

1. INTRODUCTION AND OBJECTIVES

1.1 General overview

The Kingdom of Cambodia, one of developing countries in South-East Asia, occupies a territory of some 181.035 square kilometers (km²) and is home to a rapidly growing (growth rate: 3.8%) population in excess of more 13 million (NIS Census, 1998, FAO, 2003). It shares its frontier with Thailand, Laos and Vietnam, with the Gulf of Thailand serving the other boundary. The country is divided administratively into 24 provinces including Phnom Penh municipality. It is a country that is highly varied in economic development, living condition (standards) and social benefits. Moreover, Cambodia is poorest and least developed in agricultural industries, especially in livestock production and veterinary services (FAO, 1999).

Cambodia's climate- like that of the rest of Southeast Asia is dominated by the monsoons, which are known as tropical wet and dry because of the distinctly marked seasonal differences. This climate is governed by two monsoons: the cool, dry northeastern monsoon from November to March, and the humid southwestern monsoon from May to October. The monsoon airflows are caused by annually alternating high pressure and low pressure over the Central Asian landmass. In summer, moisture-laden air, the southwest monsoon, is drawn landward from the Indian Ocean. The flow is reversed during the winter, and the northeast monsoon sends back dry air. Temperatures are fairly uniform throughout the Tonle Sap Basin area, with only small variations from the average annual mean of 25°C. The maximum mean is about 28°C while the minimum mean is about 22°C. Maximum temperatures of higher than 32°C, however, are common and, just before the start of the rainy season, they may rise to more than 38°C. Minimum temperatures rarely fall below 10°C. January is the coldest month, and often reaching 40 °C, April is the hottest month (FAO, 1999).

The total annual rainfall average is between 100 and 150 centimeters, and the heaviest amounts fall in the southeast. The relative humidity is high at night throughout the year; usually it exceeds 90 percent. During the daytime in the dry season, humidity averages about 50 percent or slightly lower, but it may remain about 60 percent in the rainy period (FAO, 1999; FAO 2003).

1.2 Livestock production and pork demands in Cambodia

Cambodia is characterized by its agricultural domain, which employs over 80 % of the population. Around 46.4 % of the agricultural Gross Domestic Products (GDP) and 14.4 % of the total GDP are estimated to be from livestock production. But its role in national economy is far above the figures suggested (Census 2001, MAFF).

In reference to the Department of Animal Health and Livestock Production Census 2002, it is estimated that the country has 2.9 million cattle, 0.6 million buffalo, and 2.1 million pigs (Census of DAHP, 2002). The animal production is only plays an important role for supplying domestic demands. The annual growth rate per species: cattle 2.4 %, pig 2.5 % and poultry 5.6 % (Census, MAFF, 2000; FAO, 2003).

Over 80 % of Cambodian farms are in rural areas and raise pigs, cattle, buffalo and poultry for draught power, food consumption and generating income (Census, MAFF, 2000).

The annual production of meat and percentage of growth rate are estimated approximately: beef 69,900 metric tons (6.1%), pork 105,000 tons (5.7%), poultry 20,400 tons (1.8%) and milk 25100 tons (4.4%). Moreover, annual consumption and percentage of growth rate are: beef 60,100 tons (4.8%), pork 102,500 tons (4.5), poultry 24,700 tons (3.9%) and milk 47,200 tons (10.6%), (FAO, 2003).

Livestock production in Cambodia is mostly marginal due to free ranging conditions, feed shortages for the greater part of the year, widespread occurrence of

animal diseases, low educated people, poor genetic potential, hygienic and husbandry practices as well as underdeveloped infrastructure and marketing systems. In addition, slaughter slabs and slaughterhouses in Cambodia have not been “standardized” due to a lack of hygienic concerns, missing or improper disease control measures, inspection and prevention, and underdevelopment (Report of MAFF, 2003).

Among the many prevalent animal diseases, parasitism represents major problems. Of the various parasitic diseases, porcine cysticercosis and trichinellosis are considered to be two of the most important zoonosis (Flisser *et al.*, 2004; La Rosa *et al.*, 1998).

1.3 Porcine cysticercosis and trichinellosis

Porcine cysticercosis caused by the human tapeworms, *Taenia solium* and *T. asiatica* as well as trichinellosis which is caused by nematode in the genus *Trichinella* were two of the most serious parasitic zoonosis leading to a high economic loss. These two helminthic zoonoses are widespread over the world, occurring mainly in rural areas of underdeveloped countries where the hygienic conditions and health education are low. The prevalence is fostered when pigs are reared traditionally and have access to free running areas outside (Dorny *et al.*, 2004; Garcia *et al.*, 2005). Porcine cysticercosis and human taeniosis are mainly known in regions where pork is consumed predominantly. Main focuses are in Central America, Africa and Asia. In the Indochina region many investigations on this subject have been done in the recent past, whereas in Cambodia no detailed data concerning porcine cysticercosis and trichinellosis and their zoonotic risk have been published in recent times. Consequently, the epidemiological and veterinary public health aspects of the diseases are poorly worked out in most countries of Asia such as Cambodia. Data on the prevalence of porcine cysticercosis, *Taenia asiatica* and trichinellosis in most countries of Asia are not available or are of questionable reliability. Moreover, reliably estimated prevalence of *Taenia solium* cysticercosis by overview is 10% in Cambodia, 8% in Vietnam, 11% in Thailand and 10% in Laos (Singh *et al.*, 2002). In

China, the sero-prevalence of trichinellosis in humans by AB-ELISA has been found to be approximately 4.01% and sero-prevalence in pigs is around 7.3% (Liu *et al.*, 2002).

Therefore, the main goals were to identify recent prevalence of porcine cysticercosis and trichinellosis in pigs in different areas of Cambodia using several methods such as tongue palpation, visual meat inspection, as well as *Trichinella* larval E/S antigen ELISA test.

1.4 Objectives of the study

As a basis of assessing these problems, basic survey data is required. Such data are necessary to carry out for the design and possible recommendation of control measures and prevention. Therefore the important objectives of the present study are to:

1. Determine prevalence and identify predilection sites of *T. solium* cysticercosis in pigs by *ante* and *post mortem* examination as well as determine additional occurrence of *T. asiatica* cysticercosis (*viscerotropica*).
2. Determine sero-prevalence of trichinellosis using *Trichinella* larval ES antigens AB- ELISA.
3. Retrospectively collect data on the occurrence of neurocysticercosis in humans in selected hospitals in Phnom Penh / Cambodia.