sera	17*	76*	1**	3	10	8*

* : confirmed by absorption tests;

** : confirmed by absorption and indirect agglutination tests

According to the results obtained in these surveys, it can be concluded that the West Province of Cameroon, and especially the Menoua district, is a very important focus of *T. solium* cysticercosis. This can easily be explained since all the conditions are present for direct human-to-pig transmission of the parasite: open air fecalism or deliberate defecation in the pig sties, clandestine slaughtering of pigs, lack of trained and qualified inspectors, consumption of raw or insufficiently cooked pork, lack of detection and treatment of human *T. solium* carriers. Currently a pilote programme has been started in the Menoua district in order to control human and porcine cysticercosis.

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