การสำรวจและจำแนกชนิดพยาธิในระบบทางเดินอาหารในไก่พื้นเมืองในพื้นที่ราบต่ำ ประเทศกัมพูชา

นายสมัท ซัม

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
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SURVEY AND IDENTIFICATION OF GASTRO INTESTINAL PARASITES IN DOMESTIC CHICKEN (*GALLUS DOMESTICUS* L.) IN LOWLAND OF CAMBODIA

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for the Degree of Master of Science Program in Veterinary Pathobiology
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สมัท ซัม : การสำรวจและจำแนกชนิดพยาธิในระบบทางเดินอาหารในไก่พื้นเมืองในพื้นที่ราบต่ำประเทศกัมพูชา (SURVEY AND IDENTIFICATION OF GASTRO INTESTINAL PARASITES IN DOMESTIC CHICKEN (*GALLUS DOMESTICUS* L.) IN LOWLAND OF CAMBODIA) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ปิยนันท์ ทวีถาวรสวัสดิ์, อ.ที่ปรึกษาวิทยานิพนธ์ร่วม: สุดจิตต์ จุ่งพิวัฒน์, 115 หน้า.

ไก่พื้นเมืองที่เลี้ยงปล่อยให้หากินเองตามธรรมชาติเป็นแหล่งอาหารโปรตีนที่สำคัญของประชากรในประเทศกัมพูชา เกษตรกรเลี้ยงไก่ปล่อยให้หากินเองตามธรรมชาติตามพื้นที่ แปลงหญ้าหลังบ้าน ไก่หากินอาหารเช่นไส้เดือน แมลงต่าง ซึ่งทั้งไส้เดือนและแมลงจะเป็นโฮสต์กึ่งกลางของปรสิตหนอนพยาธิชนิดต่างๆ ทำให้ไก่ติดโรคหนอนพยาธิได้ ปรสิตหนอนพยาธิบางชนิดที่พบในไก่เป็นโรคสัตว์สู่คน ดังนี้นจุดประสงค์ในการศึกษาครั้งนี้เพื่อสำรวจและจำแนกชนิดปรสิตหนอนพยาธิในไก่พื้นเมือง ในเขตพื้นที่ราบต่ำ ประเทศกัมพูชา ตัวอย่างอวัยวะภายในระบบทางเดินอาหารของไก่จำนวน ๕๐๙ ตัวอย่างซื้อจากตลาดที่ขายไก่พื้นเมือง ทำการเปิดผ่าอวัยะภายในแต่ละส่วน ตรวจหาพยาธิด้วยตาเปล่า และกล่องจุลทรรศน์แสงสว่าง และกล้องจุลทรรศน์สเตอริโอ เก็บตัวอย่างอุจจาระจากไส้ตันจำนวน ๔๐๙ ตัวอย่างตรวจหาปรสิตด้วยวิธีทำให้ปรสิตลอยตัวแบบธรรมดา และปรสิตจมแบบธรรมดา ผลจากการศึกษาพบปรสิตในระบบทางเดินอาหาร ๔๘๓ ตัวอย่างจาก ๕๐๙ ตัวอย่างคิดเป็น ๙๔.๘๙% ได้แก่หนอนพยาธิตัวกลม ตัวตืด และพยาธิใบไม้ คิดเป็น ๘๖.๕๗%, ๘๔.๔๗% และ ๖.๐๙%ตามลำดับ สำหรับพยาธิใบไม้หัวหนามซึ่งเป็นโรคสัตว์สู่คนพบจำนวน ๒๔ ตัวอย่าง (๔.๗๑%) .ในจังหวัดกานเดล เปรเหวง และ ตะเกว ผลการตรวจอุจจาระพบปรสิตในระบบทางเดินอาหาร ๙๒.๙%(๓๘๐/๔๐๙) ปรสิตที่พบได้แก่ไข่พยาธิตัวกลม ไข่พยาธิตืด ไข่พยาธิใบไม้ และอัยเมอเรีย โอโอซีสต์ คิดเป็น ๘๙.๔๘,๑๓.๒, ๕.๑๓ และ ๖๐.๘๘% ตามลำดับ ผลจากการศึกษาในครั้งนี้แสดงให้เห็นถึงอัตราการติดโรคปรสิตในระบบทางเดินอาหารที่ค่อนข้างสูงซึ่งจะเป็นข้อมูลเบื้องต้นให้สัตวแพทย์ และนักวิจัยได้นำไปใช้ในการป้องกัน รักษา และควบคุมโรคปรสิตในระบบทางเดินอาหาร และพยาธิที่เป็นโรคสัตว์สู่คน

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SAMUTH SUM: SURVEY AND IDENTIFICATION OF GASTRO INTESTINAL PARASITES IN DOMESTIC CHICKEN (*GALLUS DOMESTICUS* L.) IN LOWLAND OF CAMBODIA. ADVISOR: ASST. PROF. DR PIYANAN TAWEETHAVONSAWAT, CO-ADVISOR: MRS SUDCHIT CHUNGPIVAT, 115 pp.

In Cambodia, domestic chickens or backyard chickens are source of protein that are importance for people nowadays. Farmers raise the domestic chickens on their backyard. Chickens eat either insects or earthworm as intermediate host for parasites. Some of gastrointestinal parasites causes of zoonosis. The objective of this study was survey and identification gastrointestinal parasites in domestic chickens of lowland regions in Cambodia. 509 samples of gastrointestinal tract (GI) from carcasses were bought from markets and 409 fecal samples from caecum were examined by using the conventional methods. The GI samples were performed by gross examination and observed under stereo and light microscope. The fecal specimens were examined by simple sedimentation and simple floatation techniques. 483 from 509 (94.89%) specimens found the worm in GI tract. The most common parasites were nematode, cestode and trematode. They were positive 86.57, 84.47 and 6.09%, respectively. Echinostome, which is a zoonosis, was found 24 from 509 carcasses (4.71%) in Kandal, Prey Veng and Takeo provinces. The fecal examination was GI parasite positive 92.9% (380/409). The common parasites eggs were nematode, cestode, trematode and *Eimeria* oocysts,. They were positive 89.48, 13.2, 5.13% and , 60.88, respectively. This study showed the high prevalence of GI parasites in domestic chickens of lowland areas in Cambodia. Regarding from this information, it will be helpful for the veterinarians and researchers to design strategies for prevention and treatment the GI parasites in order to control some parasites that are causes of zoonosis

Department:	Veterinary Pathology	Student's Signature	.....
Field of Study:	Veterinary Pathobiology	Advisor's Signature	.....
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LIST OF ABBREVIATION

AFA	=	Acetic acid Formalin Alcohol
hrs	=	hours
^{0}C	=	Degree Celsius
HCl	=	Hydrochloride
Cm	=	Centimeter
GI	=	Gastrointestinal
GDP	=	Gross Domestic Product
%	=	Percentage
FZT	=	Fishborne Zoonoses Trematodes
FZT	=	Foodborne Zoonoses Trematodes
US	=	United State
$	=	Dollar
g	=	Gram
ml	=	Milliliter
pH	=	Power of hydrogen
A.	=	*Ascaridia*
H.	=	*Heterakis*
R.	=	*Raillietina*
C.	=	*Cotagnia*
T.	=	*Tetrameras*
E.	=	*Echinostoma*
G.	=	*Gongylonema*
spp.	=	Species
No	=	Number
et. al	=	et alia (and others)
dpi	=	Day Post Infection
sm int.	=	Small intestine

CHAPTER I

IMPORTANCE AND RATIONALE

Cambodia is a Southeast Asia country that has a tropical climate by distinct dry and rainy seasons. In Cambodia, the major economic sector is agriculture, overall Gross Domestic product (GDP) of agriculture is 37.1 percent while the contributory livestock is 9.7 percent (Knip, 2004). Moreover, eighty percent of Cambodian are farmers. Therefore livestock is the third largest subsector, next to crop production and fishery (Young et al., 2014). The livestocks in Cambodia are the cattle, swine, duck and chicken. Furthermore, the among population of chickens is increased 6.2 for Cambodia while 2.8 for Lao People Democratic Republic (Knip, 2004). However, animal raising play the important role for Cambodian farmers as their daily food and to provide a draft power, income, and consumption. 90-95% of farmers raise the domestic chickens for food. Additionally, domestic chickens are raised scavenging also fed supplementary feeds involving rice, corn, bean, and some farmers raised their domestic chickens by free-feeding otherwise chickens forage the feed by themselves on backyard or paddy (Khieu, 1999; Knips, 2004). Domestic chickens (*Gallus gallus domesticus*) are the most common and widespread domestic animal which are the source of meat, eggs, feathers, and feces (Dar and Tanveer, 2013). Moreover, the domestic chickens are the important protein resource for the people living far away from market. Then, they need to raise chickens on the backyard and freely feed on the field. Then chickens eat the intermediate host of parasites such as ants, cockroaches, flies, grasshoppers, beetles, earthworms, snails and aquatic animals. Feces of chickens are source of parasitic infection for the free-range chickens (Lim, 1971; Vattanodorn et al., 1984). In another hand, in Cambodia, owner of chickens raising has many problem with factors of challenges including slow growth and infections, disorders are occurred in domestic chickens such as; Newcastle, chickens cholera, bird flu, white diarrhea, avian pox and GI parasites (DGD and VVOB, 2013; Por et al., 2013).

Ectoparasites and endoparasites are common in domestic chickens (Nnadi and George, 2010).The prevalence of parasites in the village chickens flocks are close to 100 percent, that are mostly infected by parasite more than one species (Permin et al., 1997).

Gastrointestinal parasites include trematodes, cestodes, nematodes and coccidia. Normally, *Echinostoma revolutum* was known a zoonosis (Saijuntha et al., 2013). Food-borne trematodiases are an important public health, and veterinary problem to control the disorders on definitive host (McManus and Dalton, 2006). In 2005, people around 56.2 million were infected with food-borne trematodiasis, 7.9 million were severe infected, and 7,158 people were death (Furst et al., 2012). The human, mammal and poultry are fed by rare meat or undercook of intermediate hosts as freshwater fish (lab pla, koi pla, pla som, and pla ra), frogs, shellfish, snails, tadpoles, snakes, water plants and other aquatic products that can be contaminated with food-borne zoonoses trematode (Sithithaworn et al., 2007). Nevertheless, in Cambodia and especially Southeast Asia and Easter Asia have been reported the trematodiosis on the domestic chickens (Schou et al., 2007; Bootboonchoo and Wongsawad, 2012; Dar and Tanveer, 2013).

Cestodiosis is the most prevalent and pathogenic helminthes parasites in domestic chickens. However, cestodes of domestic chickens are not caused zoonosis but it has effected to economic loss (Shahin et al., 2011; Bootboonchoo and Wongsawad, 2012). The environment is very important for life cycle of tapeworm because they need the intermediate host such as ants, grasshoppers, earthworms and beetles to complete their life cycle. The weather in Cambodia is a humid and dry, similar to Thailand, Loa, Vietnam, Malaysia, Philippine and India that have been reported the cestodiosis by many researchers (Lancaster, 1957; Krishnasamy et al., 1983; Vattanodorn et al., 1984; Lee et al., 1991; Jones and Bray, 1994; Schou et al., 2007; Bootboonchoo and Wongsawad, 2012; Dar and Tanveer, 2013).

Nematodiosis is a common disorder in domestic chickens, especially *Ascaridia galli* which locate in small intestine. This worms are effective in young chickens. *Heterakis gallinarum* is located in caecal lumen, both parasites caused economic lost

every year. There have been reported the prevalence of nematodiosis in the domestic chickens in India, Nepal, Philippine, Malaysia, Vietnam and Thailand (Schou et al., 2007; Rahman et al., 2009; Dar and Tanveer, 2013; Naphade, 2013).

Coccidiosis is a common disease in broiler and backyard and has been distributed worldwide especially in tropical and subtropical regions. All breeds and ages of chickens are susceptible to contaminate with coccidiosis (Lindsay et al., 1997; McDougald and Reid, 2003). The disease has occurred in chickens where owner raised in broiler house several years. Coccidiosis can be transmission by chickens to another chickens while chickens shed feces that have oocysts. Oocysts developed to infective stage (sporulated oocyst) in flock and then another chickens ingest the sporulated oocysts through litter or the contamination of food or water. Oocysts may be spread mechanically by many different animal, insects, contaminated equipment, wild birds, and dust. Oocysts were resistant to environment and to disinfectants. Sometimes coccidiosis can transmit from one farm to another farms by facilitated like movement of personnel and equipment between farms and also wild chickens migrates (Forrester et al., 1987; McDougald and Reid, 2003).

In Cambodia has limit information about the parasite in animal. Moreover, it has not reported about GI parasites in domestic chickens.

1.2: Objective of this study

The aim of this study is to survey and identification of gastrointestinal parasites in domestic chickens *(Gallus domesticus L.)* in lowland of Cambodia.

CHAPTER II

LITERATURE REWIES

Literature Review

The parasitic infections have been common disorders in domestic chickens (*Gallus domesticus*) such as trematodes, cestodes, nematodes, and protozoa. Moreover, some species of trematodes in chickens cause zoonosis in human (Saijuntha et al., 2013). In 2005, the people around 56.2 million were infected with food-borne trematodiasis, 7.9 million have severely infected, and 7158 were death (Furst et al., 2012). Heavy infection of gastrointestinal helminthiasis is characterized by retarded growth, emaciation, decreased egg production, mucous diarrhoea, catarrh, loss of appetite, anaemia, weakness, paralysis, and death (Fatihu et al., 1990a). Otherwise, cestodes are infected the chickens by show villous atrophy, catarrhal enteritis, granuloma formation in duodenum, desquousmation of villi and submocousal glands congestion, inflammatory reaction, and vacillation of epithelial cells (Kurkure et al., 1998). All of GI parasitic diseases are the severely impact economic loss (Shirley et al., 2004; Morris et al., 2007). However, the reports showed with coccidiosis, total price loss of commercial chickens products at least US$ 1.5 billion every years (Yadav and Gupta, 2001). The average annual consumption of anticoccidial drug is 320 million dollars (McDougald and Reid, 2003; Michels et al., 2011b). Nevertheless, backyard and free-range poultry are been raised nearly the house of citizens, owners are given the feed such as seed and waste from kitchen, was not enough to growth up. Therefore, the chickens are fed full daytime, wherever on the field. The chickens are fed with grass, insects, and aquatic animal which the intermediate host parasites including snails, fish, tadpoles, frogs, earthworms, grasshoppers, ants (Rahman et al., 2009; Anh et al., 2010; Saijuntha et al., 2013). Nonetheless, currently study, the seasonal weather was impact to the infection of coccidiosis in domestic and broiler chickens (Awais et al., 2012; Ahad et al., 2014; Sreedevi et al., 2014). Recently study of prevalence of *Eimeria* spp.

have been reported from variable regions in the world that were the highly prevalent infection on native and broiler chickens (Hadipour et al., 2011; Shirzad et al., 2011; Velkers et al., 2012; Gyorke et al., 2013; Luu et al., 2013; Ali et al., 2014; Thenmozhi et al., 2014).

2.1: Trematodes

Many researchers have been found the trematodes in domestic chickens such as: *Echinostoma revolutum, Catatropis verracosa, Prosthogonimus pellucidus, Echinoparyphium recurvatum, Hypoderaeum conoideum, Centrocestus formosanus* and *Echinostoma cinetorchis Notocotylus* spp. (Sangvaranond, 1994; Rabbi et al., 2006; Anh et al., 2010; Saijuntha et al., 2011; Chantima et al., 2013). These trematodes are infected in the intestine organs of poultry and mammals, some of these trematodes caused zoonotic diseases approximately sixteen species by *Echinosome* (Carney, 1991b). In Cambodia has been reported the *Echinostoma revolutum* what infection in the children in Mekong and Tonle Sab region (Lee et al., 2002; Park et al., 2004; Sohn et al., 2011a; Sohn et al., 2011b). Moreover, *Echinostoma revolutum* had been reported in backyard chickens (*Gullas domesticus* L.) in the world, mostly Southeastern and Eastern Asia, was fed the domestic chickens with mollunc, fish, frogs, and tadpole on the field (Tangtrongchitr and Monzon, 1991; Ayudhya and Sangvaranond, 1997; Macpherson et al., 2000; Anh et al., 2010; Saijuntha et al., 2013). However, all the species of trematodes are need at least one the intermediate host to complete the life cycle. Furthermore, *E. revolutum* is needed two the intermediate host to complete the life cycle (Kanev, 1994).

2.1.1: The life cycle of *Echinostoma revolutum*

A part of life cycle of *Echinostoma revolutum* is complicated to understanding. *E. revolutum* always is sylvatic cycle, pathogen require two intermediate hosts to complete the life cycle. The first intermediate host is fresh snails, and second intermediate host is aquatic animals or fresh snail as well (Carney, 1991a). The mature of *E. revolutum* produce unembryonated eggs into faeces final host, throughout environment. If temperature, moisture, and climate are suitable, the eggs become to

embryonade eggs. The embryonated eggs developed to miracidia, then hatched, and find the fresh snail to penetrate. The miracidia is developed in cavity of snail and become to sporocyst. Thereafter, sporocyst is persisted and start dark-grey, small, and empty that called mother rediae or first generation. The mother rediae is produced daughter radiae. Currently, daughter radiae is grown to cercariae. In the stage, cercariae are leaved from fresh snail and find the second intermediate host and developed to metacarceriae. This stage is infective stage of *E. revolutum* when definitive host is consumed the feed, has metacercariae (Kanev, 1994). The prepatent period of *Echinostoma* spp. is little different depending species of *Echinostoma*, normally egg was found in feces on 11 to 12 dpi. Overall *E. caproni* was detected on the stool at 10-12 dpi, *E. malayanum* was released at 14 days dpi, and *E. revolutum* was produced the eggs at 10 dpi (Franco et al., 1986; Kanev, 1994; Toledo et al., 2003; Srisawangwong et al., 2004).

2.1.2: Epidemiology of *E. revolutum*

In poultry cases, many researchers were distributed worldwide especially Southeastern and Eastern Asia that are the region, consume feed by uncooked, undercooked of fresh snails, fish, frogs, and tadpoles. In Southeast Asia has been occurred 59 species internal fluke infected in human included *E. revolutum* (Keiser and Utzinger, 2005; Chai et al., 2009). In Republic of Korea, it has been found *E. revolutum* from house-rat in Yangyang, Kangwon-do (Lee et al., 1990). Moreover, *E. revolutum* was infected in feral cats from a market in Busan, Republic of Korea (Sohn and Chai, 2005). In addition, Ryang has been studied on *Echinostoma* spp. in the Chungju Reservoir and upper streans of the Namhan River that was found 22% of prevalence (Ryang, 1990). However, Echinostomatidae has been caused foodborne diseases (Chai and Lee, 2002). In China, fishborne zoonotic trematodes are still risk in human food safety. Tilapia has been observed low prevalence (1.5%) of Heterophyidae and Echinostomatidae (Li et al., 2013). Moreover, seven species of *Echinostoma* has been found in human (5%), Cats (9.5%), dogs, and rats (80%), respectively (Li, 1991). In Kingdom of Thailand, many researchers has been reported the *Echinostoma* on intermediate host and definitive host. The *E. revolutum* was occurred 1.90%, found from the native chickens in central part of Thailand (Sangvaranond, 1994). However,

freshwater snails are played the important intermediate host of intestinal flukes, the freshwater snails and aquatic animals were collected from fishponds that found metacercariae of *E. revolutum* and another pathogen of human cause zoonosis in Chiang Mai and Khon Kaen provinces (Chantima et al., 2013; Tesana et al., 2014). Another studies have been found eggs of *E. revolutum* in faeces of citizens that lived Thailand and the Loa PDR border, Mekong river region (Saijuntha et al., 2011; Chai et al., 2012). Moreover, free-grazing ducks were contaminated *E. revolutum* at Northern, Central, and Northeastern regions of Thailand (Saijuntha et al., 2013). In Vietnam, metacercariae of *E. revotulum* was detected from snails in local market, Nam Dinh province (Chai et al., 2011). Moreover, chickens and ducks were reservoir hosts fishborne zoonotic trematode in Vietnam (Anh et al., 2010). The prevalence FZT metacercariae has been investigated from fish farm at Nghe An province that was 43.6% included echinostomatids (Chi et al., 2008). Moreover, prevalence FZT diseases are still an important zoonosis in Vietnam (De et al., 2002; Hop et al., 2007; Thien et al., 2007; Phan et al., 2010b; Phan et al., 2011; Hung et al., 2015). In Cambodia, eggs of *E. revolutum* has been surveyed in children, Pursat province, Cambodia by faecal examination. The children were infected of egg *E. revolutum* (22.4%) of prevalence (Sohn et al., 2011a). Nonetheless, Oddar Meanchey province, the faecal examinations of children and adults human have been detected of egg *Echinostoma* 1.0% (Sohn et al., 2011b). Moreover, the egg of *Echinostoma* spp. has been detected from the faecal examination of childen in Kampong Cham and Bat Dambang (Lee et al., 2002; Park et al., 2004). In contrast, another Southeast Asia have been described the prevalent information of *Echinostoma* included: Malaya, the Philippine, Taiwan, respectively (Bonne et al., 1953; Cross and Basaca-Sevilla, 1986; Bundy et al., 1991).

2.1.3: Clinical signs and pathogenesis of *E. revolutum*

Pathology of echinostomatic diseases is still represented a complex and various reaction which depended factors, included characteristics of the echinostome species and the nature of the host species. The main symptom of serious infection is a weakness, watery diarrhea, weight loss, anorexia, and unthriftiness (Graczyk and Fried, 1998; Toledo et al., 2006). Moreover, *E. revolutum* is presented lesions in the small intestine consisting of mild hyperemia with a severe catarrhal enteritis of geese (Griffiths et al.,

1976). However, pathology of *E. revolutum* in domestic chickens is damaged that intestinal villi is observed at the site of the worm attachment along with proliferation of goblet cells (Huffman et al., 1984). The metacercariae of *Echinostoma* is migrated into common a bile duct, the liver, gall gladder, and pancreas which was the liver damages and blood vessel in hemorrhagic region and mononuclear infiltration.

2.1.4: Diagnosis of *E. revolutum*

The trematodiatic diagnosis is used feces to examination by conventional techniques. However, the conventional methods are lost qualitative and quantitative then molecular methods (Han et al., 2012). Overall, the sedimentation method is useful to observe and identify egg of flukes (Mwale and Masika, 2011). In contraction, the Kato-Katz (KK) method is used to detect egg of fluke, is easier to observe than the sedimentation (Sohn et al., 2011a; Han et al., 2012). Moreover, the evidence of (KK) is faster and cheaper, may be used to calculate the intensity of among infection (Choi et al., 2005). Nonetheless, the sensitivity of this method is still low when compare with ELISA (Hong et al., 2003; Han et al., 2012). By another hand, the morphology fluke identification is successful to diagnosis of fluke. The worm is stained and mounted, the size and shape of the body, organs, and collar spines are measured by looking under light microscope (Sohn et al., 2011a; Chantima et al., 2013)

2.1.5: Treatment and prevention of *E. revolutum*

It is difficult to prevention of Echinostomiasis because of birds and mammals are still fed malnutrition or insufficient food inspection and sanitation. Moreover, the region-old traditions are eaten food by uncooked, or undercooked which widespread the reservoirs of trematodiasis to definitive host (Fried et al., 2004). Nonetheless, Li (2013) was suggested that animal aquatic is the intermediate host that is easy to transmit the metacercariae to definitive host. The preventing tramatodiasis is improvement of management and biosecurity must be high level (Lee et al., 2002; Park et al., 2004; Li et al., 2013). The prazuantel was used to treat and prevent, the children infected with *E. revolutum* by using oral dose combined with magnesium sulfate (Sohn et al., 2011a).

Moreover, another antihelminchtics are detected to prevent the parasites including: albendazole, and metromidazole (Lee et al., 2002; Park et al., 2004).

2.2: Cestodes

The cestodes are the tapeworm of parasitic diseases therefore cause the infection in birds and mammals. In animals infected with tapeworm such as cattle, swine, and poultry especially domestic chickens. There are many tapeworms have been reported such as *Hymenolepis* spp., *Choanotaenia infundibulum, Cotugnia digonopora, Amoebotaenia cuneata, Amoebotaenia sphenoides, Raillietina* spp., and the most important *Raillietina echinobothrida* (Sangvaranond, 1994; Maqbool et al., 1998; Poulsen et al., 2000; Mukaratirwa et al., 2001; Hassouni and Belghyti, 2006; Abdelqader et al., 2008; Eslami et al., 2009b; Ekpo et al., 2010; Nnadi and George, 2010). Moreover, *R. echinobothrida* has been highly prevalence and pathogenic worm in chickens, especially in the domestic chickens. The cestodes body is the hermaphrodite worm that has both male and female reproductive organs. Nevertheless, *R. echinobothrida* has impacted with economic that caused the responsible nodular diseases in domestic chickens (Morishita et al., 2007). All of cestodes in the chickens are needed the intermediate host to complete the life cycle (Reid et al., 1938).

2.2.1: The life cycle of *Raillietina* spp.

Overall tapeworms are required the intermediate host to complete the life cycle, therefore life cycle is still the complexion including *R. echinobothrida* that is pathogen of poultry (Lafferty, 1999). The life cycle of *Raillitina* spp. started from the adults of *Raillietina* spp. are lived in the intestinal tract of chickens, worms are produced mature gravid proglottids into feces of host. The gravid proglotteds contain egg capsules, overall egg capsules have among eggs inside about 3-8 eggs following the *Raillietina* species, throughout site body of host. The environment, humid, and temperature are important for eggs develop (Reid et al., 1938). The eggs are hatched to the larvae that called onchosphere stage or hexacanth. Moreover, hexacanth was ingested by insects and penetrated into the alimentary canal and develop to cysticercoid (Horsfall, 1938). The cysticercoid was developed to maturity in *Tetramorium caespitum* and *Pheidole*

vinelandica, P. sitarches campestris and *P. bicarinata* about 28-34 days depend on species of *Raillietina* (Horsfall, 1938; Bartel, 1965). The prepatent period of *Raillietina* spp. are depended the various species; *R. echinobothrida* (19 days), *R. tetragona* (21 days), and *R. cesticillus* (25-85 days), respectively (Jones and Horsfall, 1935; Jones and Horsfall, 1936; Reid et al., 1938).

2.2.2: Epidemiology of *R. echinobothrida*

R. echinobothrida is transmitted by many kind of insects that is the feed of backyard chickens, therefore *R. echinobothrida* can be contaminated worldwide in domestic chickens. Overall the parasitic diseases are found in tropics and subtropics countries. Moreover, In India, the various regions have been reported of *R. echinobothrida* that was got infection in the domestic chickens (Malhotra and Capoor, 1982; Bhalya et al., 1984; Fotedar and Khateeb, 1986; Yadav and Tandon, 1991; Kulkarni et al., 2001). Currently study, differentiate place, free-range backyard chickens are seriously infection with gastrointestinal parasites, respectively (Katoch et al., 2012; Dar and Tanveer, 2013; Bhat et al., 2014). Moreover, seven species of cestodes found in free-range chickens in the Northeastern of Algeria. *R. echinobothrida* was highest found infection prevalence (Ilyes and Ahmed, 2013). Others authors have been investigated the infective cestodes that were high prevalence as well (Irungu et al., 2004; Mungube et al., 2008; Rayyan and Hindi, 2010). Otherwise, the parasitic infection in the farm chickens was low (Hassouni and Belghyti, 2006). However, the first report of free range chickens in of the various Iran contaminated with cestodes. Overall chickens were found the detection costodes that is moderate infection (Radfar et al., 2012; ShahrokhRanjbarBahadory et al., 2014; Yagoob and Mohsen, 2014). Nonetheless, In Nigeria, the backyard chickens are important for food of people in there, but backyard chickens are still high contamination with endoparasites. It had many researchers were reported, the differentiate areas of Nigeria (Luka and Ndams, 2007; Yoriyo et al., 2008; Ekpo et al., 2010; Nnadi and George, 2010; Ohaeri and Okwum, 2013; Junaidu et al., 2014; Idika et al., 2015). In addition, In Zimbabwe has been detected the highly parasitic diseases in domestic chickens. Ten species of GI parasites were seen from different region (Mukaratirwa et al., 2001; Mukaratirwa and Hove, 2009). In South and West Africa absolutely found 100% prevalence of parasites

that were infected in backyard chickens (Poulsen et al., 2000; Mwale and Masika, 2011). The mostly free-range indigenous chickens were high infection of *R. tetragona* and *R. echinobothrida,* (Mukaratirwa and Hove, 2009). However, the neighbor countries of Cambodia has been reported the prevalence of parasitic diseases of gastrointestinal tract in domestic chickens (Sangvaranond, 1994; Ayudhya and Sangvaranond, 1997; Schou et al., 2007; Rahman et al., 2009; Ngui et al., 2011).

2.2.3: Clinical signs and pathogenesis of *R. echinobothrida*

The backyard chickens was infected with *R. echinobothrida,* overall was the increase of among goblet cell, enlargement of epithelial cells villi in the intestinal organ. Some chickens has been seen the necrosis of endothelial cells convoluted tubules of kidney. Moreover the hydropic degeneration has had in the liver (Bahrami et al., 2012). Normally, the infective cestodes in chickens were caused nodule formation in the intestinal mucosa, ulceration, and rough mucosal layer of intestinal. The lesions of post-mortem is been had the enteritis, villous atrophy, and granuloma formation. The desquamation of submucosal gland and villi were shown. Moreover the cross examination can be have inflammatory vacuolation and reaction of epithelia cells (Anwar et al., 2000). However, the author has been investigated on the liver of chickens that has infected of cestode, is seen some hepatocytes undergone fatty change and hyperplasia of hepatocytes (Abed et al., 2014).

2.2.4: Diagnosis of *R. echinobothrida*

The faecal examination is useful to detect egg of cestode. Mostly, the flotation technique is using in the laboratory parasite to investigation of egg cestode. It is easy, quickly, and cheap but low intensity the detection egg cestode. Moreover, cestode can be identified by necked eyes on the feces, may be found mature gravid segment (Soulsby and Helminths, 1982; Soulsby, 1982; Mwale and Masika, 2011). Mostly, the identification of *R. echinobothrida* in chickens are required the post-mortem by using the cross examination technique in the intestinal tracts. Overall, the morphology of *R. echinobothrida* was identified under stareo microscope, find scolex, neck, and mature

gravid segment by following the procedure according to key book (Soulsby and Helminths, 1982; Khalil et al., 1994; Abdelqader et al., 2008).

2.2.5: Treatment and prevention of *R. echinobothrida*

Albendazole is antihelminthic drug, has had a broad spectrum to against on the endoparasites (Lalchhandama, 2010). Moreover, Oxfendazole has been effected to against on *Raillietina* spp. both, immature and mature 100% by using dose 20mg/kg (Nurelhuda et al., 1989). Nonetheless, the traditional drug has been useful to prevent endoparasite in domestic chickens. Since, author has been used *Securinega virosa* to deworm the *Raillietina echinobothrida*, had sensitive, paralysis of worm, and subsequent death (Dasgupta et al., 2013). Moreover, *Acacia oxyphylla* has been broad spectrum on cestode, caused the paralysis suddenly (Roy et al., 2012). The *Carex* is resveratrol that may be helpful like a therapeutic to against cestode parasites (Giri and Roy, 2014).

2.3: Nematodes

Many authors have been reported the nematodes of domestic chickens such as *Ascaridia galli, Heterakis gallinarum, Capillaria obsignata, Strongyloides, Trichuris, Gongylonima ingluvicola, Tetrameres fissispina, Tetrameres americana, Trichostrongylus tenuis,* (Sangvaranond, 1994; Abdelqader et al., 2008; Ekpo et al., 2010; Nnadi and George, 2010; Rayyan and Hindi, 2010; Mwale and Masika, 2011; Nghonjuyi et al., 2014). These parasites are widespread the worldwide. Moreover, the largest nematode in chickens is *Ascaridia galli*. Therefore *A. galli* is a common nematode found in the intestine of domestic chickens. The *A. galli* is frequently lived in small intestine of chickens therefore is still impact of economic loss on backyard, broiler, breeder, and layer chickens (Permin and Ranvig, 2001). *A. galli* is caused high prevalence and seriously pathogenic, especially in young domestic chickens (Luna-Olivares et al., 2015). When worm twists together in small intestinal, the feed could not intake and cause inhabits the small intestinal lumen, however, can be occasionally seen in organic free-range and modern layer chickens (Gauly et al., 2002; Kaufmann et al., 2011a; Kaufmann et al., 2011b). The life cycle of *A. galli* is two ways. There are called

the direct and indirect. Moreover, the indirect is needed the transport host to complete the life cycle.

2.3.1: The life cycle of *Ascaridia galli*

Ascaridia galli has different ways to complete the life cycle that are direct and indirect life cycle. In direct life cycle way is needed only the definitive host to complete this way. The adult worms are lived in small intestinal tract of chickens. Overall, eggs are passed into with faeces and throughout in environment that developed to infective state L_3 (Permin et al., 1997). The infective egg is highly the resistance into environment long term by thick shell of egg wall, that have three layers of wall egg (Ackert, 1931). Moreover, the larvae does not hatch in the environment, but it can be moulted inside of egg until it becomes to infective state. The most of fertilization egg is depended with weather, temperature and humidity; an optimal condition, 24 hours become to the first division two cell stage (Reid, 1960; Percy et al., 2012). After 24 hours, three and four cell stage has been seen in three days. Subsequently, the eggs are looked the blastomeral form which completed on fifth days. On the next 8 days, that called tadpole stage development and embryo. The more than three day after development of embryo stage, that is become to infective larvae (Ramadan and Wetmore, 1992). The life cycle of *A. galli* is completed when the infective eggs ingested by chickens throughout contaminated water or feed. L_3 was gone into the proventriculus, gezzard and duodenum where hatched within 24 hours (Claerebout and Vercruysse, 2010). The Temperature, carbon dioxide levels and pH are thought to be triggering factors. Follow the hatching, the larvae is penetrated into the mucosa layer of the intestine that become to histotrophic phase (Ackert, 1931). After this time, the larvae is leaved from mucosa layer and went to the small intestinal lumen. The larvae is developed to adult worm.

Indirect way: the complete cycle of *A. galli* must have the insects such as grasshoppers, beetles and earthworms especially *Lumbricus terrestris* as the transport host to complete its. The *Lumbricus terrestris* is ingested the feed containing infective stage of *A. galli* into alimentary canal. Therefore, the chickens is eaten earthworms that are contaminated with *A. galli* so the chickens is infected with disease and developed

to adult worm (Ramadan and Abouznada, 1992; Anderson, 2000). Furthermore, the *A. galli* live, feed and produce huge of eggs that is passed to the faeces and throughout into environment (Ramadan and Abouznada, 1992). The prepatent period of *A. galli* is variable from 5 to 8 weeks (Pankavich et al., 1974; Permin et al., 1998b).

2.3.2: Epidemiology of *A. galli*

Ascaridia galli is caused the heavy infective disease in young chickens which disorder was a broad in the world. The first case of *A. galli* has been reported in Italy and Mexico (Gómez Peña et al., 2009; Fioretti et al., 2010). The reports in a subtropical high-rainfall area of India was found many species of nematodes nematode included *A. galli* (Yadav and Tandon, 1991; Bhat et al., 2014). The different regions of Nigeria has been recorded the high contamination of nematodes in domestic chickens (Mikail and Adamu, 2008; Ekpo et al., 2010; Nnadi and George, 2010). In Iran from various area, the roundworms of infection was satisfied infection on backyard chickens but it is moderate infection (Eslami et al., 2009a; Mamashly et al., 2011a; Mansour et al., 2014; Yagoob and Mohsen, 2014). Moreover, GI parasites in free range chickens were influence in role raising poultry in North and West of Africa where high prevalent infection in backyard poultry production (Poulsen et al., 2000; Mwale and Masika, 2011). Furthermore, in Zimbabwe, the free-range chickens are had the high risk of parasitic disorders, the importantly parasitic infection is gastrointestinal parasites (Mukaratirwa et al., 2001; Permin et al., 2002; Percy et al., 2012; Tesfaheywet et al., 2012). Nonetheless, Thailand has been recorded the infection of GI parasite in domestic chickens, high prevalence (Sangvaranond, 1994; Ayudhya and Sangvaranond, 1997). Currently, Vietnam was found eight species of nematodes by (Schou et al., 2007). Furthermore, Scavenging was been nutritionally important but chickens were easy out parasites. Free range chickens have been identified to be severely infected with helminths especially nematodes and cestodes (Amin-Babjee et al., 1998; Magwisha et al., 2002). The infective *A. galli* have been occurred after ingestion the sporulated eggs or transport hosts including; cockroaches, grasshoppers, antes, and earthworms (Soulsby and Helminths, 1982). Unluckily, tropical and sub-tropical are known wet and dry like Southeast Asia countries effective with parasites full year. It is heavy infection roundworm parasites in fowl (Sangvaranond, 1994). Another reason of contaminated

parasites, litter of poultry can be caused infectiousness of intestinal roundworms; *A. gilla*, *H. gallinarum*, and *Capillaria* spp. (Maurer et al., 2009).

2.3.3: Clinical sign and pathogenesis of *A. galli*

The clinical sign of *A. galli* of backyard chickens were shown weight lost, pale ocular, and severe anaemia of oral mucous membrane. Moreover, the chickens were seen the abnormal dropping of wing, depress, and emaciation (Permin et al., 1998a; Bsrat et al., 2014). Moreover, the feces of chickens were had the blood-tinged diarrhea, loss of appetite, and chickens looking dropsy, head nodding downwards, shiver and dirty cloacal area (Adang et al., 2010). However, the chickens of experimental design was not shown the clinical signs (Schwarz et al., 2011a; Luna-Olivares et al., 2012; Das and Gauly, 2014; Luna-Olivares et al., 2015). The post-mortem of necropsy was shown the haemorrhagic intestine, thickened and oedematous wall. Therefore pin point granulation, multi foci caseous, and increasing fat accumulation in liver, heart, and abdominal cavity (Bsrat et al., 2014). Therefore, the necrotize liver, lung, heart, and intestine were had mononuclear and polymorphonoclear (Adang et al., 2010). The heavy infections, adult worms are sometimes seen in the oviduct and found in hen's eggs. Nevertheless, the worms are also seen in the chickens' feces (Jacobs et al., 2003).

2.3.4: Diagnosis of *A. galli*

The heavy infection of *A. galli* might be seen worms throughout with feces. Moreover, the Mc master technique are useful to diagnostic eggs of nematodes which qualitative method. The gratefully identified egg of *A. galli* is flotation technique to float eggs of parasites what cheap, fast, and easy method. However, the cross examination of intestinal organ of chickens are still necessary method for identifying *A. galli* when light infection that faecal examination sometimes may not observe to see under light microscope (Mwale and Masika, 2011; Tesfaheywet et al., 2012).

2.3.5: Treatment and prevention of *A. galli*

Ivermectin has been shown the high affection to against of *A. galli* worm that is used the subcutaneous infection at a dose 0.3 mg/Kg in the experimental infection in

chickens (Sharma and Bhat, 1990). Moreover, Levamisole was better drug for treatment and prevention of *A. galli* than *Punica granatum* peel by using oral administration, dose 30 mg/Kg and 1.5 mg/Kg (Sabri, 2013). Furthermore, antiparasitic drug, flubendazole was showed an absolutely high efficacy 100% to against, the natural infections of roundworms in chickens (Squires et al., 2012). However, a traditional medicines are the best treatment and prevention of the parasitic infection in backyard chickens. Overall the owners can save money for economic. Many studies were used plant to control the parasitic disorders. The *Citrus* peel was significant of against the contamination of *A. galli* in the experimental chickens (Abdelqader et al., 2012). However, *Acacia oxyphylla* was efficacy to against *A. galli* by using concentration solutions, therefore caused the mortality of *A. galli* (Lalchhandama et al., 2009). In another study was reduced 76-77.5% of *A. galli* by *Tephrosia vogelli* and *Vernonia amygdana* leaves.

2.4: *Heterakis gallinarum*

Heterakis gallinarum is one kind nematode parasites that lives in the cecum of poultry, the particularly high contamination with ground feeders of chickens such as domestic chickens and turkeys. *H. gallinarum* is caused the high prevalence, but is mildly pathogenic. However, *H. gallinarum* is mostly carried out a protozoan parasite *Histomonas meleagridis* which can cause of histomoniasis, blackhead disease (Lund et al., 1975; Das et al., 2011; Schwarz et al., 2011b). The transmission of *Heterakis meleagridis* is by ingestion of the egg. *H. gallinarum.* Normally, morphology of *H. gallinarum* is approximately 1 to 2 cm in length with sharply pointed tail and a preanal sucker (Permin and Hansen, 1998). The life cycle of *H. gallinarum* is the direct way.

2.4.1: The Life cycle of *H. gallinarum*

H. gallinarum is parasitic location in caecum lumen of chickens. Overall the life cycle of *H. gallinarum* is a direction within definitive hosts. The maturity of *H. gallinarum* is produced unembryonated eggs into feces and throughout environment. Moreover, an optimal temperature and humidity of eggs are become infective in 12 to 14 days and can survive in soil several years. Furthermore, the temperature and climate

are influenced of embryonated eggs of *H. gallinarum.* Normally, embryonated egg is significant on the life cycle when the temperature between 12- 22^0C (Saunders et al., 2000). Additionally, variable climate is able to affected the prevalence and intensity of helminthes especially zoonotic helminthiasis (Mas-Coma et al., 2008). However, embryonated egg or infective stage is ingested by chickens with contaminated food or water. Therefore the embryonated egg is swallowed and hatched into the gizzard of duodenum, and trough directly to the caecum lumen that is developed to adult of *H. gallinarum*. Either some of larvae of *H. gallinarum* are entered the mucosa. In another hand, earthworm and houseflies are considered paratenic host; the egg of *H. gallinarum* can be ingested by intermediate host and hatched in tissues then developed into juvenile stage which stayed in dormant until chickens are eaten (Permin and Hansen, 1998). The prepatent period time is 24 to 30 days (Das et al., 2014).

2.4.2: Epidemiology of *H. gallinarum*

H. gallinarum is the parasitic disorder that located in caecem lumen of chickens, and distributed worldwide. Recently study of nematiasis in native chickens were higher prevalence that infect association with *H. gallinarum.* In 2006, Brener was observed of nematodes in the turkey, Maleagris galloparo, Brazil, overall evidence showed highest infection of *H. gallinarum* 70% in the turkey (Brener et al., 2006). Currently investigate, the determination of prevalence endoparasitic infection in free range chickens were observed moreover the eggs of nematodes found 32.7% while *H. gallinarum* (5.7%) (Tomza-Marciniak et al., 2014). In the prevalence of endoparasitic helminth in Bangladesh, the evidence of different species of nematodes were seen including *H. gallinarum* in indigenous chickens (Alam et al., 2014). Another study was observed the prevalent nematode in free-range laying hens by relation of housing and husbandry, overall the evidence of faecal examination was found the highest infection of *H. gallinarum* (Sherwin et al., 2013). Moreover, the grower chickens are susceptible than adult chickens in free-range chickens in Morocco (Magwisha et al., 2002). In addition, a prevalence of *H. gallinarum* in birds slaughter house in Makurdi Township, the various breeds were the different prevalence, domestic chickens, broiler chickens and layer chickens (72.5%, 42.9% and 9%), respectively (Ogbaje et al., 2012). Furthermore, survey on the intestinal helminthiais in broiler breeders in southeastern

United States, overall *H. gallinarum* was high prevalence of infection (Yazwinski et al., 2013).

2.4.3: Clinical sign and pathogeneses of *H. gallinarum*

The infected *H. gallinarum* was related the clinical signs included; weight lost, ruffled feathers, depression (Schwarz et al., 2011b). However, post mortem was seen the enlargement of caecum lumen, the nodules on the mucos of caeca. Overall diffuse chronic typhlitis and associate mononuclear cells infiltration. Whatever, the microscopic lesion was observed the cecal chronic deffuse inflammation related to mononuclear and polymorphonuclear, leucocytes infiltration, mucosa and sub-mucosa saw edema (Brener et al., 2006; Halajian et al., 2013). However, co-infection of *H. gallinarum* and *Histomonas meleagridis* were shown formation of fibrinous develop to fibrinohaemorrhagic exudation in the caecal lumen, the focal hepatic necrosis, and lesions on the caeca. Moreover, mixed infection of *H. gallinarum* with *H. meleagridis* were appeared the severe and extensive granulomatous inflammation, giant multinucleate cells of infiltrilation (Schwarz et al., 2011b; Halajian et al., 2013).

2.5: Protozoa

Many species of protozoas are caused the infection in domestic chickens and broiler chickens. Moreover, coccidia disorder is still caused diseases in chickens by differentiate species of parasitic protozoan, the genus *Eimeria* overall coccidiosis is still a majority of economic impact in worldwide (Morris and Gasser, 2006; De-Gussem, 2007; Siddiki et al., 2008). Moreover, the variable regions *Eimeria* caused disorder in backyard and broiler chickens at least 5 species (Haug et al., 2008; Molla and Ali, 2015). Additionally, *Eimeria tenella* is the most virulent pathogens of coccidiosis in young chickens and association with others pathogens that caused necrotic enteritis (Michels et al., 2011a; Shen et al., 2012; Burt et al., 2013; Bangoura et al., 2014).

2.5.1: The life cycle of *Eimeria tenella*

The life cycle of *Eimeria* species have three phases that involve sporulation, schizogony, and gametogony. Overall sporulation is infective transmission of

sporulated oocysts, schizogony is asexual stage what merogony amplify in the intestine, and gametogony is sexual stage (Chapman and Jeffers, 2014). Therefore life cycle of *E. tenella* in chickens are started when definitive hosts became to consume the feed or water that contaminated with sporulated oocysts. After swallowing into esophagus of chickens, the oocysts throughout in the gizzard is become rupture and the sporozoite is escaped from the sporocyst in the small intestine making the way to the large intestine (cecum) (Tabares et al., 2004). Moreover, sporozoite is invaded and passed into epithelial cells where place the developed sporozoite is become a trophozoite and underwent considerable growth. In the next, trophozoite is multiplied to merozoite, which is occurred giving rise to the first generation oocyst that eventually broke out into the intestinal lumen of the caecum. Some of these merozoites are entered caecal epithelial cells produced the second merozoite generation. Additionally, merzoite is ultimately gave rise to the third generation of merozoites. On another hand, third generation merozoites are penetrated deeply to epithelial cells of the caecum and underwent to gametogonical stage. Both macro- and microgametocytes are produced with the microgametes which eventually entered cells containing macrogametes, allowing for the fertilization stage to the young zygote and developed to mature zygote. The last one, the zygote is released from epithelial cell into faeces and throughout in environment then become unsporulated oocyst (Shirley et al., 2005). The prepatent period of *Eimeria* is depended on variable species; *E. tenella* (138 hrs), *E. acervulina* (97 hrs), *E. mitis* (99 hrs), *E. maxima* (123 hrs) and *E. necatrix* (138 hrs), (Edgar, 1955).

2.5.2: Epidemiology of *E. tenella*

Eimeria is mostly distributed worldwide especially in tropical and subtropical regions such as Haiti, Mexico, Brazil, El Salvador, Venezuela, and Southeast Asia (Chai et al., 2005; Shirley et al., 2005). All breeds and ages of chickens are sensitive to contamination with coccidiosis. However, immunity has been developed after mild contamination of *Eimeria* spp. normally young chickens are high susceptible infection of *Eimeria* spp. Moreover, outbreak of disease are investigated around 3-6 weeks of age, and seldom see in chickens flocks at less than 3 weeks. Overall the evidence of contamination may be seen 1 week of age (McDougald and Reid, 2003). However, the disease is occurred in chickens where owner raised in broiler house several years.

Reports of coccidia in broilers house in Georgia has been showed that oocysts of coccidian build up during growth of flock. Coccidiosis rarely infected in layers and breeders because result immunity (Forrester et al., 1987; Velkers et al., 2012; Gyorke et al., 2013).

However, coccidiosis may be transmitted by chickens to other chickens whereby chickens shed feces that have oocysts. Oocysts became infective stage in flock whenever others chickens are swallowed the oocysts on litter or the contaminated food or water. Moreover, oocysts may be spread by many mechanic of differentiate animals, insects, contaminated equipment, wild birds, and dust. Therefore oocysts were resistant to environment and to disinfectants. Overall, oocysts can survive for several weeks in land, nonetheless in litter only 2-3 days because of the heat and ammonia released by decaying of litter and activity of molds and bacteria of dust inside and outside broiler houses have been showed oocysts and include insects in poultry litter (Forrester et al., 1987; Ali et al., 2014). Transmission from one farm to another farms are facilitated like movement of personnel and equipment between farms and also wild chickens migrates. New farm can be free of *Eimeria* ssp. for the first raising. The weather can be destroyed sporozoites and sporocysts when weather approximately 37 ^{0}C can survive 2-3 days but when 55 ^{0}C or freezing kills oocysts suddenly (McDougald and Reid, 2003). Currently study, the seasonal weather was impact to the infection of coccidiosis in domestic and broiler chickens (Awais et al., 2012; Ahad et al., 2014; Sreedevi et al., 2014). Recently study of prevalence of *Eimeria* spp. have been reported from variation regions in the world that were the highly prevalent infection on native and broiler chickens (Hadipour et al., 2011; Shirzad et al., 2011; Velkers et al., 2012; Gyorke et al., 2013; Luu et al., 2013; Ali et al., 2014; Thenmozhi et al., 2014).

2.5.3: Clinical signs and pathogenesis of *E. tenella*

The infection of *Eimeria tenella* in chickens were shown clinical signs the ruffled feather, weakness in young chickens, severe diarrhoea and anorexia, mild of appetite, and weight lost, however the severe infection saw haemorrhagic diarrhoea in the feces of chickens (Kimbita et al., 2005; Ogbe et al., 2009; Alnassan et al., 2014). Moreover, a young chickens were the more susceptible than old chickens of the natural

infection (Al-Quraishy et al., 2009). Nonetheless, the post-mortem of chickens were investigated the inflammatory epithelial cells of cecum, the frequently flattened and damaged mucosa and an epithelial cells loos. Normally a necrosis and anabrosis of the mucosal layer in patches of the superficial epithelial cells were seen in the high magnification (Zhou et al., 2010). In another hand, the histopathology of infected chickens has been observed a slight thickening villi, saw eosinophils in lamina propria, an infiltrative cells. Moreover, the inflammation and haemorrhage of the lamina propria and caecal lumen were seen after the infection 3 days, and became into per acute haemorrhage of the caecitis mucosa including submucosa. Furthermore, after 6 days of infection the inflammation and haemorrhage of muscular layer were seen core formation in the lumen. The schizont and gamete saw in the villus epithelium and crypt therefore was caused a severely aggravated lesions of immature fibrobrast involving haemorrhages submucosa. However, the chronic infection was investigated after post infection 8 days that lesions saw ulcerative caecitis and hyperplasia of epithelial cells (Siddiki et al., 2008).

2.5.4: Diagnosis of *E. tenella*

Coccidiosis in chickens are the intestinal tract of diseases which have different species of protozoa parasites, have genus *Eimeria* and various species. Moreover, the species of *E. tenella* is an effective parasites that main reasons is still a majority of problem in backyard and commercial chickens. While the traditional techniques are had the majority of limit diagnosis of coccidiosis (Morris and Gasser, 2006). Frequently, oocyst count and lesion scoring are the available diagnosis techniques but the interpretation data is still complex, not are easy (De-Gussem, 2007). However, the size and shape oocysts of *Eimeria* various species and lesions of characteristic intestine can be devised the different species of *Eimeria,* while information of pre-patent period and immune responding have been distinguished (Shirley et al., 2005; Morris and Gasser, 2006). In addition, an independent diagnosis of conventional methods in coccidiasis is regarded to human skilling because the infection can be co-infection of *Eimeria* or mixed infection within others pathogens that can caused enteritis. On other hand, the molecular techniques are very useful to identify various species *Eimeria.* It is best

method of quality and quantity of *Eimeria* species (Morris and Gasser, 2006; Zhang et al., 2012; Giannenas et al., 2014; Gadelhaq et al., 2015; Han et al., 2015).

2.5.5: Treatment and prevention of *E. tenella*

Coccidiosis is the intestinal diseases that caused enteritis of intestinal tracts. The main impact of cocidiosis is caused loss very year in the world while in 1995 in UK lost $59.03 million (Williams, 1995; Williams, 2005; Morris and Gasser, 2006). Therefore the researchers are found the medicines or vaccine to treatment and preventions of eimeriosis. Sulfonamides are regarded old synthetic antibacterial but still effective in the treatment of *Eimeria* spp. in chickens (Laczay et al., 1995; Campbell, 2008). Moreover, the salinomycin and monensin were sensitive to against the sporozoites of *Eimeria tenella* (Jenkins et al., 2014). However, the controlled program is used in commercial chickens to prevent by using chemotherapeutic agent. Whereas diclazuril was used to decreased of damage in caecal lumen in infected chickens of *Eimeria tenella* (Tian et al., 2014). Additionally, vaccination of eimeriosis has been effected to control the mixed infection of necrosis enteritis in chickens (Bangoura et al., 2014). Furthermore, the layer chickens are raised long time in the pens overall it is easier to contaminate with eimeriosis therefore owner should be used disinfection and sanitation however these protocols is not enough to prevention, whenever must be done the vaccination (Chapman and Jeffers, 2014).

CHAPTER III
MATERIAL AND METHOD

3.1: Material and Method

3.1.1: Study area

The land of Cambodia is divided into four distinct parts; I) Plateau and Mountain region, this area is northern and western of Cambodia. II) Coastal region, this area is southwestern of Cambodia. III) Tonle Sap Lake region, this side is province around Tonle Sap Lake. IV) Lowland region, this area is nearly Vietnam border and around Phnom Penh capital city. The last region had been collected samples from five provinces and each provinces were chosen four market (Ministry of Environment, 2009).

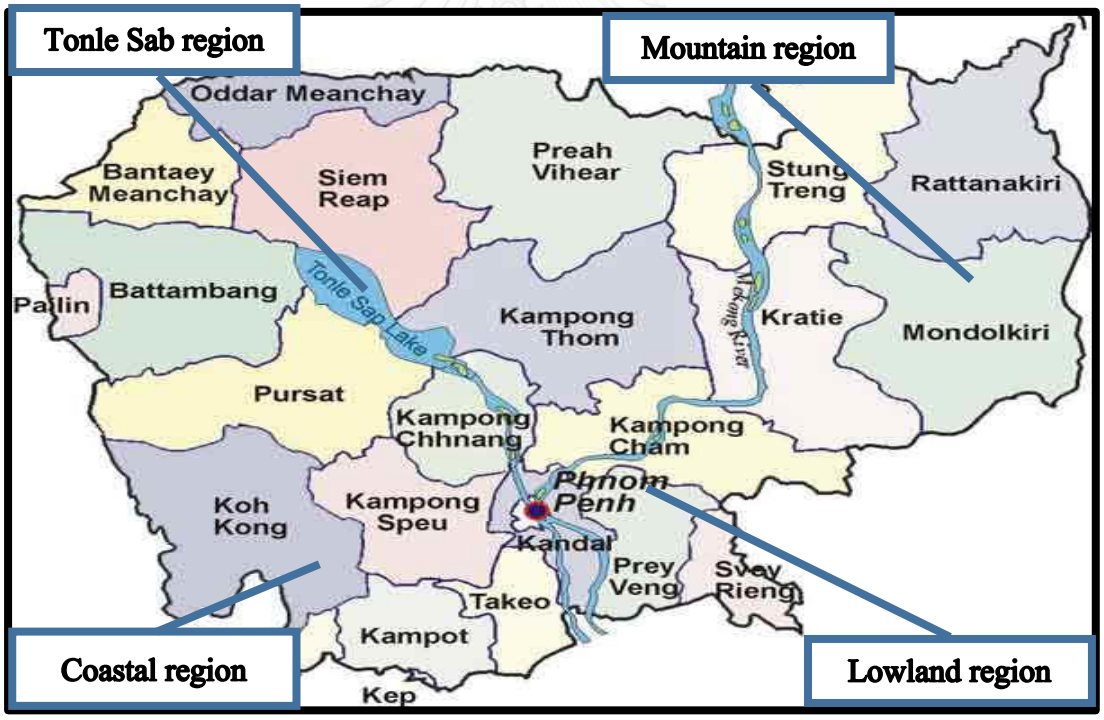

Figure 1: The map of Cambodia

3. 2: Population size

3.2.1: Sample size

The sample had been estimated from population of domestic chickens in each provinces surrounding Phnom Penh by followed the data of domestic chickens Department of Animal Product and Health in 2012. All provinces, samples had been calculated following the formula of Yamane (1967:886) as below.

$$n = \frac{N}{1 + N(e)^2}$$

n = the sample size of domestic chickens
N = the population size of domestic chickens each province
e = the acceptable sampling error

3.2.2: Criteria of simple collection

Five hundred nine samples of gastrointestinal organs (oesophagus, crop, proventriculus, gizzard, small intestine and cecum) domestic chickens (*Gallus domesticus L.)* of different ages and breeds of domestic chickens had been collected from provinces around Phnom Penh. The chickens were randomly purchased from different local regions from domestic chickens sellers in the slaughter houses. The samples of chickens had been brought to the Laboratory Parasitology of Division of Research and Extension of the Royal University of Agriculture and Parasitology unit, Faculty of Veterinary Science, Chulalongkorn University. The samples were collected during April 2014 to February 2015. These samples were examined to find the parasites.

3.2.3: Gross examination of internal organ

All of GI tracts samples from slaughter house were cleaned with tap water. The gastrointestinal organs were prepared on the tray. The gastrointestinal organs were separated the oesophagus, crop, proventriculus, gizzard, small intestine and caecum. All parts of intestinal organs were opened with scissor. The first large worms were looked by necked eyes, and used forceps to pick up worm and put into petri dish

containing normal saline solution. Moreover, small worms, the gastrointestinal organ was cut about 2-4 centimeters and put into glass bottle, and added tap water then shook them strongly about 3 minutes. The specimens were passed on the sieve and took small pieces of intestine throughout, and transferred specimen into petri-dish that has normal saline solution and then looked under the stereomicroscope. The worms were cleaned by clean hair brush with normal saline two or three time (Soulsby, 1982; Phiri et al., 2007).

Figure 2: The gastrointestinal tract of domestic chickens

3.3: Collection of fecal sample:

The feces was collected from caecum and kept in plastic bag and clearly mark with the time and data of collection. All the samples were kept at 4 ^{0}C to slowdown or stop the development of parasites.

3.3.1: Faecal examination

3.3.1.1: Simple flotation method:

Faecal simple flotation method is quantitative technique for the examination of nematode eggs, cestodes eggs, coccidial oocysts and larvae and that of fecal debris. However, simple flotation can be found egg of trematode (*Notocotylus* spp.). The goal of the technique is to float the egg of parasites to the top of the tube and adhere the coverslip then remove the coverslip and put on the light microscope.

The procedure of method:

For simple flotation method, the first was taken about 2 g of feces from the caecum chickens and put feces into the plastic cup. Add about 30 ml of saturated salt solution, using a tongue depressor, then that was made an emulsion by thoroughly mixing the solution with the feces until no large pieces of feces remain. The solution was poured into another plastic cup what cover with sieve. The solution was transferred from plastic cup into the centrifugal tube until slightly overfill it. Coverslip was allowed to remain undisturbed on top of the centrifugal tube for 5-10 minutes. If remove before this time all of the eggs may not have time to float to the top. The coverslip was carefully removed, picking it straight up, then was place it on the glass slide. When placing it on the glass slide, be sure to hold the coverslip with one edge tilt slightly up and had been allowed it to settle level on the slide gradually. This was avoid air bubbles under the coverslip. The final was examined the area of the slide under the coverslip with a light microscope with 10 x objective, 40 x objective.

3.3.1.2: Simple sedimentation method:

The faecal simple sedimentation is qualitative technique for examination and identification of trematodes eggs. However, it can be detected egg of nematodes, cestodes and together coccidial oocysts, either it is not good as flotation. Mainly sedimentation is used to detect eggs and cysts that flotation cannot float it. Sometimes fluke eggs are larger or smaller then roundworm and some fluke eggs can float or cannot

float. The problem is gravity solution that using highly so fluke eggs can be damaged that become hard to identify.

The procedure of method:

First of all, the simple sedimentation were taken about 2 g from the caecal lumen of domestic chickens put into a plastic cup. That was added about 30 ml of tape water and mixed faecal sample, and water thoroughly with glass stirring rod then through into another plastic cup, cover with sieve. After filtrated, the supernatants were transferred into sedimentation flask and allowed the sediments about 30 minutes. Poured off the supernatant about 2/3 Sediments were throughout the upper part and added more tape water one or two time to make the specimen clearly. Pour off the supernatant without disturbing the sediment and then using pipette transfer a small drop of sediment to put on the glass slide and place a cover slide on the drop of sediment and examination the sediment under the light microscope with 10x objective lance.

3.4: Worm identification

3.4.1: Microscopic examination

All nematodes, cestodes and trematodes were examined under stereo and light microscope.

3.4.2: Aceto Acetic Carmine staining

3.4.2.1: Nematodes

Small worms were identified by the morphology under light and stereo microscope. First step: kill the worms with hot 10% formalin washed in normal saline 2 or 3 times and transferred to glass slide contain small drop of lactophenol and put a coverslip on top and examined by looking the morphology under light stereo microscope.

3.4.2.2: Trematodes and cestodes

For successful whole mounts of worms, live specimens should be used. Before fixing procedures it is recommended to clean and remove all mucus and debris from the parasites by swirling in tap water 2-3 times until it clean.

Procedure of method

Each fluke or tapeworm was separated and transfer into petri-dish with normal saline and kept in refrigerator and let the worms relaxed overnight.

Prepare specimen for identification:

Entire tapeworm was cut into scolex, mature segmented and gravid segmented. Fluke was used the whole body. The thick worm were compressed between 2 glass slides with the internal organ with rubber band and the compress worm fixed in AFA about 10-24 hrs. Remove the worm from glass slide by passing with tape water. Wash the worm 2-3 times with tape water and transfer into petri-dish containing 70% alcohol. After washing the next step, specimens were kept into Semichon's carmine working solution and allowed specimen to stain overnight (12-24 hrs). Furthermore, the next, specimens were decolored in 70% alcohol acidified with few drops of 1N HCl to remove the excess of stain. For specimen about 2-3 cm, destaining should be usually accomplished in around 30 minutes. Specimens were cleaned in several times with solution changes of 70% alcohol until the stains were no longer washed out. Worms were dehydrated in successive changes of series alcohol (50%, 70%, 80%, 90%, 95% and absolute alcohol), and each staining had about 30 minutes. Specimens were cleared in methyl salicylate until the worm sink to the bottom. Worms were transferred to two changes of xylol. Specimens were mounted on slide and covered with permount after that covered with coverslip. Add the end the specimens were let dry in 37 ^{0}C in oven, at least 2 days to accelerate the hardening process of the mounting medium. The staining specimens were examined and identify under light and stereo microscope and used the key book for identified species (Soulsby and Helminths, 1982).

3.5: Data analysis

The study of prevalent infection was estimated for each GI parasites per market as follow the formula below:

$$\textbf{Prevalence(\%)} = \frac{\text{Number of infected domestic chickens}}{\text{Total number of domestic chickens were examined}} \textbf{ x 100}$$

Figure 3: The morphology of cestode and nematode in peptri dish contain normal saline by using gross examination

Figure 4: The morphology of *Heterakis gallinarum* eggs had thick and smooth shells by using simple flotation

CHAPTER IV

RESULTS

4.1: The location of study

In this study, survey and identification of gastrointestinal parasite of domestic chickens (*Gallus domesticus L.)* in lowland of Cambodia, The collecting of samples were started during April 2014 until February 2015(table 4.1).

A survey of GI parasites in domestic chickens in lowland of Cambodia were conducted in 5 provinces. In this study was collected the gastrointestinal tracts and feces (509 and 409 samples) from nineteen local butcher house markets. All samples were brought to laboratory of Division of Research and Extension (DRE) of Royal University of Agriculture (RUA) in Cambodia. All sample were cleaned with tap water 2-3 times. The samples were separated oesophagus, crop, proventriculus, gizzard, small intestine and caecum. All organs opened with scissor.

Table 1: The number of specimen and area were collected the specimen in lowland of Cambodia

N_o	Provinces	Market	GI tracts	Feces
1	Takeo	Donkeo	25	ND
		Samroung	27	ND
		Angtasoum	25	ND
		Angkor Borei	23	ND
2	Kampong Speu	Sangkarsei	20	20
		Udong	32	32
		Chbamon	50	50
3	Kandal	Kor Kee	35	35
		Saang	25	25
		Kor Thum	15	15
		Takhmeo	30	30
4	Prey Veng	Neak Loeung	35	35
		Prey Veng	20	20
		Bar Phnom	27	27
		Phea Rang	20	20
5	Kampong Cham	Being Kork	35	35
		Phsa Chen	30	30
		Phsa Sakhun	25	25
		Phsa Phaav	10	10
	Total		509	409

4.2.1: The prevalence of GI parasitic worms in domestic chickens (*Gallus domesticus* L.*)* lowland of Cambodia

The gastrointestinal parasitic diseases were highly infected in domestic chickens (*Gallus domesticus L.*) in lowland of Cambodia (table 4.2).

Table 4.2: The prevalence of GI worms in domestic chickens (*Gallus domesticus* L.) lowland of Cambodia

N_0	Provinces	Markets	N	Positive	Prevalence (%)	Total Prevalence (%)
1	Takeo	Donkeo	25	20	80.00	
		Samroung	27	24	88.88	
		Angtasoum	25	23	92.00	
		Angkor Bore	23	18	78.26	85.00
2	Kampong Speu	Sangkarsei	20	20	100	
		Udong	32	28	93.75	
		Chbamon	50	49	98.00	91.17
3	Kandal	Kor Kee	35	33	94.28	
		Saang	25	24	96.00	
		Kor Thum	15	14	93.33	
		Takhmeo	30	30	100	96.19
4	Prey Veng	Neak Loeung	35	35	100	
		Prey Veng	20	19	95.00	
		Bar Phnom	27	27	100	
		Phea Rang	20	19	95.00	98.03
5	Kampong Cham	Being Kork	35	35	100	
		Phsa Chen	30	30	100	
		Phsa Sakhun	25	23	92.00	
		Phsa Phaav	10	9	90.00	97.00
	Total		509	483		94.89

In lowland region of Cambodia, the parasitic diseases were high prevalence in backyard chickens. The total 509 samples were found 94.89% (483/509) of different type of gastrointestinal parasites. Moreover, some places of this study showed 100 percent such as; Sankarsei, Takhmou, Neak Leoung, Ba Phnom, Beng Kork, Phsa Chenn and others markets as Chbamon (98.05), Saang (96.00%), Prey Veng and Pea Rang (95.00%), Kor Kee (94.28%), Udong (93.75%), Kor Thum (93.33%), Phsa Skun and Angtasoum (92.00%), Samroung (88.88%), Donkeo (80.00) and Angkor Borei (78.26%) respectively. Nevertheless, the highest province has infected that is Prey Veng (98.03%) followed by Kampong Cham (97.00%), Kandal (96.19%), Kampong Speu (91.17%) and Takeo (85.00%).

4.2.2: The GI parasites identification in domestic chickens in lowland region of Cambodia

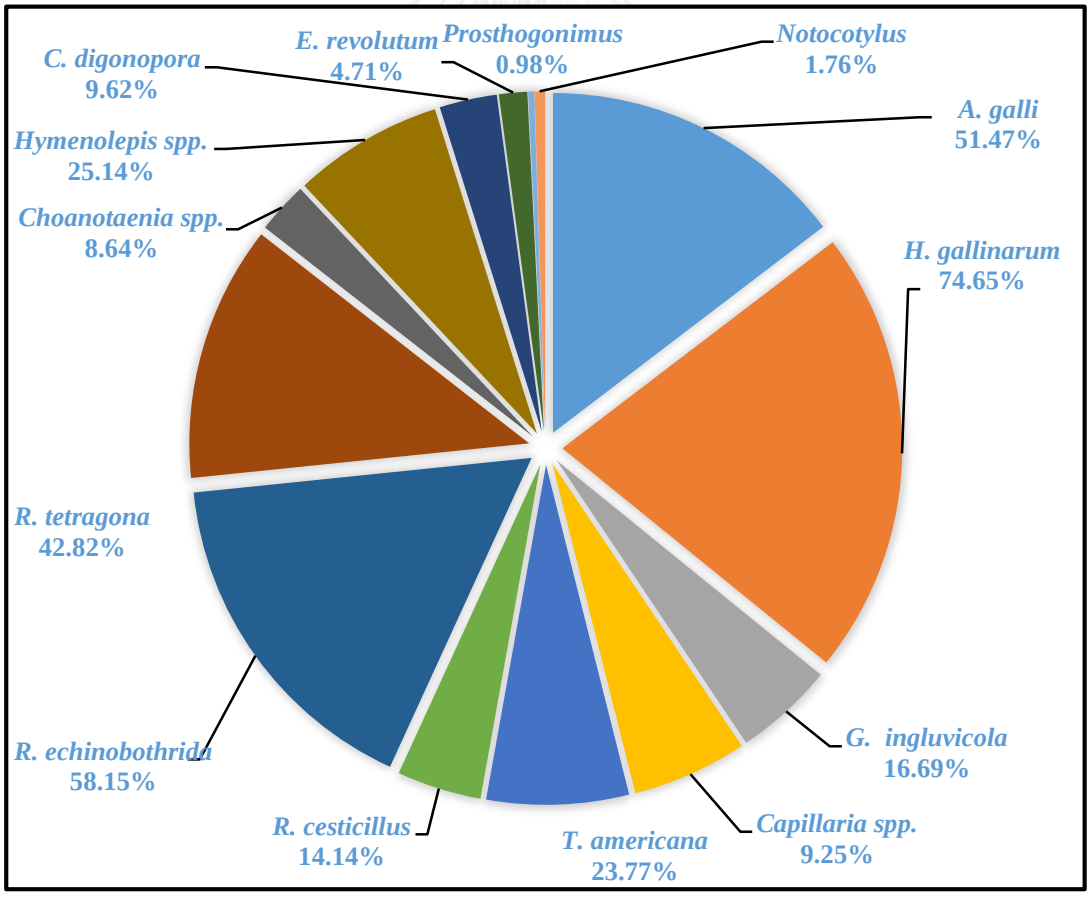

Figure 5: The GI parasites identification in domestic chickens in lowland region of Cambodia

The result showed the different prevalence of GI parasite in backyard chickens. In this study, parasitic identification had three kinds of parasites such as nematodes, cestodes and trematodes. The most common nematode species were *H. gallinarum* (74.65%), followed by *A. galli* (51.47%), *T. americana* (23.77%), *Capillaria* spp. (19.25%), *G. ingluvicola* (16.69%), and cestode speies were *R. echinobothrida* (58.15%), whereby *R. tetragona* (42.82%), *Hymenolepis* spp. (25.14%), , *R. cesticillus* (14.14%), *C. digonopora* (9.62%), *Choanotaenia* spp. (8.64%), while the trematode species were the light prevalence which had *E. revolutum* (4.71%), *Notocotylus* (1.76%) and *Prostogonemus* (0.98%).

4.2.3: The faecal examination of GI parasites in domestic chickens (*Gallus domesticus* L.*)* lowland of Cambodia

The faecal examination of GI parasites were detected eggs and oocyst. The domestic chickens (*Gallus domesticus L.*) in lowland of Cambodia were infected the high prevalence of gastrointestinal parasite.

Table 4.3: The prevalence of faecal examination in domestic chickens (*Gallus domesticus* L.) lowland of Cambodia

N_o	Provinces	Markets	N	Positive	Prevalence	Total (%)
1	Kampong Speu	Sangkarsei	20	19	95.00	
		Udong	32	20	75.00	
		Chbamon	50	40	80.00	80.38
2	Kandal	Kor Kee	35	34	97.14	
		Saang	25	24	96.00	
		Kor Thum	15	15	100	
		Takhmeo	30	30	100	98.09
3	Prey Veng	Neak Loeung	35	34	97.14	
		Prey Veng	20	20	100	
		Bar Phnom	27	26	96.29	
		Phea Rang	20	19	95.00	97.05
4	Kampong Cham	Being Kork	35	35	100	

	Phsa Chen	30	29	96.66	
	Phsa Sakhun	25	22	88.88	
	Phsa Phaav	10	10	100	96.00
Total		409	380		92.90

The total 409 samples found 92.90% (380/409) of eggs and oocysts in the faeces of domestic chickens (*gallus domesticus L.*) in lowland of Cambodia. In addition, some places had the highest prevalence of eggs and oocysts parasite full 100% such as; Kor Thum, Takhmou, Prey Veng, Beng Kork and Phsa Paav (100%) and others places were Kor Kee and Neak Leoung (97.14%), Phsa Chenn (96.66%), Ba Phnom (96.29), Saang (96.00%), Sankarsei and Pea Rand (95.00%), Phsa Skun (88.88%), Chbamon (80.00%) and Udong (75.00%), respectively. Nevertheless, the highest province was infected the eggs and oocysts that are Kandal (98.09%), Prey Veng (97.05%), Kampong Cham (96.00%) and Kampong Speu (80.38%), respectively.

4.2.4: The faecal examination in domestic chickens in lowland region of Cambodia

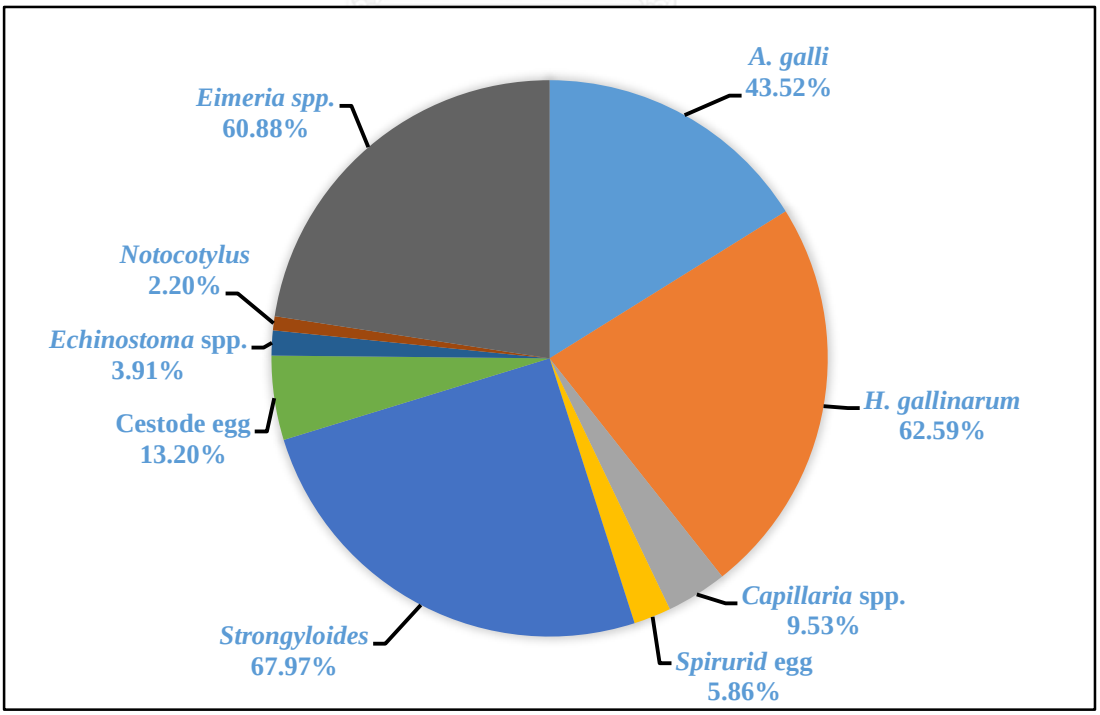

Figure 6: The faecal examination in domestic chickens in lowland region of Cambodia

The faecal examination in domestic chickens found the three kinds of helminthes eggs such as nematodes, cestode, tremotode eggs, and one kind protozoa oocyst (*Eimeria* spp.). The common nematode species eggs were *Strongyloides* (67.97%) whereby *H. gallinarum* (62.59%), *A. galli* (43.52%), *Capillaria* spp. (9.53%), Spirurid egg (5.86%). cestode egg (13.20%), while the common trematode species eggs had *E. revolutum* (3.91%) and *Notocotylus* (2.20%). The protozoa was the high prevalence by incidence 60.88% of *Eimeria* spp.

4.3.1: The prevalence of GI parasitic worms in domestic chickens (*Gallus domesticus L.)* in Kampong Speu province

Table 4.4: The prevalence of GI worms in domestic chickens (*Gallus domesticus* L.) in Kompong Speu province

Endoparasites	Organ of infection	Sangkarsei (%)	Udong (%)	Chbamonn (%)	Total (%)
A. galli	sm int.	38.00	46.87	35.00	39.95
H. gallinarum	caecum	90.00	62.90	25.00	21.54
G. ingluvicosa	crop	24.00	15.62	25.00	21.54
Capilliria spp.	sm int., crop	12.00	12.50	15.00	13.16
T. americana	proventriculus	26.00	21.87	20.00	22.62
R. cesticillus	sm int.	24.00	12.50	40.00	25.50
R. echinobothrida	sm int.	68.00	65.62	90.00	74.54
R. tetragona	sm int.	46.00	46.87	70.00	54.29
Hymenolepis spp.	sm int.	2.00	18.75	40.00	20.75
Choanotaenia spp.	sm int.	4.00	6.25	10.00	6.75
C. digonapara	sm int.	10.00	9.37	20.00	13.12
Mixed infection	sm int.	100	93.33	94.00	95.77

The total 102 samples from Kampong Speu province were found five species of nematodes and six species of cestodes that were infected in domestic chickens. The most common worms were found in each areas in Kampong Speu province such as; the nematodes are *A. galli* 39.95% (Udong 46.87%, Sangkarsei 38.00% and Chbamann

35.00%), *H. gallinarum* 77.50% (Sangkarsei 90.00%, Chbamann 80.00% and Udong 62.90%), *G. ingluvicosa* 21.54% (Chbamann 25.00%, Sangkarsei 24.00% and Udong 15.62%), *Capillaria* spp. 13.16% (Udong 15.00%, Chbamann 12.50 and Sangkarsei 12.00%) and *T. americana* 22.62% (Sangkarsei 26.00%, Udong 21.87% and Chbamann 20.00%), meanwhile, the cestodes were found including *R. cesticillus* 25.50% (Chbamann 40.00%, Sangkarsei 24.00% and Udong 12.50%), *R. echinobothrida* 74.54% (Chbamann 90.00%, Sangkarsei 68.00% and Udong 65.62%), *R. tetragona* 54.29% (Chbamann 70.00%, Udong 46.87% and Sangkarsei 46.00%), *Hymenolepis* ssp. 20.25% (Chbamann 40.40%, Udong 18.75% and Sangkarsei 2.00%), *Choanotaenia infumdibulum* 6.75% (Chbamann 10.00%, Udong 6.25% and Sangkarsei 4.00%) and *C. digonopora* 13.12% (Chbamann 20.00%, Sangkarsei 10.00% and Udong 9.37%). Moreover, the mixing infection was 95.77%. However, the mixing infection was different prevalence from others markets; Sangkarsei (100%), Chbamann (94.00%) and Udong (93.33%) respectively.

4.3.2: The percentage male and female of nematodes in domestic chickens in Kampong Speu province

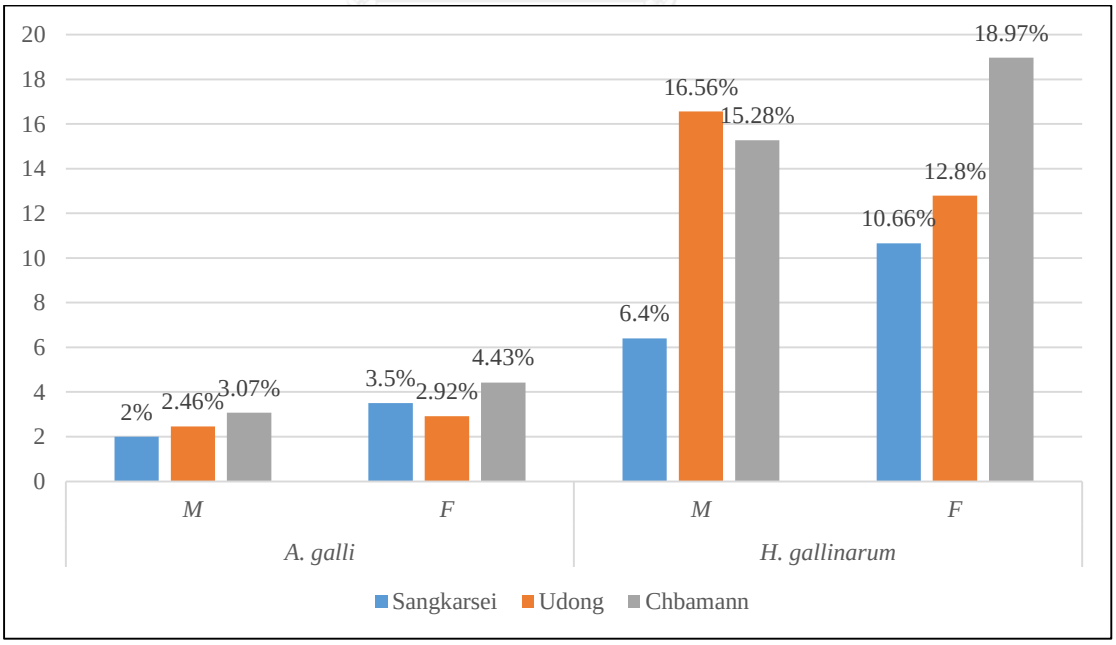

Figure 7: The percent of sexual *A. galli* and *H. gallinarum* in Kampong Speu province

The figure 7 showed percentage of male and female of nematodes from different markets. The highest percent of male *A. galli* was in Chbamann market (3.07%) and the lowest at Sangkarsei market (2.00%) and also the highest female was in Chbamann market (4.43%) but the lowest in Udong market (2.92%). The highest percent of male *H. gallinarum* was at Udong market (16.56%) and lowest in Sangkarsei market (6.4%), on the other hand, the highest female was in Chbamann market (18.97%) and the lowest in Sangkarsei market (10.66%).

4.3.3: The faecal examination of GI parasites in domestic chickens in Kampong Speu province

Table 4.5: The prevalence of eggs and oocysts of endoparasite in domestic chickens in Kampong Speu province

Egg and oocyst	**Sangkasei (%)**	**Udong (%)**	**Chbamann (%)**	**Total (%)**
A. galli	30.00	18.75	32.00	27.74
H. gallinarum	75.00	28.12	52.00	49.01
Capillaria spp.	00	00	4.00	1.96
Strongyloides	80.00	59.37	54.00	60.78
Cestodes eggs	10.00	9.37	6.00	7.84
Eimeria spp.	75.00	28.12	44.00	45.09

The prevalence of eggs and oocyst were calculated by faecel examination, the total of 102 faecal samples from three markets at Kampong Speu province were identified. The positive samples were found 82 (80.39%) of eggs and oocysts. In this province found only four nematode species. The highest infection was *Strongyloides* (60.78%), whereby *H. gallinarum* (49.01%), *A. galli* (27.74%), *Capillaria* spp. (1.96%), cestodes eggs (7.84%) and while *Eimeria* spp. (45.09%), respectively. The prevalence in each markets; in the Sangkarsei market, the common nematode eggs were found as *Strongyloides* (80.00%) followed by *H. gallinarum* (75.00%), *A. galli* (30.00%) and cestodes eggs (10.00%) and a oocyst of *Eimeria* spp. (75.00%) was the high prevalence in this market, respectively. For the Udong market is lowest prevalence than another markets. The normal nematode eggs were found *Strongyloides* (59.37%),

where by *H. gallinarum* (28.12%), *A. galli* (18.75%), cestodes eggs (9.37%) and *Eimeria* spp (28.12), respectively. The Chbamann market the highly infective eggs and oocyst were *Strongyloides* (54.00%), *H. gallinarum* (52.00%), *A. galli* (32.00%), *Capillaria* spp. (4.00%), cestodes egg (6.00%) and *Eimeria* spp. (44.00%), respectively.

4.4.1: The GI parasite of identification in domestic chickens (*Gallus domesticus L.)* in Kandal province

Table 4.6: The prevalence of GI parasitic worms in domestic chickens (*Gallus domesticus* L.) in Kandal province

Endoparasites	Organ of infection	Kor kee (%)	Saang (%)	Korth um(%)	Takhm ou (%)	Total (%)
A. galli	sm int.	48.57	48.00	60.00	66.66	55.23
H. gallinarum	caecum	94.28	84.00	80.00	96.66	90.47
G. ingluvicola	crop	8.57	36.00	20.00	36.66	24.76
Capillaria spp.	sm int., crop	28.57	48.00	26.66	36.66	35.23
T. americana	proventriculus	42.85	48.00	40.00	36.66	41.90
R. cesticillus	sm int.	8.57	4.00	20.00	6.66	8.57
R.echinobothrida	sm int.	65.71	52.00	40.00	60.00	57.14
R. tetragona	sm int.	45.71	32.00	33.33	33.33	37.14
Choanotaenia spp	sm int.	17.14	32.00	20.00	10.00	19.04
Hymenolepis spp.	sm int.	25.71	36.00	53.33	20.00	30.47
C. digonopora	sm int.	28.57	8.00	33.33	66.66	18.04
E. revolutum	sm int.	5.17	4.00	13.33	16.66	9.52
Prosthogonimus	sm int.	00.00	0.00	00.00	3.33	0.95
Notogotylus	sm int.	00.00	00.00	00.00	6.66	1.90

In Kandal province, worm identification was perform in four markets. The result found five nematodes species, six cestodes species and three trematodes species. In Kor Kee market, the nematode species were contaminated the high prevalence. The evidence parasites showed the incidence of *H. gallinarum* (94.28%), followed by *A.*

galli (48.57%), *T. americana* (42.28%), *Capillaria* spp. (28.57%) and the lowest infection was *G. ingluvicola* (8.57%). The highest infection of cestodes species was *R. echinobothrida* (65.71%), *R. tetragona* (45.71%), *C. digonapora* (28.57%), *Hymenolepis* spp. (25.71%), *Choanotaenia* spp. (17.14%), and the lowest infection *R. cesticillus* (8.57%) while the trematode was found only one species which was *E. revolutum* (5.17%). Moreover, in Saang market was observed the infection of 5 nematodes species such as *H. gallinarum* (84.00%) followed by *A. galli* (48.00%), *T. americana* (48.00%), *Capillaria* spp. (48.00%) and the lowest infection was *G. ingluvicola* (36.00%). The highest prevalence of cestodes species were *R. echinobothrida* (52.00%) followed by *Hymenolepis* spp. (36.00%) *R. tetragona* (32.00%), *Choanotaenia* spp. (32.00%), *C. digonapora* (8.00%) and the lowest prevalence was *R. cesticillus* (4.00%). The prevalence of trematode was *E. revolutum* and *Prosthogunimus sp.* (4.00%). In addition, Kor Thum market found 5 nematodes species and the highest prevalence which had *H. gallinarum* (80.00%), *A. galli* (60.00%), *T.americana* (40.00%), *Capillaria* (26.66%) and *G. ingluvicola* (20.00%), the highest prevalence of cestodes were *Hymenolepis* spp. (53.33%), *R. echinobothida* (40.00%), *R. tetragona* and *C.diganapora* (33.33%), *R. cesticillus* and *Choanotaenia* spp. (20.00%), respectively and the prevalence of trematode was *E. revolutum* (13.33%). Furthermore, the Takhmou market found the highest prevalence species of nematode that had *H. gallinarum* (96.66%), followed by *A. galli* (66.66%), *T. americana, G. ingluvicola* and *Capillaria* spp. (36.36), the highest prevalence species of cestodes were *R. echinobothida* (60.00%), followed by *R. tetragona* (33.33%), *Hymenolepis* spp. (20.00%), *Choanotaenia* spp. (10.00%), *T. cesticillus* and *C. digonapora* (6.66%), and the prevalence species of trematodes were *E. revolutum* (16.66%), *Notocotylus* spp. (6.66%) and *Prosthogunimus sp.* (3.33%), respectively. Kandal province found the prevalence species of nematodes such as: *H. gallinarum* (90.47%), *A. galli* (55.23%), *T. americana* (41.90%), *Capillaria* spp. (35.23%) and *G.ingluvicola* (24.76%), the cestodes species were *R. echinobothrida* (57.14%) followed by *R. tetragona* (37.14%), *Hymenolepis* spp. (30.47%), Choanotaenia spp. (19.04%), *C. digonopora* (18.04) and *R. tetragona* (8.57%), and trematodes species were *E. revolutum* (9.52%), *Notocotylus* spp. (1.90%) and *Prosthogunimus sp.* (0.95%), respectively.

4.4.2: The percentage male and female of nematodes in domestic chickens in Kandal province

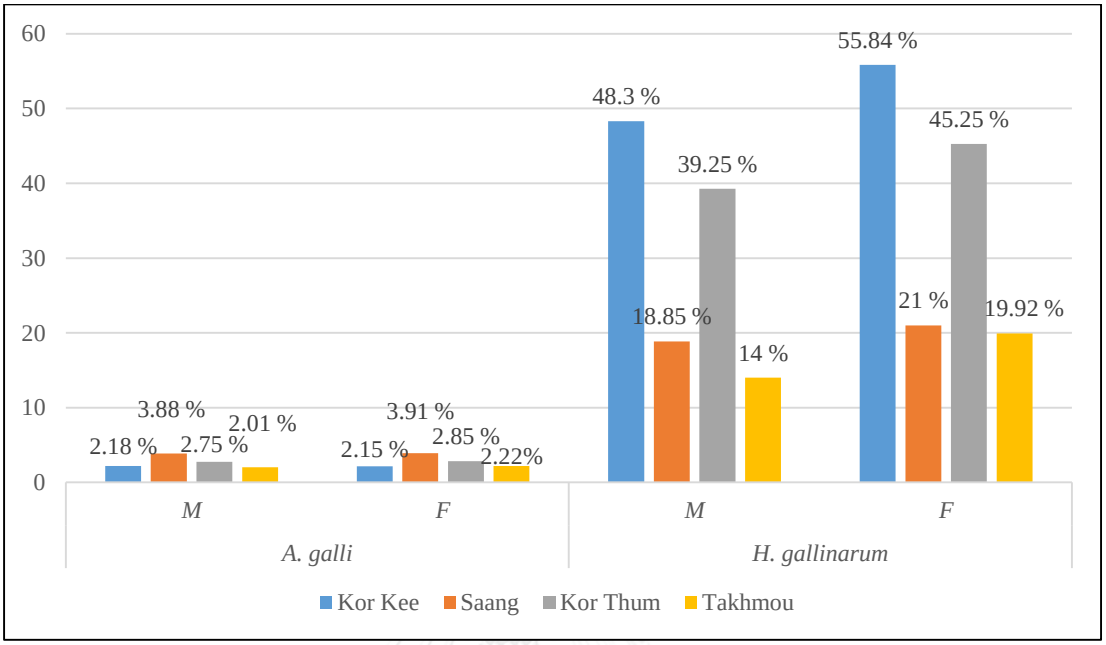

Figure 8: The percentage male and female of nematodes in domestic chickens in Kandal province

The percent of male and female of *A. galli* were highest shown infection at Saang market, moderately infective male at Kor Thum and Kor Kee markets but the female at Kor Thum and Takhmou markets, and the lightest infection male at Takhmou market and female at Kor Kee market (3.91, 3.88, 2.85, 2.75, 2.22, 2.18, 2.15 and 2.01), respectively. Moreover, the male and female of *H. gallinarum* were highest shown infection at Kor Kee market, moderate at Kor Thum and Saang markets, and the lightest infection at Takhmou market (55.84, 48.30, 45.25, 39.25, 21.00, 19.92, 18.85 and 14.00), respectively (fig. 8).

4.3.3: The percent of trematodes in domestic chickens in Kandal province

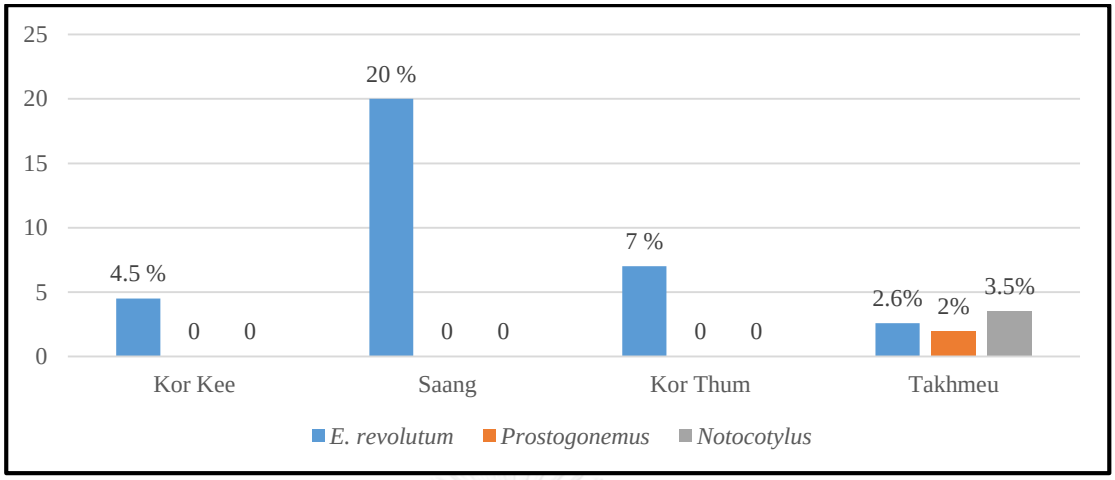

Figure 9: The percent of trematode in domestic chickens in Kandal province

The figure 9 showed the percent of trematodes in Kadal province, the *E. revolutum* was found at four markets. However, *Prostogonemus* and *Notocotylus* were found in Takhmeu market. The percentage of *E. revolutum* was highest in Saang followed by Kor Thum, Kor Kee and the lowest in Takhmeu market (20, 7, 4.5 and 2.6), respectively. The average of *Prosthogonemus* was 2 in Takhmeu market. The average of *Notocotylus* was 3.5 in Takhmeu market.

4.4.4: The faecal examination of GI parasite in domestic chickens in Kandal province

Table 4.7: The faecal examination of GI parasite in domestic chickens in Kandal province

Egg & oocyst	Kor Kee (%)	Saang (%)	Kor Thom (%)	Takhmou (%)	Total (%)
A. galli	37.14	48.00	40.00	66.66	48.57
H. gallinarum	85.71	76.00	80.00	90.00	83.80
Capillaria spp.	5.71	36.00	6.66	10.00	14.28
Spirurid egg	22.85	24.00	13.33	26.66	22.85
Strongyloides	2.85	48.00	80.00	73.33	44.76
Cestodes eggs	11.42	16.00	20.00	6.66	12.38
E. revolutum	5.71	4.00	00.00	6.66	4.76
Notocotylus spp.	00.00	00.00	20.00	00.00	2.85
Eimeria spp.	45.71	48.00	80.00	60.00	55.23

Determining eggs and oocysts of endoparasites were depended on the morphology and based upon the technical examination of faeces. The prevalent of endoparasites in domestic chickens at Kandal province were shown the different infection prevalence of parasite species from different markets. In Kandal province; the total infection of endoparasite egg was infected the highest prevavence of *H. gallinarum* (83.80%), %, *A. galli* (48.57%), *Strongyloides* (44.76%), Spirurid eggs (22.85%), *Capillaria* spp.(14.28%), cestodes eggs (12.38%) and the trematodes eggs had low incidence of *E. revolutum* (4.76%) and *Notocotylus* spp. (2.85%) while the *Eimeria* spp. (55.25%) was high detected in faeces. The prevalence in each markets was showd; in Kor Kee market found the highest prevalence nematode species egg was *H. gallinarum* (85.71%), whereby *A. galli* (37.14%), Spirurid egg (22.85%), *Capillaria* spp (5.71%), *Strongyloides* (2.85%), cestodes egg (11.42%), and tremotode species egg was *E.revolutum* (5.71%) respectively *Eimeria* spp. (45.71%),. In addition, Saang market found highest prevalence of *H. gallinarum* (76.00%), *A. galli* and *Emeria* spp.

(48.00%), *Capillaria* spp. (36.00%), Spirurid eggs (24.00%), cestode eggs (16.00%) and *E. revolutum* (4.00%), respectively. Also, Kor Thum market was found highest prevalence of *H.gallinarum, Eimeria* spp. and *Strongyloides* (80.00%), *A. galli* (40.00%), cestode egg and *Notocotyrus* spp. (20.00%), Spirurid eggs (13.33%) and *Capillaria* spp. (6.66%%), respectively. Similarly, Takhmou market was found highest prevalence infection of *H. gallinarum* (90.00%), *Strongyloides* (73.33%), *A. galli* (66.66%), *Eimeria* eggs (60.00%), Spirurid egg. (26.66%), *Capllirai* spp. (10.00%), cestode eggs and *E. revolutum* (6.66%), respectively.

4.5.1: The identification of GI parasites in domestic chickens (*Gallus domesticus* L.) Prey Veng province

Table 4.8: The prevalence of GI worms identification in domestic chickens (*Gallus domesticus* L.) Prey Veng province

Endoparasites	Organ of Infection	Neakeung (%)	Prey Vent (%)	BarPhnom (%)	PheaRang (%)
A. galli	sm int.	57.14	45.00	44.44	50.00
H. gallinarum	caecum	68.57	90.00	70.37	55.55
G. ingluvicola	crop	28.57	5.00	22.22	20.00
Capillaria spp.	sm int., crop	20.00	20.00	25.92	35.00
T. americana	proventriculus	37.14	15.00	29.62	25.00
R. cesticillus	sm int.	25.71	10.00	11.11	00.00
R. echinobothrida	sm int.	74.68	65.00	37.03	60.00
R. tetragona	sm int.	57.14	45.00	59.25	45.00
Choanotaenia spp.	sm int.	11.42	15.00	7.40	5.00
Hymenolepis spp	sm int.	34.28	20.00	37.03	30.00
C. digonopara	sm int.	5.71	5.00	11.11	5.00
E. revolutum	sm int.	14.28	10.00	22.22	00.00
Prosthogonimus sp.	sm int.	2.85	5.00	7.74	00.00
Notocotylus spp.	sm int.	8.57	10.00	7.74	00.00

The prevalence of this study in Prey Veng province, four markets were found five species of nematodes, six cestodes and three trematode. In Neak Loeung market, the nematode species was found the highest *H. gallinarum* (68.57%) whereby *A. galli* ((57.14%), *T. americana* (37.14%), *G. ingluvicola* (28.57%) and the lowest infection was *Capillaria* spp. (20.00%). The cestode species was found the highest *R. echinobothrida* (74.28%) followed by *R. tetragona* (57.14%), *Hymenolepis* spp. (34.28%), *R. cesticillus* (25.71%), *Choanotaenia* spp. (11.42%) and the lowest *C. digonopara* (5.71%) while the species of trematode was highest found *E. revolutum* (14.28%), *Notocotylus* spp. (8.57%) and lightest infection was *Prosthogonimus sp.* (2.85%). Moreover, in Prey Veng market was found 5 species of nematodes, six species of cestodes and three species of trematodes as well. In evidence of worm identification of the nematode nematodes was found the highest prevalence of *H. gallinarum* (90.00%) followed by *A. galli* (45.00%), *Capillaria* spp. (20.00%), *T. americana* (15.00%) and the lowest infection was *G. ingluvicola* (5.00%). The common cestode species was found the highest percentage of *R. echinobothrida* (65.00%) whereby *R. tetragona* (45.00%), *Hymenolepis* spp. (20.00%), *Choanotaenia spp.* (15.00%), *R. cesticillus* (10.00%) and the lightest percentage was *C. digonopara* (5.00%). The species trematode was found the highest prevalence *E. revolutum, Notocotylus* spp. (10.00%) and the lightest infection was *Prosthogonimus sp.* (5.00%). Furthermore, Phea Rang market was found five species of nematodes, six species of cestodes and three species of trematodes as well. The nematode species was found the highest infection of *H. gallinarum* (70.37%) followed by *A. galli* (44.44%), *T. americana* (29.62%), *Capillaria* spp. (25.92%) and the lowest infection was *G. ingluvicola* (22.22%). The cestode species was found broad spectrum of *R. tetragona* (59.25%) followed by *R. echinobothrida* and *Hymenolepis* spp. (37.03%), *R. cesticillus* and *C. digonapara* (11.11%) and the narrow spectrum was *Choanotaenia spp.* (7.40%). The trematode species was found the highest contamination of *E. revolutum* (22.22%), *Prosthogonimus sp.* and *Notocotylus* spp. (7.40%). However, in Phea Rang market was only found five species of nematodes and cestodes. The nematode species was found highest contamination of *H. gallinarum* (55.55%) whereby *A. galli* (50.00%), *Capillaria* spp. (35.00%), *T. americana* (25.00%) and the lowest infection was *G. ingluvicola* (20.00%). The cestode species was found the highest prevalence of *R.*

tetragona (45.00%) whereby *R. echinobothrida* (40.00%), *Hymenolepis* spp. (30.00%) and the lowest *Choanotaenia spp.* and *C. digonapara* (5.00%). In this market did not find the trematode.

4.5.2: The percentage male and female of nematodes in domestic chickens (*Gallus domesticus L.*) in Prey Veng province

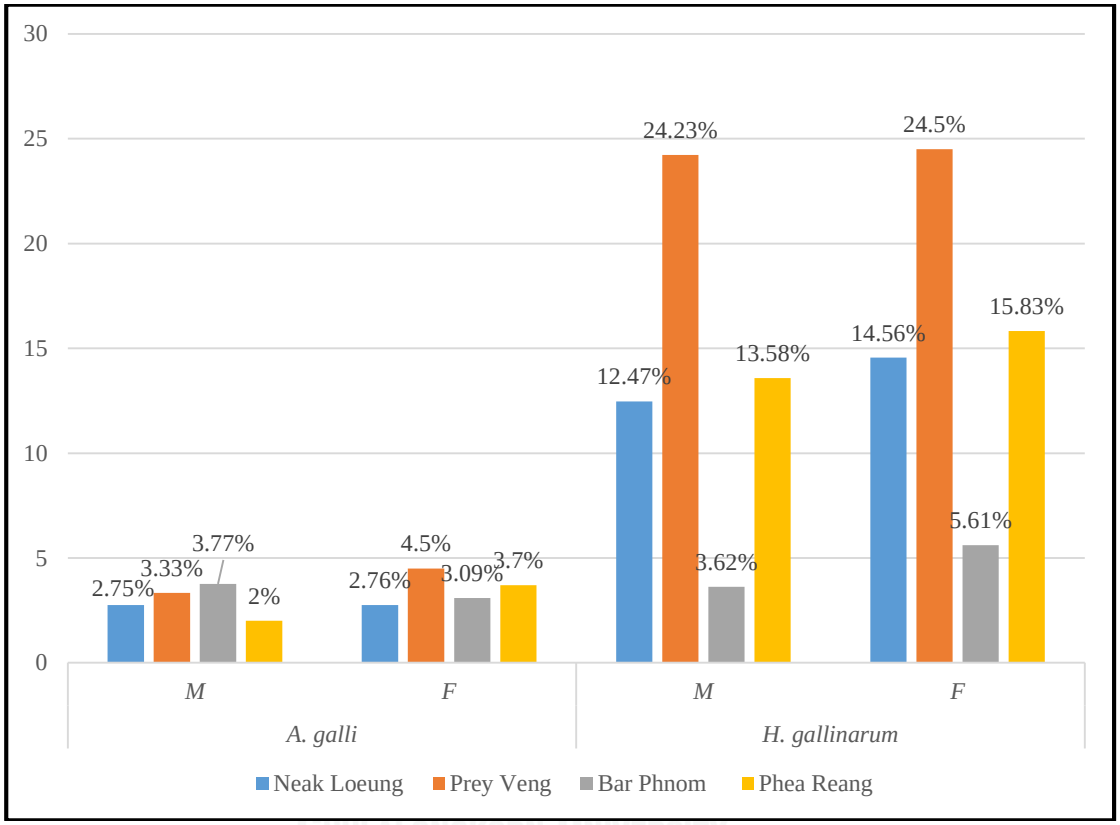

Figure 10: The percentage male and female of nematodes in domestic chickens in Prey Veng province

The percentage of male *A. galli* was found the highest infection at Bar Phnom market, the moderate infection at Prey Veng and Neak Loeung markets and the lowest infection at Phea Phnom market. The percentage of female *A. galli* was found the highest infection at Prey Veng market, the moderate infection at Phea Rang and Bar Phnom markets, lowest infection at Neak Loeung market. The percentage of male and female *H. gallinarum* was found highest infection at Prey Veng market, the moderate infection Phea Rang, and Neak Loeung markets and the lightest infection at Bar Phnom market (fig. 10).

4.5.3: The percentage of trematodes in domestic chickens in Prey Veng province

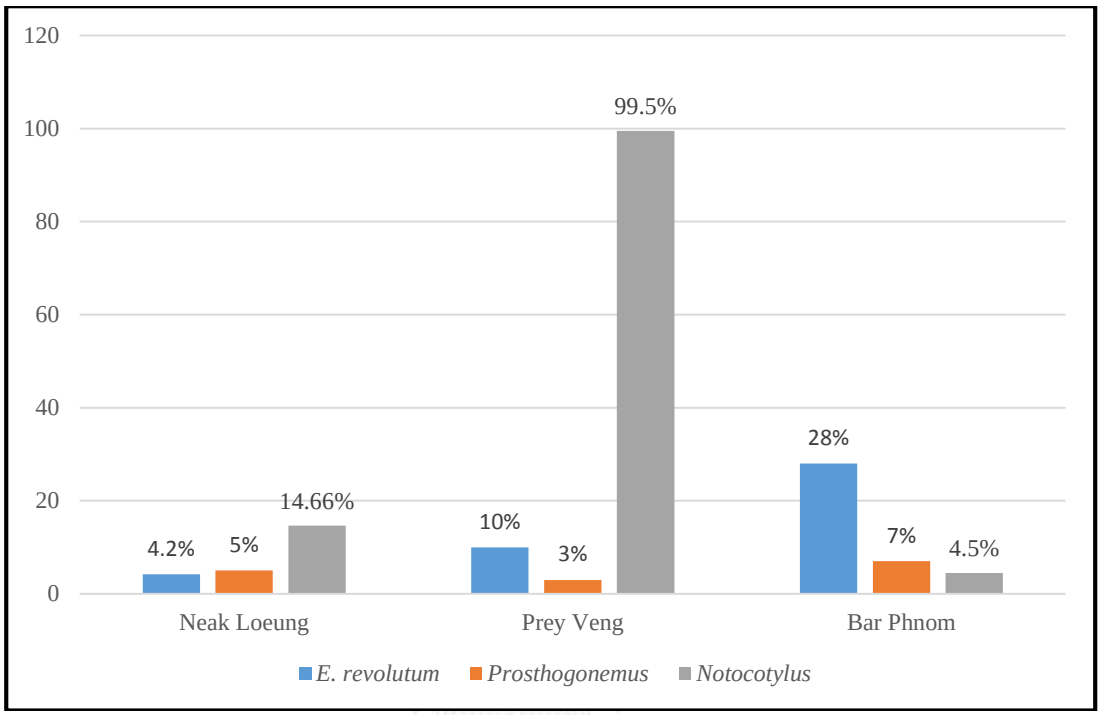

Figure 11: The percent of trematode in domestic chickens at Prey Veng province

In this province was found three markets that contaminated by the trematode. The incidence of *E. revolutum* was the highest infection at Bar Phnom, the moderate infection at Prey Veng and the lowest at Neak Loeung market. Moreover, *Prostogonemus* was the highest percent at Bar Phnom, the moderate contamination at Neak Loeung and the lowest prevalence at Prey veng market. In addition, *Notocotylus* was the highest percent at Prey Veng, moderate prevalenc at Neak Loeung and the lowest prevalence at Bar Phnom market (fig. 11).

4.5.4: The prevalence of faecal examination in domestic chickens in Prey Veng province

Table 4.9: The prevalence of faecal examination in domestic chickens in Prey Veng province

Eggs & oocyst	Neak Loeung (%)	Prey Veng (%)	Bar Phnom (%)	Phea Rang (%)
A. galli	51.42	45.00	44.44	30.00
H. gallinarum	68.57	70.00	62.96	50.00
Capillaria spp.	5.71	10.00	7.40	10.00
Strongyloides	82.85	85.00	88.88	80.00
Cestode eggs	25.71	5.00	22.22	10.00
E. revolutum	8.57	10.00	22.22	00.00
Notocotylus	2.85	15.00	7.40	00.00
Eimeria spp	61.71	85.00	62.96	62.00

The faecal examinations found the high prevalence in this province. In Neak loeung market was found highest nematode species eggs of *Strongyloides* (82.85%) whereby *H.gallinarum* (68.57%), *A. galli* (51.42%) and *Capillaria* spp. (5.71%). The cestode eggs (25.71%), while the common trematode species egg were *E. revolutum* (8.57%), and *Notocotylus* spp. (2.85%) and 68.57% of *Eimeria* spp. Moreover, Prey Veng market was found highest prevalence of nematode species eggs of *Eimeria* spp. (85.00%), *Strongyloides* (85.00%) whereby *H. gallinarum* (70.00%), *A.galli* (45.00%), *Capillaria* spp. (10.00%). The rate of cestode egg was 5.00%. The common trematode species egg was *Notocotylus* (15.00%) and *E.revolutum* (10.00%) while *Eimeria* spp (85.00%) was a huge percentage. In Bar Phnom market was found the highest prevalence of *Strongyloides* (88.88%) followed by *H. gallinarum* (62.96%), *A. galli* (44.44%), and the lowest prevalence was *Capillaria* spp. (7.40%). The incidence of cestode egg was 22.22% while the trematode species egg were *E. revolutum* (22.22%) and *Notocotylus* (7.40%) and 62.96% of *Eimeria* spp. However, in Phea Rang market was found four nematodes species, cestode egg and *Eimeria* spp. In this market did not found the trematode egg. The highest prevalence of nematode species egg were the

Strongyloides (80.00%) whereby *H. gallinarum* (50.00%), *A. galli* (30.00%) and lowest contamination was *Capillaria* spp. (10.00%). The incidence of cestode egg was 10.00% while the incidence of *Eimeria* spp. was 62.00%.

4.6.1: The identification of GI parasitic worms in domestic chickens (*Gallus domesticus* L.) Kampong Cham province

Table 10: The identification of GI parasitic worms in domestic chickens (*Gallus domesticus* L.) Kampong Cham

Endoparasites	Organ of infection	Being Kork (%)	Phsa Chen (%)	Phsa Sakun (%)	Phsa Paav (%)
A. galli	sm int.	71.42	63.33	48.00	50.00
H. gallinarum	caecum	88.57	90.00	68.00	70.00
G. ingluvicola	crop	17.14	13.33	12.00	30.00
Capillaria spp.	sm int., crop	22.85	16.66	24.00	30.00
T. americana	proventriculus	22.85	26.66	16.00	10.00
R. cesticillus	sm int.	20.00	10.00	12.00	00.00
R. echinobothrida	sm int.	62.85	70.00	36.00	70.00
R. tetragona	sm int.	51.42	63.33	52.00	40.00
Choanotaenia spp.	sm int.	5.71	6.66	16.00	00.00
Hymenolepis spp	sm int.	37.14	30.00	32.00	20.00
C. digonopara	sm int.	2.85	30.00	4.00	00.00

The identification of worms were followed by the each worms that was found in Kampong Cham province. In Being Kok was observed 5 nematodes, 6 cestoeds and a protozoa. The most common highest nematodes species was found the *H. gallinarum* (88.57%) followed by *A. galli* (71.42%), *Capilliria* spp. (22.85%), *G. ingluvicala* (17.14%) and the lowest prevalence *T. Americana* (5.71%). The highest percentage of cestode species was *R. echinobothrida* (62.85%), followed by *R. tetragona* (51.42%), *Hymenolepis* spp. (51.42%) and *Choanotaena* spp. (5.71) and the lowest infection of *C. digonopara* (2.85%). Moreover, Phsa Chen market was found highest infection of

H. gallinarum (90.00%) followed by *A.galli* (63.33%), *T. americana* (26.66%), *Capillaria* spp. 16.66%), *G. ingluvicala* (13.33%). The highes cestode species was *R. echinobothrida* (70.00%) whereby *R. tetrogona* (63.33%), *Hymenolepis* spp. and *C. digonopara* (30.00%), *R. cesticillus* (10.00%) and the lightest prevalence was *Choanotaenia* spp. (6.66%). Furthermore, in Phsa Sakun market was found the highest infection of nematode species as *H. gallinarum* (68.00%), *A. galli* (48.00%), *Capillaria* spp. (24.00%), *T. americana* (16.00%) and 12.00% of %), *G.* ingluvicala was the lowest prevalence. The common cestode species was R. *tetragona* (52.00%) whereby *R. echinobothrida* (36.00%), *Hymenolepis* spp. (32.00), *Choanotaenia* spp. (16.00%), *R. cesticillus* (12.00%) and the lightest prevalence was *C. digonopara* (4.00%). However, in Phsa Phaav market was identified only five nematode and three cestodes species. The most common nematodes species was *H. gallinarum* (70.00/%) followed by *A. galli* (50.00%), *G. ingluvicala* and *Capillaria* (30.00%) and the lowest rate was *T. americana* (10,00%) while the common cestode species was *R. echonobothrida* (70.00%), *R. cesticillus* (40.00%), *Hymenolepis* spp. (20.00%).

4.6.2: The percentage male and female of nematodes in domestic chickens in Kampong Cham province

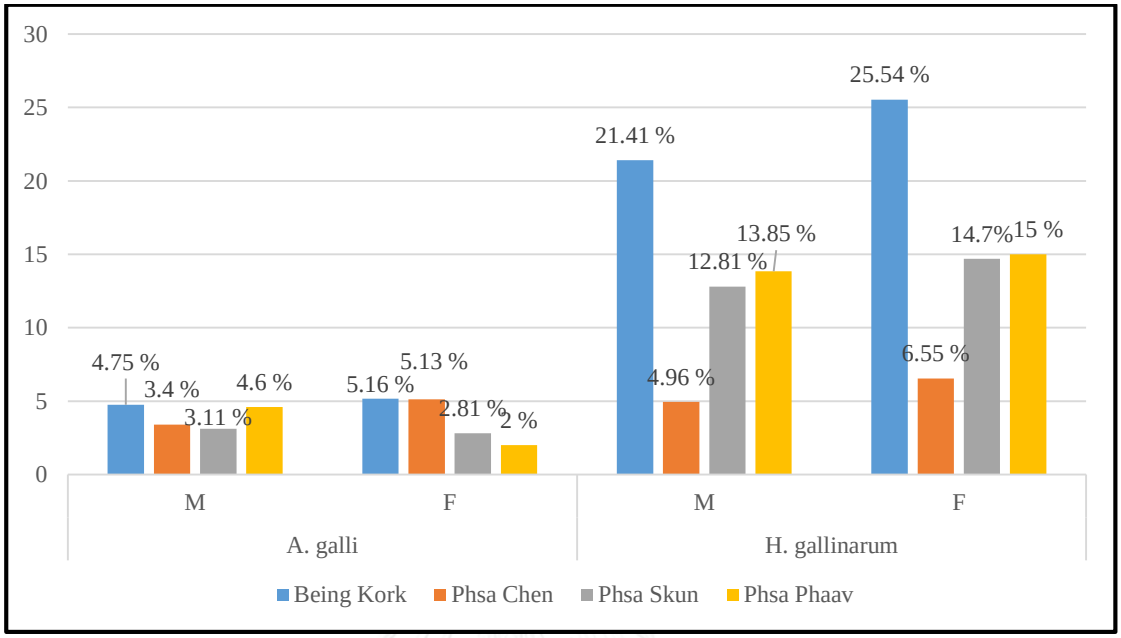

Figure 12: Percentage of male and female of nematodes in domestic chickens in Kampong Cham province

The figure 12 showed the percent of male *A. galli* was highest at Being Kork market (4.75) when compared with other markets. The percent of female *A. galli* was highest at Being kork market (5.16) as well but the lowest at Phsa Phaav market (2). Moreover, the percent of male and female *H. gallinarum* was shown highest at Being Kork market (25.54, 21.41) when compared with other markets.

4.6.3: The faecal examination in domestic chickens in Kampong Cham province

Table 4.11: The faecal examination in domestic chickens in Kampong Cham province

Eggs & oocysts	Being Kork (%)	Phsa Chen (%)	Phsa Skun (%)	Phsa Paav (%)
A. galli	82.85	40.00	32.00	40.00
H. gallinarum	82.85	50.00	16.00	50.00
Capillaria spp.	37.14	3.00	4.00	00.00
Strongyloides	80.00	90.00	68.00	80.00
Cestode spp.	14.28	20.00	12.00	10.00
Eimeria spp.	85.71	70.00	68.00	70.00
Mixed infection	100	83.33	72.00	70.00

The faecal examinations observed the high prevalence in each markets. In Being Kok found the high prevalence of *Eimeria* spp. (85.71%). The most common nematode species were *A. galli* and *H. gallinarum* (82.85%) followed by *Strongyloides* (80.00%), *Capillaria* spp. (37.14%) and lowest prevalence of cestodes egg (14.28%). The mixed infection was 100% in this market. In Phsa Chen market was found highest prevalence of nematodes egg species of *Strongyloides* (90.00%) whereby *H. gallinarum* (50.00%), *A. galli* (40.00%), and the lowest prevalence was *Capillaria* spp. (3.00%) while the cestode egg had (30.00%). *Eimeria* spp. was positive 70.00%. The mixed infection was 83.33%. However, Skun market found lowest prevalence market in this province. The highest prevalence parasite was *Strongyloides* (68.00%) whereby *A. galli* (32.00%), *H. gallinarum* (16.00%), and the lowest infection of *Capillaria* spp. (4.00%) while the prevalence cestodes egg had 12.00%. The prevalence of *Eimeria* spp. had 68.00%. The mixed infection was 72.00%. Beside, in Phaav market was found the highest prevalence nematode egg species of *Strongyloides* (80.00%), followed by *H. gallinarum* (50.00%), *A. galli* (40.00%) and the prevalence of cestodes egg had 10.00%. This market was not found egg of *Capillaria* spp. The prevalence of *Eimeria* spp. had 70.00%. The mixed infection was 70.00%.

4.7.1: The worm identification in domestic chickens in Takeo province

Takeo province is southern part of Phnom Penh, between Kandal and Kampong Speu province. In this province, it has lake of eastern part of province.

Table 4.12: The prevalence of GI parasitic worms in domestic chickens (*Gallus domesticus* L.) Takeo province

Parasites	Organ of infection	Donkeo (%)	Somroung (%)	Antasoum (%)	Angkor Borie (%)
A. galli	sm int.	52.00	44.44	36.00	60.86
H. gallinarum	caecum	40.00	48.14	60.00	47.82
G. ingluvicala	crop	00.00	00.00	00.00	47.82
T. americana	proventriculus	12.00	00.00	00.00	00.00
R. cesticillus	sm int.	8.00	7.40	24.00	8.69
R.echinobothrida	sm int.	32.00	48.14	60.00	47.82
R. tetragona	sm int.	16.00	22.22	28.00	8.69
Hymenolepis spp	sm int.	12.00	3.70	4.00	13.04
E. revolutum	sm int.	00.00	00.00	00.00	4.34

In Takeo province was lowest prevalence when compared others province of my study. A total positive sample was 85.00% (85/100). In Donkeo market was observed the highest prevalence of nematode species of *A. galli* (52.00%) followed by *H. gallinarum* (40.00%), *T. americana* (16.00%) while the cestode species had *R. echinobothrida* (32.00%), whereby *R. tetragona* (16.00%), *Hymenolepis* spp. (12.00%) and the lowest prevalence of *R. cesticillus* (8.00%). Moreover, in Samroung market was found the highest prevalence of nematode species of *H. gallinarum* (48.14%) and *A. galli* (44.44%). The common cestode species were *R. echinobothrida* (48.14%) followed by *R. tetragona* (22.22%), *R. cesticillus* (7.40%) and the lowest prevalence of *Hymenolepis* spp. (3.70%). However, Antasoum market was found highest prevalence nematode of *H. gallinarum* (60.00%) and *A. galli* (36.00%) while the prevalence of cestode egg had *R. echinobothrida* (60.00%) followed by *R. tetragona* (28.00%), *R. cesticillus* (24.00%) and the lowest prevalence of *Hymenolepis* spp. (4.00%), in

addition, Angkor Borei market was found the prevalence of nematode species of *A. gilla* (60.86%) followed by *H. gallinarum* (47.82%) and *G. ingluvicala* (4.34%). The most common cestode species had *R. echinobothrida* (47.82%) followed by *Hymenolepis* spp. (13.04%), *R. tetragona* and *R. cesticillus* (8.69%). In this market of Takeo province was foud the trematodes which species is *E. revolutum* (4.34%).

4.7.2: The percent of nematodes in domestic chickens at Takeo province

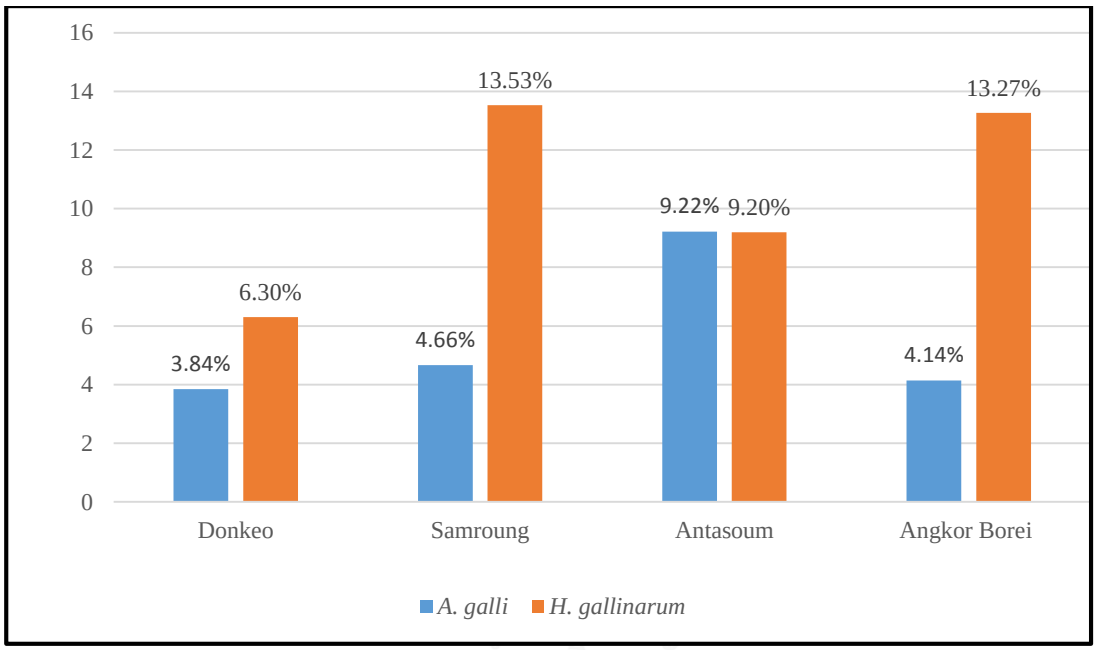

Figure 13: The percent of nematodes in domestic chickens at Takeo province

The average of *A. galli* was highest at Antasoum market and the lowest at Donkeo market. However, the average of *H. gallinarum* was highest at Somroung market and lowest at Donkeo market (fig 13), respectively.

Figure 14: The morphology of *Echinostoma revolutum*

Figure 15: The morphology of *Prosthogonimus*

Figure 16: The morphology of *Notocotylus*

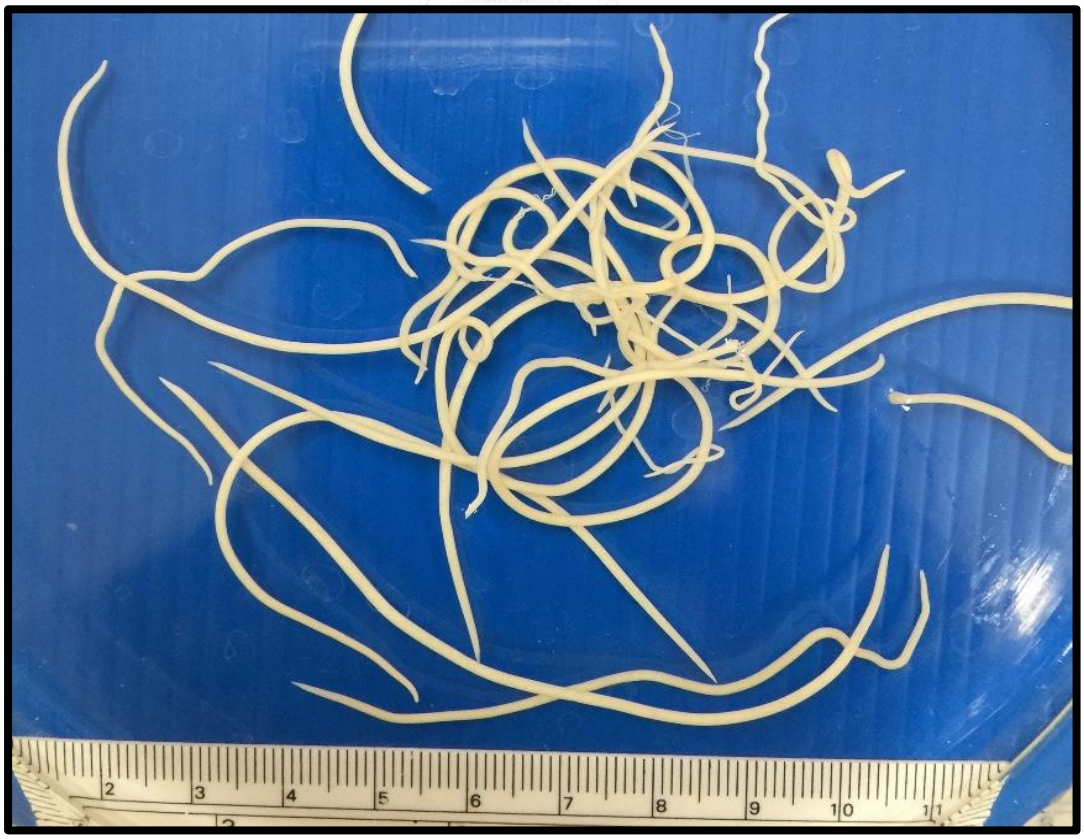

Figure 17: The morphology of adult *Ascaridia galli*

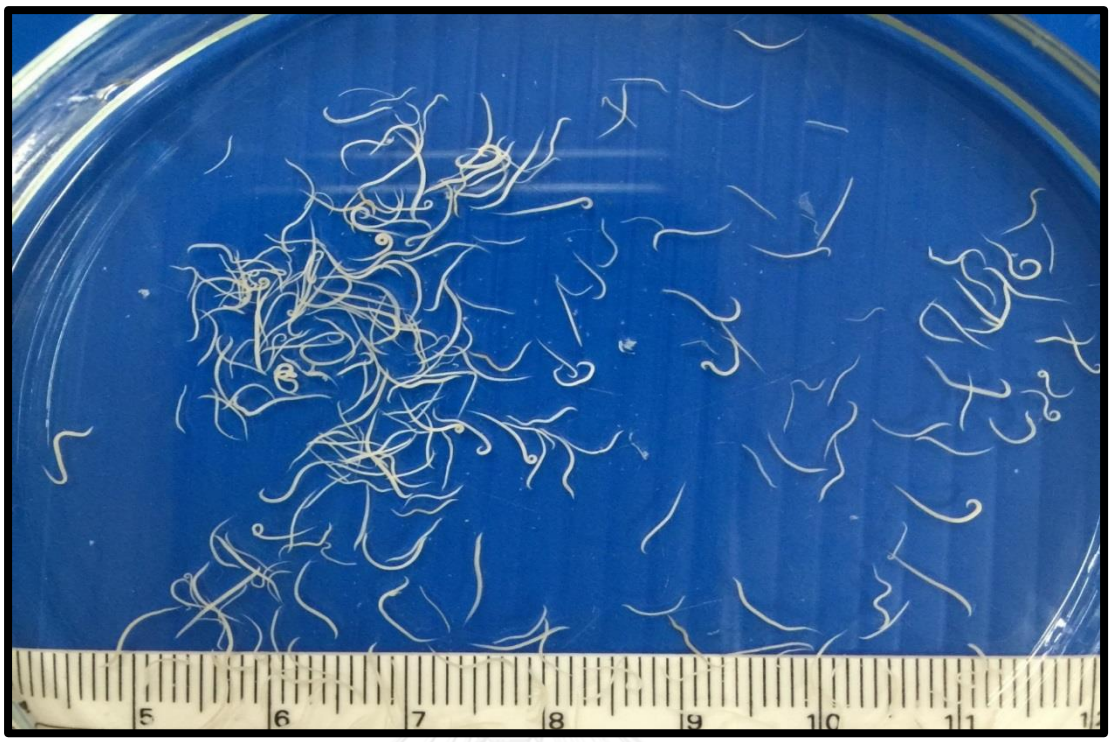

Figure 18: The morphology of adults *Heterakis gallinarum*

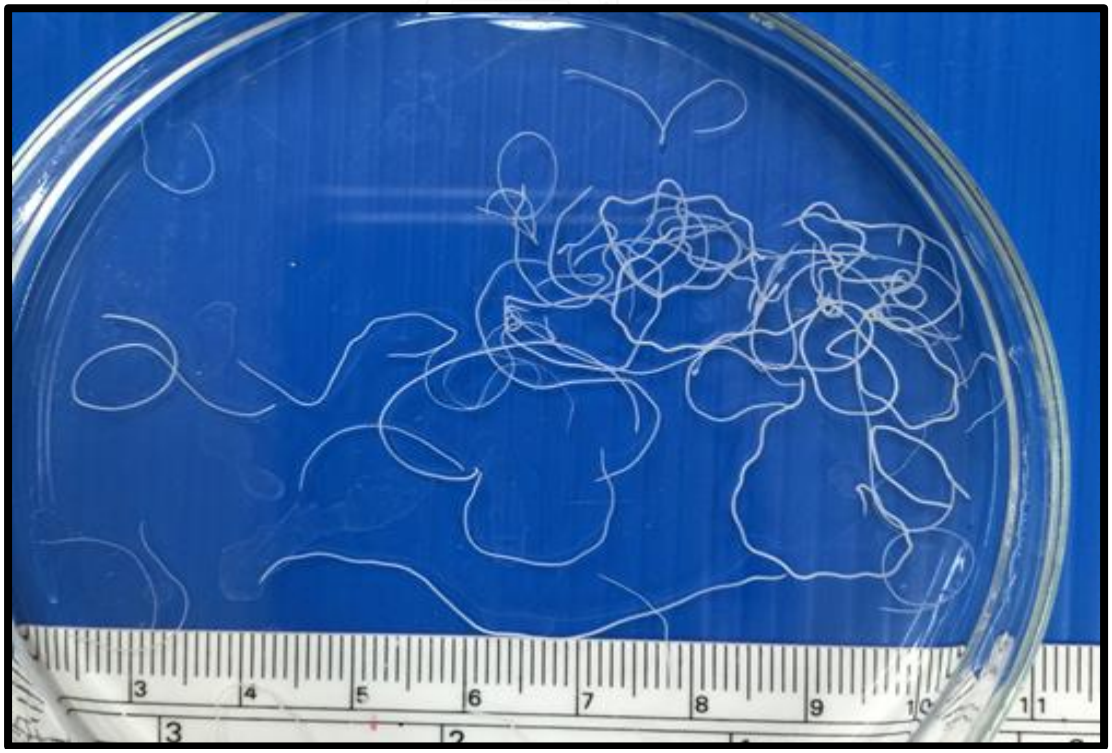

Figure 19: The morphology of adult *Gongylonema ingluvicola*

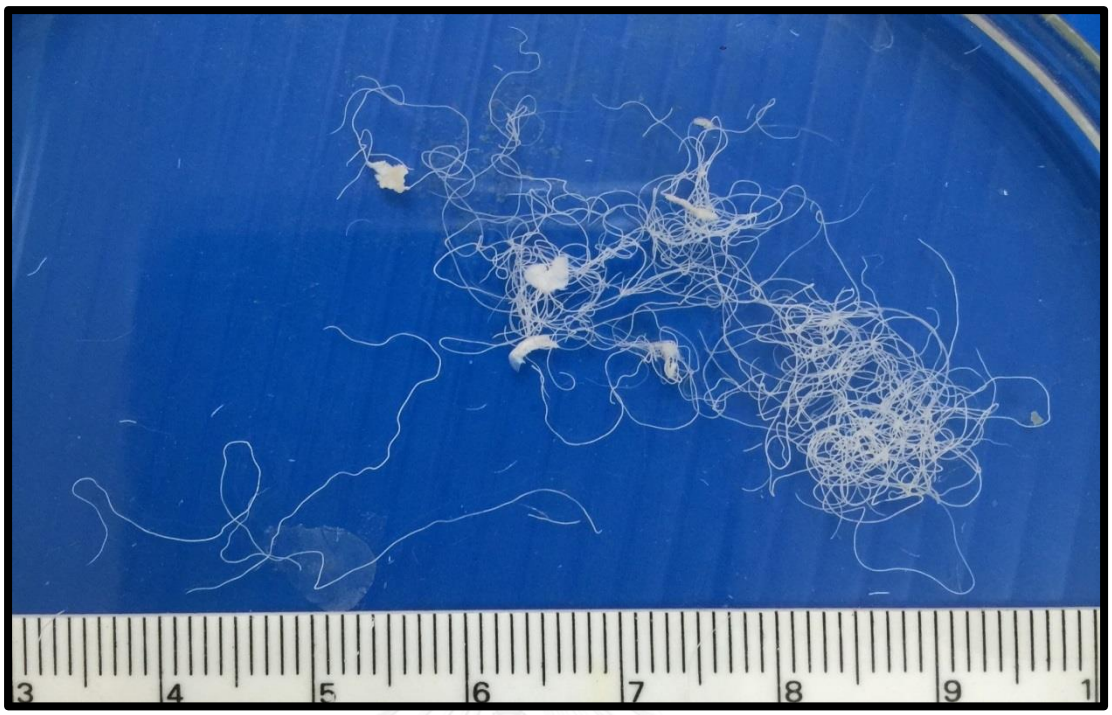

Figure 20: The morphology of adult *Capillaria* spp.

Figure 21: The morphology of female *Tetrameres americana*

Figure 22: The morphology of scolex *Raillietina echinobothrida*

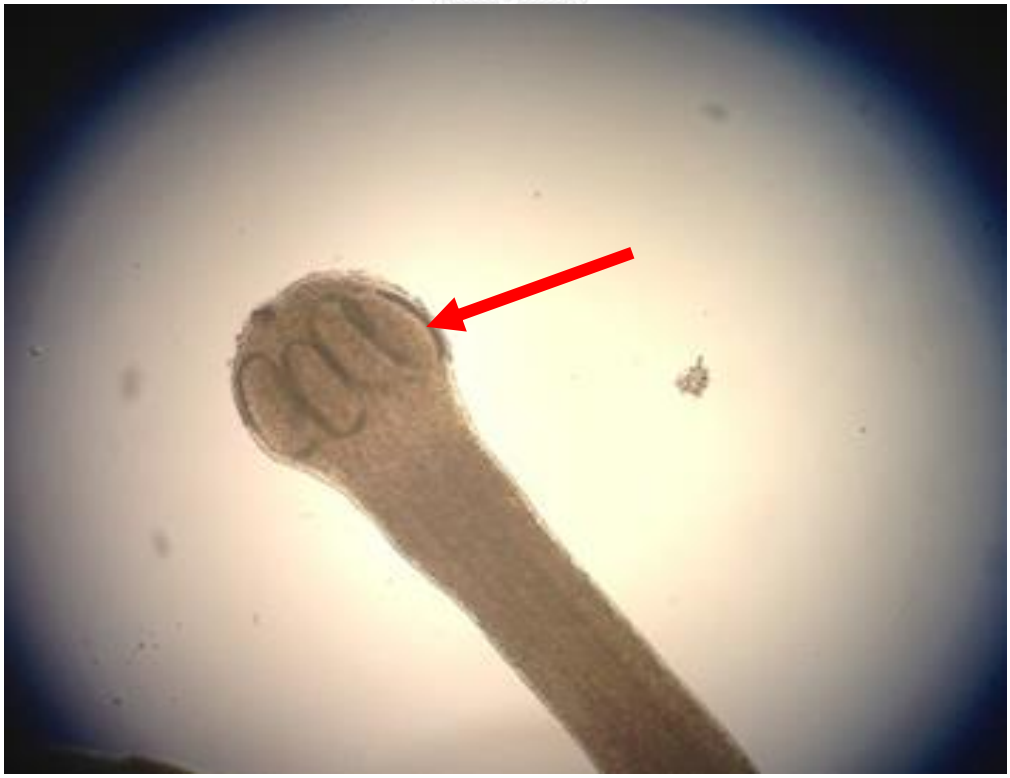

Figure 23: The morphology of scolex *Raillietina tetragona*

CHAPTER V
DISCUSSIONS AND CONCLUSIONS

5.1: Discussions

The parasitic diseases are main impact on animal husbandry. There have many countries in the world especially tropical and subtropical countries that have contaminated the parasitic diseases. The GI parasites are great infected to animal that lived on the ground or poor condition the mostly backyard chickens. This study was found the high prevalence of GI parasites in the backyard chickens, the positive sample was the 94.89%, the most common nematodes were *H. gallinarum* (74.65%), followed by *A. galli* (51.47%), *T. americana* (23.77%), *G. ingluvicola* (16.69%), *Capillaria* spp. (19.25%), while the most common cestodes were *R. echinobothrida* (58.15%), followed by *R. tetragona* (42.82%), *Hymenolepis* spp. (25.14%), *R. cesticillus* (14.14%), *C. digonopora* (9.62%), *Choanotaenia* spp. (8.64%). In addition, this study was found the trematodes in some provinces. They were positive *E. revolutum* (4.71%), *Notocotylus* (1.76%) and *Prostogonemus* (0.98%), respectively. This result was similar compared to other researchers that had been reported worldwide. For example, GI parasites had been reported in free-range chickens in Iran. The most common nematodes was found the *A. galli* (56%) followed by *H. gallinarum* (24%), *Capillaria anatis* (4%) and *Cheilospirura humulosa* (4%) while the highest prevalence of cestodes were *R. tetragona* (58%) followed by *Ch. infundibulum* (8%) and *R. echinobothrida* (6%), (Eslami et al., 2009b). Moreover, in Golestan province, Northern part of Iran was surveyed the parasitic infection on poultry, the result showed 92.73% which is the high prevalence. The common nematodes were seen *A. galli* (48.18%) followed by *H. gallinarum* (18.18%), *Acuaria spiralis* (15.45%), *Syngamus trachea* (15.45%), *Capillaria sp.* (1.81%), while cestodes was *R. tetragona* (53.63%) followed by *R. echinobothrida* (25.45%), *R. cesticillus* (14.45%) and *Ch. infundibulum* (11.81%), (Mamashly et al., 2011b). In recently, in Piranshahr city in Iran, the prevalence in native chickens showed 63% of GI parasitic infection, these studies were positive lesser than my study. Normally, nematodes were the highest prevalence (47%), followed by the cestodes (16%). The most common nematodes in native chicken were *A. galli* (21 %) and *H. gallinarum* (12 %). The most prevalence cestodes infected in native chickens

were *Railietina* spp. In addition, in Mashhad (Northeast, Iran), gastrointestinal helminths in free-range chickens were infected with *A. galli* (29%), *H. gallinarum* (23%), *H. isolonche* (9%), *Subulura brumpti* (3%), *R. tetragona* (15%), *R. echinobothrida* (11%), and *Ch.infundibulum* (4%), respectively. However, some study has been reported in the native turkeys in Amol, The prevalence of GI parasite in native turkeys was 75% which infected with nematodes, cestodes and trematode. The common parasite species was *A. galli* (51%) followed by *Capillaria* (20%), *Echinostoma* (11%). *R. echinobothrida* (8%) and *R. tetragona* (8%). In Iran, overall native and free-range chickens were infected with the high prevalence of nematodes and cestodes but did not positive with trematode whereas native turkeys were infected with nematodes, cestodes and trematodes. The variation of parasitic infection can be ascribed to variation in geographic location and climate of the districts from which birds were sample (Ebrahimi et al., 2014; ShahrokhRanjbarBahadory et al., 2014; Yagoob and Mohsen, 2014).

In eastern region of Ghana, they had contaminated of GI parasite in scavenging chickens. The most percentage of cestode species were *R. echinobothrida* (81%) and *Hymenolepis* spp. (66%), while the percentage of nematodes species were *G. ingluvicola* (62%) followed by *Capillaria* spp. (60%), *T. fissispina* (58%), *H. gallinarum* (31%), *A. galli* (24%), respectively (Poulsen et al., 2000). Shinde had been observed endoparasites from alimentary canal of *Gallus gallus domestics*, the result showed the high infection of cestodes more than nematodes (Shinde, 2001). Both studies had the different results from my study.

In Morocco, gastrointestinal helminthes had been distributed in chicken farms, it was the high percentage of infection (89.90%). The chickens had infection with nematode, cestode and trematode. The most prevalent infection of nematodes were *Subulura brumpti* (15.3%), *H. gallinarum* (10%), *A. galli* (9%), *Capillaria obsignata* (6%), *Dispharynx nasuta* (5.3%), *Tetrameres sp.* (3.3%) and *Cheilospirura hamulosa* (2.7%), while the most infected cestode were *R. cesticillus* (12%) followed by *R. tetragona* (9.3%), *H. contaniana* (7%), *R. echinobothrida* (5.7%) and *H. carioca* (3.7%), moreover only one species of trematode had found which was *Notocotylus gallinarum* (0.7%) (Hassouni and Belghyti, 2006). In Nigeria, many studies had been reported the helminthic parasites in free-range chickens from different regions. Besides the study

was compared to the gastrointestinal helminthes in two groups between local chickens and exotic chickens group. They were raised under the extensive native free-range system and under the intensive system of management. 95.7% and 11.8% of GI parasites in the local chickens and exotic chickens were infected, respectively. The local chickens had 7 species of cestodes and 12 species of nematodes and exotic chickens had only one cestode and one nematodes species (Fatihu et al., 1990b). In Sokoto Metropolis was surveyed the helminthic infection of chickens. The prevalence of parasitic infection in chickens were (92.6%). The highest prevalence of nematodes were *Heterakis* (28.66%) followed by *Ascaridia* (18.66%), *Tetrameres* (9.33%), *Capillaria* (4.00%) and *Trichostrongylus* (1.33%) while the highest cestodes were *Raillietina* (74.66%) followed *Choanotaenia* (5.33%), *Amoebotaenia* (2%) and *Davainea* (0.66%) (Mikail and Adamu, 2008). Samaru, Zaria in Nigeria was studied the gastrointestinal parasites in domestic fowl Gallus-gallus domesticus. The chickens had infected with cestodes such as: *Hymonolepis corioca* (25%), *R. tetragona* (23.9), *R. echinobothrida* (13%), *Coanotaenia infundibulum* (10.9%) and *R. cesticillus* (9.8%) while the nematodes had *A. galli* (43.8%), *H. gallinarum* (33.7%), *Syngamus trachea* (2.2%) and *Gongylonema ingluvicola* (1%), respectively (Luka and Ndams, 2007). In addition, the study of village chickens in the Sub-humid Zones of South-Eastern Nigeria was observed three kinds; chick, growers and adults. The total prevalence was 71.3%. The most common parasites were *A. galli* (48.39%) followed by *H. gallinarum* (35.48%), *Capillaria* spp. (16.13%), *Raillietina* spp. (16.13%), *Syngamus trachea* (12.9%), *Davainea proglottina* (9.68%), *Sublura brumpti* (6.49%) and *Amoebotaenia* spp. (3.33%), respectively (Nnadi and George, 2010). Moreover, a preliminary surveyed the helminthic infection in free-range chickens in Abeokuta, Ogun state. All free-range chickens was contaminated with endoparasites. The high prevalence of nematodes species were *A. galli* and *H. gallinarum* (60%) while the high prevalence of cestodes species was *Raillietina* spp.(80%) (Ekpo et al., 2010). Current studies, in Ikwuano, Abia State, Nigeria was observed the gastrointestinal parasites in domestic fowls. The gastrointestinal parasites had contaminated 62.7% in domestic fowls. The highest contamination of helminthic parasites was nematode and followed by cestodes. Mostly, nematode species was *A. galli* (41.6%), followed by *C. caudinflata* (7.2%), *H. gallinarum* (4.4%), *Strongyloides avium* (1.6%), *C. obsignata* (1.1%), *Trichostrongylus*

tenus (1.1%) and *Subutura brumpti* (0.5%), while the common cestodes species was *Hymenolepis carioco* (3.3%), *R. tetragona* (6.1%), *R. echinobothrida* (1.6%), *R. cesticillus* (0.5%) and *Davainea proglottina* (0.5). The high prevalence of helminthic parasites in the domestic fowl (*Gallus-gallus domesticus*) slaughtered in Giwa market, Giwa local government, Area, Kaduna State, Nigeria were 81.5%. The domestic fowls were found 6 species of helminthes such as: *R. tetragona, R. echinobothrida, R. cesticillus*, *Hymenolepis*, *carioca*, *A. galli*, and *H. gallinarum*. Moreover, the gastrointestinal parasites of local chickens were identified from selected communities in Nsukka region of South-Eastern Nigeria. The result was 81.5% which found 6 species of gastrointestinal helminthes. The highest species had *R. echinobothrida* (78%) followed by *R. tetragona* (60%), *R. cesticillus* (6%), *Choenotaenia infludibulun* (12%), while the nematdes had *A. galli* (22.3%) and *H. gallinarum* (12.4%). However, the gastrointestinal tracts of domestic turkeys were collected from slaughter in Kaduna Metropolis, Kaduna State that examined. The prevalence (57.7%) was presented. The highest prevalence of parasite species was *Ascaridia* .spp (26.0%), followed by *Eimeria* (22.45%), *Subulura brumpti* (3.6%), *R. cesticillus* (2.6%), *H, gallinarum* (1.0%) *Ch. infundibulum*, *Davainea meleagridis*, *Methroliasthes lucida* and *capillaria* spp had the least prevalence of (0.5%). In this country did not found the trematodes infections in the chickens (Ohaeri and Okwum, 2013; Junaidu et al., 2014; Udoh et al., 2014; Idika et al., 2015). In Zimbabwe, many reports had been published. The first survey the parasitic nematodes in domestic chickens were examined. 11 of nematodes species had identified, the most common nematodes were *Allodapa brumpti* (64.8%) followed by *Tetrameres americana* (64.1%), *G. ingluvicala* (60.1%), *A. galli* (32.9), *H. gallinarum* (15.2%), *Cheilospirura hamalosa* (4.4%), *Dispharynxnasuta* spp. (4.8%), *C. obsignata* (3%) and *C. contorta* (1.5%). Moreover, ectoparasite, cestodes and management of free-range indigenous chickens in rural Zimbabwe were examined. The highest prevalence of cestode species in free-range chickens had *R. tetragona* (84.4%), followed by *R. echinobothrida* (32.2%), *Hymenolepis* spp. (31.9%), *R. cesticillus* (27.3%), *Amoebotaenia cuneata* (28.9%), *Ch. infundibulum* (8.9%), *Davainea proglottina* (4.1%), *Cotugnia digonopora* (1.9%) (Mukaratirwa et al., 2001; Mukaratirwa and Hove, 2009). In the Goromonzi District in Zimbabwe was observed the ectoparasite, endoparasite and haemoparasite in free-range chickens. The study was

compared between the grower and adult chickens groups. The almost grower chickens were contaminated with nematodes higher than adult chickens but the cestodes were contaminated the higher of adult chickens. The most common nematodes had *Allodapa suctoria* (76%; 72%), *A. galli* (48%; 24%), *G, ingluvicola* (28%; 56%), *H. gallinarum* (64%; 62%) and *T. americana* (70%; 62%), while the cestodes had *Amoebotaenia cuneata* (60%; 68%) followed by *Hymenolepis* spp. (62%; 80%), *R. echinobothrida* (66%; 34%), *R. tetragona* (94%; 100%), *Skruabinia cesticillus* (50%; 76%), respectively (Permin et al., 2002). Currently study of seasonality investigated parasite in free range chickens from a rural district in Zimbabwe, mostly free-range chickens was contaminated higher of parasites in summer. The common parasite found *A. galli, H. gallinarum, Capillaria obsignata* and *T. americana.* The cestodes found *Ch. infundibulum, Hymenolepis* spp. and *Amoebotaenia cuneata* (Percy et al., 2012). In Central Zambia had been distributed the gastrointestinal parasite and related with weight gain in free-range chickens. The result was 95.2% of GI parasites which infected in free range chickens. The common species of parasites were *Allodapa suctoria* (85.6%) followed by *Raillietina* spp. (81.6%), *T. americana* (80.8%), *G.ingluvicola (50.4%), H. gallinarum* (32.8%) and *A. galli* (28.8%), respectively (Phiri et al., 2007). In India, the helminth of domestic chickens had been investigated in rainfall regions that occurred the high percentage of helminthic infection of domestic fowls in a subtropical high-rainfall. The result was 90.9% infection, moreover the common gastrointestinal parasite had *A. galli* (60.5%) followed by *Raillietina* spp. (51.5%), *H. gallinarum* (40.9%), *Capillaria contorta* (13.5%), *C. annulata* (11.6%), *Echinolepis carioca* (6.5%), *Echinostoma sp.* (1.1%) and *Strongyloides sp.* (0.1%) (Yadav and Tandon, 1991). Recently studies were reported from different regions of India. The free-range chickens in the subtropical and humid zone, Northwestern India had four nematodes such as *A. galli, H. gallinarum, Capillaria* spp. and *Cheilospirura hamolusa* while the cestodes had four species such as: *R. echinobothrida, R. tetragona, R. cesticillus* and *Amoebotaenia cuneata.* The overall prevalent infection was 72%. In addition, in Kashmir, India, prevalence of cestode was investigates in free-range backyard chickens (*Gallus gallus domestics*) that collected from different localities of Kashmir. The result was (85.83 %) which infected with cestode parasites. The common cestode species had nine which was *R. tetragona* (65%) followed by *R. echinobothrida*

(33.33%), *R. spiralis* (26.66%), *R. cesticillus* (22.50%), *Amoebotaenia cuneata* (20.00%), *Davainea proglottina* (18.33%), *Choanotaenia infundibulum* (18.33%), *A. domesticus* (15.00%) and *C. gondwana* (10.83%). Moreover, the prevalence of helminthic parasites in backyard poultry in North India region. 68.33% of percentage was infected in backyard chickens. The common nematode had *A. galli* (20%), *H. gallinarum* (10.83%), *Capillaria* spp. (5%) and *Cheilospirura hamlosa* while cestode had *R. tetragona* (9.16%) *R. echinobothrida* (5%), *Hymelolepis* spp. (5%), *Cotugnia digonopara* (3.33%) and *R. cesticillus* (2.5%), respectively (Katoch et al., 2012; Dar and Tanveer, 2013; Bhat et al., 2014). In Bangladesh had been studied the different type of poultry, all of backyard chickens were infected 100%, while layer chickens (48.75%) and broiler (3.75%). The highest prevalence parasite in backyard poultry were *R. tetragona* (100%), followed by that of *A. galli* (87.50%) and *H. gallinarum* (80%) (Rabbi et al., 2006). In Southeast Asia, they had been reported the helminthic infection in domestic chickens. In Malaysia was observed the higher percentage of *A. galli*, followed by *R. echinobothrida* and *R. tetragona* (Rahman et al., 2009). In Thailand, helminthic parasites of domestic chickens had been reported from many researchers. In Southern part of Thailand, the adult native chickens had infected 83.71% by endoparasites. The native chickens infected two kind of helminthes and one kind of protozoa. The common nematodes species were *H. gallinarum* (33.71%) followed by *Gongylonema inglovicula* (31.71%), *T. americana* (16.57%), *Capillaria contorta* and *C. annulata* (14.57%), *A. galli* (8.29%) and *Cheilospirura hamulosa* (8%) while the cestodes species were *R. echinobothrida* (62%) followed by *R. tetragona* (18.29%), *Hymenolepis* (4.57%), *Amoebtaenia* (4.29%), *R. cesticillus* (3.43%) and 0.29% *Davainia proglottina.* Moreover, the central part had reported the helminthes in native chickens, the study identified found three trematodes, six cestodes and five nematodes species. The most common parasites species found trematodes such as; *Prosthogonimus pellucidus* (12.5%), *E. revolutum* (1.9%) and *Catatropis verrucosa* (0.9%), and the cestodes species such as *R. echinobothrida* (66.8%), *R. tetragona* (20.1%) *Hymenolepis carioca* (37.9%), *Amoebotaenia cuneata* (12.2%), *R. cesticillus* (8.4%) and *Cotugnia digonophora* (2.3%) while the nematodes species were *H. gallinarum* (21.5%), *Tetremeres fissispina* (43.8%), *A. galli* (21.5%), *G. influvicola* and *Oxyspirura mansoni* (Sangvaranond, 1994; Ayudhya and Sangvaranond, 1997). In

current study percentage of *Raillietina* spp. in domestic Chickens from Phayao Province were infected 100% (Bootboonchoo and Wongsawad, 2012). In Vietnam was investigated the helminthic parasites in indigenous and exotic chickens including the age of chickens. The overall prevalence had 95.5% and the common species found *A. galli, H. beramporia, T. mothedai, C. obsignata, R. echinobothrida* and *R. tetragona*. The 2 groups of adult, chicks were found the higher prevalence and infection of several species of helminthes. In contrast, *A. galli* and *C. obsignata* were seen to be more prevalent in Luong Phuong chicks. Moreover, the difference age of chickens were indicated in the group of chickens in which the prevalence, the infection was higher for the adult than the young chickens for most helminthes (Schou et al., 2007).

In this study, faecal examinations were positive GI parasites 92.90%. They had positive helminth eggs and protozoa oocysts. The high prevalence of nematode egg was *Strongyloides* (67.79%) followed by *H. gallinarum* (62.59%), *A. galli* (43.52%), *Capillaria* spp. (9.58%) and spirurid egg (5.86%), while the prevalence of cestode eggs had only (13.20%). and also the trematodes egg had *E. revolutm* 3.91% and *Notocotylus* 2.20%. The percentage oocysts had 60.88%. In this result was shown the high percent when compared to others researches. In Kenya, the faecal examination of native chickens had 84.2%. The most common parasites were coccidial oocysts (27.04%) followed by nematodes egg such as *A. galli* (25.63%), *Capillaria annulata* (8.45%), *C. retunsa* (5.21%), *H. gallinarum* (1.41%), *Syngamus trachea* (0.3%) while the cestodes egg had only *Raillietina tetragona* (2.96%). They did not find the trematode eggs (Kaingu et al., 2010). In South Africa had studied the prevalence helminthic parasites in village chicken by using the faecal examination method. The overall parasite infection of village chickens was 99%. The most parasites had been found nematode egg and protozoa oocysts. The highest prevalence was *H. gallinarum* and coccidian. The common helminth species had *H. gallinarum, A. galli, Capillaria* spp. *Strongyloides, Syngamu trachea, Subbulura brunpti, Ch. infundibulum, R. cesticillus, Amaebotaenia sphenoides, Prosthogonimus* and *Eimeria* (Mwale and Masika, 2011). In India, The overall prevalence was 63.67%. The faecal examination found the high prevalence of *A. galli* (19.16%) followed by *H. gallinarum* (9.5%), *Capillaria* spp. (3.5%) and *Trichostrongylus* (2.5%) while cestodes had 16.16% of *Raillietina* (Bhat et

al., 2014). In addition, 60.88% of *Eimeria* spp. in domestic chickens in Cambodia was lesser than the others reports in worldwide. In Iran, the *Eimeria* spp. were infected in scavenging native chickens (64%) and broiler chickens (75%), respectively. The most prevalence is *Eimeria tenella* in both groups. (Hadipour et al., 2011; Shirzad et al., 2011).

According to my study in domestic chickens was investigated the *E. revolutum* (4.71%) which is low prevalence, but it is caused of zoonosis in human (Tangtrongchitr and Monzon, 1991; Anh et al., 2010; Sohn et al., 2011a; Saijuntha et al., 2013). In Cambodia, they were studied a prevalent gastrointestinal parasites from primary school in children at Pursat, Kampong Cham, Bat Dambang, and Oddar Meandhey provinces were investigated low positive of faecal examination 22.4%, 15.6%, 4.8% and 0.7%, respectively. In General, children eat the mollusc raw, incompletely cooked, poor sanitation, unclean drinking water (Lee et al., 2002; Park et al., 2004; Sohn et al., 2011a; Sohn et al., 2011b). However, the Southeast Asia countries was contaminated of trematiatic infection. Many report in Thailand was studied the prevalence of metacercariae of *E. revolutum* in fresh water snails and domestic poultry. The study was shown the high percentage in free-grazing ducks and low percentage in chickens by using fresh snail water feeding. Moreover, metacercariae of *E. revolutum* was examined from fishponds, and others pathogens caused zoonosis in the human (Chantima et al., 2013; Saijuntha et al., 2013; Tesana et al., 2014; Kiatsopit et al., 2015). Nonetheless, in Loa PDR was observed the infection of echinostome fluke in human whom live on riparian. The faecal examination was found the egg of *E. revolutum* and another fluke what infected human (Chai et al., 2012). Moreover, Vietnam is a major problem country that is infected with foodborne zoonosis. In Vietnam, people are really like to consume the raw or undercooked vegetable, fish, crabs and mollusc. In addition, owner's farms of domestic poultry are raised near or on fishponds therefore poultry can be consumed fresh snail water or fish which has metacercariae of trematodes. The study was observed poultry's farm whenever was reservoirs of zoonotic fish-borne (Anh et al., 2010). Trematiasis is still widespread zoonotic diseases and economic loss every year (Phan et al., 2010a; Chai et al., 2011; Besprozvannykh et al., 2013; Boerlage et al., 2013; Hung et al., 2015). Furthermore, the Republic of Korea was reported the

prevalence of trematodes that infected in the human and animals, overall caused food-borne zoonosis (Chai and Lee, 1991; Chai and Lee, 2002; Chai et al., 2005; Youn, 2009; Cho et al., 2014). Currently studies were found the metecercariae of *E. revolutum* in worldwide (Jimenez et al., 2012; Serbina, 2014; Zimmermann et al., 2014; Rondelaud et al., 2015). However, the movement people, animals can be spread of parasitic diseases around the world, involving culture, customs, and behavior. Moreover, the increasing consumption of meat, fish, shrimp, and crabs, mollusc raw, incompletely cooked, pickled or dried facilitates among of trematodes (*Fasciola sp., Opisthorchis* spp., *Metagonimus sp. Echinostoma* spp.,) are caused zoonosis.

5.2: Conclusions

In lowland of Cambodia, domestic chickens was observed a huge prevalence of helminthic parasite that found three kinds of helminthic parasites (nematodes, cestodes and trematodes) and a protozoa (*Eimeria* spp.). The most common nematode species had *H. gallinarum* whereby *Strongyloides, A. galli, T. americanum, Capillaria* spp. and *Gongilonema* spp. while the common cestode species had *R. echinobothrida* followed by *R. tetragona, Hymenolepis* spp. *R. cesticillus, C. digonopora,* and *Choanotaenia* spp. However, the prevalence of trematode in this study is light prevalence. There are *E. revolutum, Notocotylus* and *Prostogonemus.* However, the prevalence of *Eimeria* spp. was high infection in domestic chickens. All of these parasites were used the worms identification and the faecal examination. The positive samples from worms identification was 94.89% while the faecal examination had 92.90%. Beside, in this study was recorded the location of parasitic infection. Mostly, domestic chickens was contaminated with multiple helminthic infections.

In addition, according to each provinces of this study, the domestic chickens from Prey Veng, Kandal and Takoe the domestic chickens found the *Echinostoma revolutum* which cause foodborne zoonotic in the human and two province did not found the *E. revolutum* because the places don't have rivers or lakes that cannot survived the living of intermediate host. The life cycle of *E. revolutum* need two the intermediate hosts to complete the life cycle. The first intermedite host has fresh snail water and the second intermediate host has fresh snail water, aquatic animals and frogs.

5.3: Suggestions

Further studies should be needed to determine the morbidity and mortality of effect the parasitic infection in domestic chickens in Cambodia. In addition, the concurrent bacterial, viral and parasitic diseases in domestic chickens should be studied. Moreover, the farmers must be raised the chickens with good condition and stop its relationship from intermediate host. The farmers should be deworm their chickens. The official governor should be established information to the farmers.

5.4: Advantages of study

This study of gastrointestinal parasites in domestic chickens is the first report in Cambodia. All information can be improved the knowledge to farmers, veterinarians and researchers about treatment and control the parasitic diseases in Cambodia. Moreover, the information can be applied to further studies in the future. In addition, this study can be improved the laboratory of parasitic diagnosis.

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APPENDIX

APPENDIX A: The GI parasites identification

N_0	PROVINCES	Markets	*A. galli*		*H. gallinarum*		*Gonylonema ingluvicls*	*Capillaria* spp.	*T. americana*	*R. cesticillus*	*R.echi oboth rida*	*R. tetragana*	*Choanotaenia* spp.	*Hymenolepis* spp.	*C. digonopora*	*E. revolutum*	*Prosthogunimus*	*Notocotylus*
			M	F	M	F												
1	Kamong Speu	Sangkarsei	0	0	6	15	0	0	0	0	1	1	0	1	0	0	0	0
2			0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0
3			0	0	8	15	1	0	0	0	1	1	0	1	0	0	0	0
4			0	0	4	5	0	1	1	1	1	1	0	1	0	0	0	0
5			1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
6			0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0
7			1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
8			0	0	1	1	0	1	0	1	1	1	0	1	0	0	0	0
9			0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0
10			1	0	0	3	1	0	0	1	1	0	0	1	0	0	0	0
11			0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
12			0	0	1	6	0	0	0	0	1	1	0	0	0	0	0	0
13			0	0	22	30	0	0	1	1	1	1	0	0	1	0	0	0
14			0	0	2	4	1	0	0	0	1	0	0	1	1	0	0	0
15			0	0	1	1	1	0	0	0	1	1	0	1	1	0	0	0
16			1	0	11	7	0	0	1	1	1	1	0	1	1	0	0	0
17			5	9	2	2	0	0	0	0	1	1	0	0	0	0	0	0
18			0	0	6	10	0	0	0	0	1	0	0	0	0	0	0	0
19			0	0	8	17	0	1	0	1	1	0	0	0	0	0	0	0
20			0	3	22	43	1	0	0	0	0	1	1	0	0	0	0	0
21		Udong	0	3	7	13	0	0	0	0	1	0	0	0	0	0	0	0
22			0	0	8	11	0	1	1	0	1	0	0	0	0	0	0	0
23			0	0	21	18	1	0	0	0	1	1	0	0	0	0	0	0
24			2	3	0	0	0	0	0	0	1	1	0	0	1	0	0	0
25			9	12	0	0	0	1	0	0	0	1	0	0	0	0	0	0
26			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27			0	0	0	4	0	0	0	0	1	0	0	0	0	0	0	0
28			1	2	0	0	0	0	1	0	1	1	0	0	0	0	0	0
29			1	1	21	27	1	0	1	0	0	0	0	0	0	0	0	0
30			1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
31			0	0	3	10	0	0	1	0	1	1	0	1	0	0	0	0
32			0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0
33			0	0	2	7	0	0	0	0	1	0	0	0	0	0	0	0
34			0	0	4	2	0	0	0	0	0	1	0	0	0	0	0	0
35			3	1	1	1	0	1	0	0	1	0	0	0	0	0	0	0

36			1	1	5	5	1	0	0	0	0	1	0	1	0	0	0	0
37			0	0	23	17	0	0	0	0	1	1	0	0	1	0	0	0
38			0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
39			4	5	0	0	0	0	1	0	1	1	0	0	0	0	0	0
40			0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0
41			0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
42			1	2	0	0	1	0	0	0	1	1	1	1	0	0	0	0
43			0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
44			0	0	0	2	0	1	1	1	0	0	0	0	0	0	0	0
45			0	2	5	6	0	0	0	0	1	0	0	0	1	0	0	0
46			0	0	68	41	0	0	0	0	1	1	0	0	0	0	0	0
47			1	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0
48			2	2	86	76	1	0	0	1	0	0	0	0	0	0	0	0
49			0	0	3	9	0	0	0	0	1	0	1	0	0	0	0	0
50			3	2	7	5	0	0	0	0	1	0	0	0	0	0	0	0
51			0	1	0	0	0	0	0	0	1	1	0	1	0	0	0	0
52			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53		Chamom	0	0	9	9	1	0	1	1	0	0	0	0	0	0	0	0
54			0	0	8	7	0	0	0	0	0	1	0	1	1	0	0	0
55			1	1	1	1	0	0	0	0	0	1	1	0	0	0	0	0
56			0	0	78	101	1	1	0	1	1	0	0	0	0	0	0	0
57			0	0	24	35	0	0	0	0	1	1	0	0	0	0	0	0
58			0	0	2	6	0	0	0	1	1	0	0	0	0	0	0	0
59			2	3	2	3	0	0	0	1	0	1	0	0	1	0	0	0
60			0	0	3	4	0	0	0	0	1	1	0	1	0	0	0	0
61			0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
62			0	0	5	4	0	0	0	0	1	0	0	1	0	0	0	0
63			5	4	15	9	1	0	1	0	1	1	0	0	0	0	0	0
64			8	7	21	38	0	0	0	1	1	1	0	1	0	0	0	0
65			0	0	3	9	0	0	0	1	0	1	0	1	0	0	0	0
66			2	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0
67			0	0	11	17	0	0	0	0	1	0	1	0	0	0	0	0
68			0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0
69			2	4	5	3	0	1	0	0	0	0	0	0	0	0	0	0
70			0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0
71			0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
72			7	12	10	15	0	0	0	1	1	0	0	0	0	0	0	0
73			0	0	9	7	3	0	1	0	1	0	0	0	0	0	0	0
74			0	0	5	15	0	0	0	0	1	0	0	0	0	0	0	0
75			0	0	12	11	0	0	0	0	1	0	0	0	1	0	0	0
76			11	18	5	13	0	0	0	0	1	1	0	0	0	0	0	0
77			0	0	15	29	0	1	0	0	1	1	0	1	0	0	0	0
78			3	3	11	14	0	0	1	0	1	1	0	0	0	0	0	0
79			0	2	19	12	1	0	0	1	0	0	0	1	0	0	0	0
80			0	0	18	33	0	0	0	0	1	1	0	0	0	0	0	0
81			0	0	8	4	0	0	0	0	1	1	0	0	0	0	0	0

82			0	0	14	18	0	0	1	0	1	0	0	0	0	0	0	0
83			3	1	10	12	1	0	0	1	1	1	0	0	0	0	0	0
84			0	0	16	21	0	0	0	1	1	1	0	1	0	0	0	0
85			0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
86			0	1	5	13	1	0	1	0	1	0	0	0	0	0	0	0
87			0	1	0	2	0	1	1	0	1	1	0	0	0	0	0	0
88			0	1	8	3	0	0	0	0	0	1	0	0	0	0	0	0
89			0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
90			3	5	3	10	0	0	0	1	0	1	0	0	1	0	0	0
91			1	3	18	36	0	1	1	0	1	0	0	0	0	0	0	0
92			0	0	10	9	0	0	0	0	1	0	0	0	0	0	0	0
93			0	0	2	9	1	0	0	0	0	0	0	0	0	0	0	0
94			0	0	9	16	1	0	0	0	0	0	0	1	1	0	0	0
95			0	0	58	80	0	1	1	1	1	0	0	0	0	0	0	0
96			0	1	58	80	0	0	0	0	1	0	0	0	0	0	0	0
97			0	0	5	11	0	0	0	0	1	1	0	0	0	0	0	0
98			0	0	21	22	0	0	1	0	1	1	0	0	0	0	0	0
99			3	2	25	31	1	0	0	0	0	0	0	1	0	0	0	0
100			0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101			0	0	76	55	0	0	0	0	1	0	0	0	0	0	0	0
102			2	2	4	5	0	0	0	0	1	1	0	0	0	0	0	0
1	Kandal	Kor K	1	3	37	42	0	0	0	0	0	0	0	0	0	0	0	0
2			1	0	67	76	0	1	0	0	0	1	0	0	1	0	0	0
3			1	0	17	23	0	0	1	0	1	1	0	0	0	0	0	0
4			0	0	37	57	0	0	0	0	0	1	0	1	1	0	0	0
5			1	0	12	22	1	0	0	0	1	0	0	1	0	0	0	0
6			0	0	5	7	0	0	0	0	1	1	0	0	0	0	0	0
7			0	0	29	47	0	1	0	0	1	0	1	1	0	0	0	0
8			0	0	161	180	0	0	1	1	1	1	0	0	1	0	0	0
9			3	2	37	57	0	1	0	0	0	1	0	1	0	0	0	0
10			0	0	54	84	0	0	0	0	1	0	0	0	0	0	0	0
11			0	1	21	48	0	0	0	0	1	1	1	1	0	0	0	0
12			0	0	190	206	1	0	0	0	0	0	0	0	0	0	0	0
13			3	0	240	215	0	1	1	0	1	1	0	1	1	0	0	0
14			1	1	14	16	0	1	1	0	1	1	0	0	0	0	0	0
15			1	0	8	16	0	0	0	1	0	1	0	0	0	0	0	0
16			0	0	54	49	0	0	1	0	1	0	0	0	0	0	0	0
17			0	0	12	10	0	1	1	0	1	1	0	0	1	0	0	0
18			0	1	25	47	0	0	0	0	0	1	0	0	1	0	0	0
19			0	0	100	134	0	1	1	0	1	1	1	0	0	0	0	0
20			1	3	22	49	0	1	1	0	1	1	1	1	0	1	0	0
21			10	13	21	48	1	0	0	0	0	0	0	0	1	0	0	0
22			1	0	25	26	0	0	1	0	1	0	1	0	0	1	0	0
23			0	0	44	34	0	1	1	1	1	0	1	1	0	0	0	0
24			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25			0	0	145	183	0	0	1	0	0	1	0	0	1	0	0	0

26			0	0	17	12	0	1	1	0	0	1	0	0	1	0	0	0
27			0	1	32	15	0	0	0	0	1	0	0	0	0	0	0	0
28			0	0	8	11	0	0	0	0	1	0	0	0	0	0	0	0
29			0	2	14	18	0	0	0	0	1	0	0	0	0	0	0	0
30			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31			0	0	43	46	0	0	0	0	1	0	0	0	0	0	0	0
32			0	0	19	9	0	0	1	0	1	0	0	0	0	0	0	0
33			0	0	9	7	0	0	0	0	1	0	0	0	1	0	0	0
34			1	0	34	20	0	0	1	0	1	0	0	1	0	0	0	0
35			0	0	21	9	0	0	1	0	1	0	0	0	0	0	0	0
36		Saang	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37			0	0	1	6	1	0	0	0	1	0	0	0	0	0	0	0
38			0	1	10	16	0	1	0	0	1	0	0	0	0	0	0	0
39			0	0	3	3	1	0	1	0	1	0	0	0	0	0	0	0
40			4	3	12	8	0	1	1	0	0	0	1	0	1	0	0	0
41			3	1	11	10	0	1	0	1	1	0	1	1	0	0	0	0
42			0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
43			0	1	11	6	1	1	0	0	1	0	0	0	0	0	0	0
44			1	4	27	33	1	1	1	0	0	0	0	1	0	22	0	0
45			6	6	78	63	1	0	1	0	0	0	1	1	0	0	0	0
46			1	1	4	0	1	0	0	0	1	0	1	0	0	0	0	0
47			0	0	2	2	0	0	1	0	0	1	0	0	0	0	0	0
48			4	2	11	17	0	0	1	0	1	1	0	0	0	0	0	0
49			0	0	5	8	0	1	1	0	1	0	0	0	0	0	0	0
50			4	8	3	5	1	1	0	0	0	0	0	1	0	0	0	0
51			0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
52			0	0	22	70	0	0	0	0	1	1	0	0	0	0	0	0
53			11	18	5	9	0	1	0	0	1	1	0	1	0	0	0	0
54			0	0	17	21	0	0	1	0	1	1	1	1	0	0	0	0
55			0	0	14	15	1	1	0	0	0	0	1	1	0	0	0	0
56			0	0	37	44	0	1	0	0	0	1	0	0	0	0	0	0
57			0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0
58			1	1	95	56	0	0	0	0	1	0	0	0	0	0	0	0
59			0	0	21	15	1	0	1	0	1	1	1	0	0	0	0	0
60			0	0	7	13	0	0	1	0	0	1	1	1	0	0	0	0
61			0	1	10	9	0	0	0	0	1	0	0	0	1	0	0	0
62		Kor Thum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63			1	0	7	11	0	0	0	0	1	1	0	0	0	0	0	0
64			0	0	1	1	0	1	0	0	0	0	0	1	1	0	0	0
65			0	0	8	12	1	0	1	0	0	1	0	1	1	1	0	0
66			1	1	0	0	0	0	0	1	0	0	0	1	0	1	0	0
67			6	6	87	107	0	0	1	0	0	1	0	1	0	0	0	0
68			1	0	23	27	0	1	0	0	1	1	0	0	0	0	0	0
69			0	0	24	28	0	1	1	0	1	0	0	1	1	0	0	0
70			0	0	1	2	0	0	0	1	1	0	1	0	0	0	0	0
71			2	1	253	271	1	1	0	0	1	0	0	0	0	0	0	0

72			0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
73			7	8	6	6	0	0	1	1	0	1	0	1	0	0	0	0
74			3	2	45	60	0	0	0	0	0	0	1	1	0	0	0	0
75			1	1	6	9	1	0	1	0	0	0	1	1	1	0	0	0
76		Takhmou	1	4	34	47	0	1	0	0	0	1	0	0	0	0	0	0
77			1	2	4	4	0	0	0	0	1	0	0	0	0	0	0	0
78			1	2	5	8	0	0	1	0	0	0	0	0	0	0	0	0
79			0	0	15	1	1	1	1	0	1	1	0	0	0	0	0	0
80			0	0	11	22	0	1	0	1	1	0	0	0	0	0	0	0
81			2	2	9	15	0	0	0	0	1	0	0	0	0	6	0	5
82			0	0	21	30	1	1	0	0	1	0	0	0	0	3	2	0
83			0	0	50	63	0	0	0	0	1	0	0	0	0	1	0	0
84			0	0	5	8	0	1	0	0	0	1	0	1	0	0	0	0
85			0	0	11	18	1	1	0	0	1	0	0	0	0	0	0	0
86			0	1	3	6	0	0	0	0	1	1	1	0	0	0	0	2
87			0	1	2	3	1	0	0	0	0	1	0	1	0	0	0	0
88			0	3	10	14	0	0	1	1	0	0	0	0	0	0	0	0
89			0	0	5	4	0	0	0	0	1	0	0	0	0	0	0	0
90			0	1	1	2	1	1	0	0	1	1	0	0	0	0	0	0
91			0	2	5	5	1	0	0	0	1	0	0	0	0	0	0	0
92			3	2	10	24	0	0	1	0	1	0	0	0	0	1	0	0
93			2	2	6	10	0	1	1	0	0	0	0	0	1	0	0	0
94			4	1	0	0	1	0	0	0	1	0	0	1	0	0	0	0
95			3	5	4	6	1	0	1	0	0	0	0	0	0	0	0	0
96			0	0	15	35	0	0	1	0	1	0	1	0	0	0	0	0
97			1	0	1	1	0	1	0	0	0	1	1	0	0	0	0	0
98			0	3	9	12	0	0	0	0	1	1	0	1	0	0	0	0
99			2	0	4	6	1	1	1	0	0	0	0	0	1	1	0	0
100			2	1	1	0	0	0	1	0	1	1	0	0	0	0	0	0
101			0	2	10	15	0	0	1	0	1	0	0	0	0	0	0	0
102			4	5	7	7	1	1	0	0	1	0	0	0	0	0	0	0
103			0	0	61	78	0	0	0	0	0	0	0	0	0	0	0	0
104			0	0	33	47	0	0	0	0	0	1	0	1	0	0	0	0
105			1	1	54	58	1	0	1	0	0	0	0	1	0	0	0	0
1	Prey Veng	Neak Loueng	8	7	18	23	1	0	0	1	1	1	0	1	0	0	0	0
2			0	0	20	22	0	0	0	0	1	1	1	0	0	0	0	0
3			2	2	10	19	0	0	1	0	1	0	0	0	0	0	0	0
4			4	6	4	2	0	0	0	1	1	1	1	1	0	0	0	0
5			1	1	1	2	0	0	0	0	1	0	0	1	0	0	0	0
6			1	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0
7			2	4	6	6	0	0	1	1	0	0	0	0	0	0	0	0
8			0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
9			4	5	0	0	0	0	0	0	0	1	0	0	0	0	0	0
10			0	1	40	35	1	0	0	0	1	1	0	0	0	0	0	0
11			0	0	0	0	0	0	1	0	0	1	1	1	0	1	1	0
12			3	2	53	81	0	1	1	0	1	1	0	0	0	0	0	0

13			1	1	28	42	0	0	0	0	1	1	0	0	0	0	0	0
14			0	0	5	8	1	1	0	0	1	0	0	0	0	1	0	1
15			3	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0
16			0	0	19	11	1	0	1	0	1	1	0	0	0	0	0	0
17			1	0	1	1	0	0	1	0	1	0	0	1	0	0	0	0
18			0	0	5	9	0	0	1	0	0	1	0	1	1	0	0	0
19			1	1	0	0	1	1	0	0	1	1	0	1	0	0	0	0
20			1	2	13	17	0	0	0	0	1	0	0	0	0	0	0	0
21			1	2	5	10	0	0	1	0	1	1	0	0	0	0	0	0
22			0	0	9	5	1	1	0	1	1	1	0	0	1	0	0	0
23			0	0	10	11	0	0	0	0	1	0	0	1	0	2	0	0
24			0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
25			0	0	2	3	0	1	0	0	1	0	0	0	0	0	0	0
26			5	5	9	14	0	0	1	1	1	1	0	0	0	0	0	0
27			0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	5
28			0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
29			0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	38
30			0	1	9	10	1	1	0	0	1	0	0	0	0	0	0	0
31			0	1	2	3	0	0	1	0	0	1	0	0	0	0	0	0
32			0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0
33			0	0	15	20	1	1	0	0	0	0	0	1	0	0	0	0
34			0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0
35			5	4	3	3	1	0	0	1	1	1	0	1	0	1	0	0
36		Prev Veng	1	0	80	104	0	0	0	0	0	1	0	0	0	0	0	0
37			0	0	13	19	0	1	0	0	0	1	0	0	0	0	0	0
38			5	7	0	2	0	1	0	0	1	0	0	0	0	0	0	181
39			1	1	9	11	0	0	0	0	1	1	0	0	0	0	0	0
40			0	1	10	20	0	0	0	0	1	1	0	0	0	0	0	0
41			0	0	1	2	0	0	1	0	1	0	0	0	0	0	0	0
42			0	0	0	1	0	0	0	0	0	1	0	0	0	10	0	0
43			0	0	4	7	0	0	0	0	1	0	0	0	0	0	0	0
44			0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
45			0	0	1	1	0	0	0	1	1	0	0	1	0	10	11	0
46			0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	4
47			0	0	1	2	0	0	1	1	1	0	0	0	0	0	0	0
48			0	2	3	5	0	0	0	0	0	0	1	1	0	0	0	0
49			7	9	153	210	0	0	0	0	0	1	1	0	0	0	0	0
50			1	4	25	35	0	1	0	0	1	0	0	0	0	0	0	0
51			0	1	5	6	1	0	0	0	1	0	1	1	0	0	0	0
52			5	11	0	1	0	0	1	0	1	0	0	0	0	0	0	0
53			0	0	10	13	0	0	0	0	1	0	0	0	1	0	0	0
54			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

55			0	0	0	1	0	1	0	0	1	1	0	1	0	0	0	0
56		Bar Phnm	0	1	2	3	0	0	0	1	1	1	0	0	0	6	0	0
57			2	3	5	12	0	0	1	0	1	0	0	0	0	0	0	0
58			5	5	8	13	0	1	0	0	0	1	0	1	1	76	1	0
59			2	3	0	0	0	0	0	0	0	0	0	0	1	77	0	0
60			0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
61			1	1	3	3	0	1	1	1	1	1	0	0	0	5	1	0
62			0	0	5	7	1	0	0	0	1	1	0	0	0	0	0	0
63			17	9	0	0	0	0	0	0	0	1	0	1	0	0	0	0
64			0	3	0	1	0	0	0	0	0	1	0	1	0	0	0	0
65			0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
66			0	0	1	1	10	1	0	0	1	0	0	1	0	3	0	0
67			0	0	4	5	0	0	1	0	1	0	0	0	0	0	0	0
68			1	0	1	5	0	0	0	0	1	1	0	0	0	1	0	3
69			0	0	4	9	0	0	1	0	0	1	0	0	0	0	0	0
70			0	0	1	4	1	1	1	0	0	1	0	0	0	0	0	0
71			0	0	1	3	0	0	0	0	0	0	0	1	0	0	0	0
72			2	2	15	23	0	0	0	0	0	1	1	0	0	0	0	0
73			0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
74			3	2	5	5	0	1	1	1	1	0	0	1	1	0	0	0
75			0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
76			0	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0
77			0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
78			0	0	1	4	0	0	1	0	0	1	0	0	0	0	0	6
79			0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0
80			0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
81			0	0	0	0	1	0	1	0	1	1	0	0	0	0	0	0
82			1	4	0	1	0	0	0	0	0	1	0	1	0	0	0	0
83		Pea Rang	2	7	7	2	0	1	0	0	0	1	1	1	0	0	0	0
84			0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0
85			1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
86			0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0
87			4	7	5	9	0	0	0	0	0	1	0	1	0	0	0	0
88			0	1	3	5	0	1	0	0	0	1	0	1	0	0	0	0
89			0	0	15	13	0	0	0	0	0	1	0	0	0	0	0	0
90			0	1	5	6	0	1	1	0	0	1	0	0	0	0	0	0
91			3	8	18	20	0	0	0	0	1	1	0	0	0	0	0	0
92			0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0
93			0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
94			0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0
95			2	5	15	20	0	0	0	0	1	0	0	0	0	0	0	0
96			0	0	5	5	0	0	1	0	1	0	0	0	0	0	0	0
97			0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

98			1	1	51	61	1	0	0	0	0	0	0	0	0	0	0	0
99			2	5	21	29	0	0	0	0	1	1	0	0	1	0	0	0
100			0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
101			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
102			1	1	17	19	1	1	0	0	1	0	0	0	0	0	0	0
1	Kampong Cham	Phsa Chen	0	1	0	1	0	0	0	0	0	1	0	1	0	0	0	0
2			0	0	0	0	1	1	0	0	1	1	0	1	0	0	0	0
3			15	20	30	35	0	0	0	0	1	1	0	0	0	0	0	0
4			0	1	0	1	0	0	0	0	0	1	1	1	0	0	0	0
5			1	1	3	6	0	0	1	0	1	0	0	0	0	0	0	0
6			10	17	21	31	0	1	0	0	0	1	0	0	0	0	0	0
7			0	1	3	3	0	0	0	1	1	1	1	0	0	0	0	0
8			0	0	19	30	0	0	1	0	0	1	0	0	0	0	0	0
9			3	4	10	19	1	0	0	0	0	0	0	1	0	0	0	0
10			0	0	11	12	0	0	0	0	1	1	0	1	0	0	0	0
11			2	3	5	9	0	0	1	0	1	1	0	0	0	0	0	0
12			0	0	89	73	0	0	1	0	1	0	0	0	0	0	0	0
13			2	3	77	81	0	0	0	1	0	0	0	0	0	0	0	0
14			9	16	0	0	1	1	0	0	1	0	0	0	0	0	0	0
15			1	2	12	17	0	0	0	0	0	1	0	0	0	0	0	0
16			0	1	1	4	0	0	1	0	1	1	0	0	0	0	0	0
17			0	2	59	77	0	0	0	1	1	0	0	0	0	0	0	0
18			0	2	6	8	0	1	0	0	1	0	0	1	0	0	0	0
19			1	1	5	9	1	0	0	0	1	0	0	1	0	0	0	0
20			0	0	10	14	0	0	0	0	1	0	0	0	0	0	0	0
21			1	1	6	11	0	0	0	0	1	0	0	0	0	0	0	0
22			1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0
23			0	2	6	11	0	0	0	0	0	1	0	0	0	0	0	0
24			10	15	17	10	1	1	0	1	1	0	0	1	0	0	0	0
25			1	1	26	31	0	0	0	0	0	0	0	0	0	0	0	0
26			4	5	136	209	0	0	0	0	1	0	0	0	0	0	0	0
27			6	10	17	19	0	0	0	1	1	0	0	0	0	0	0	0
28			3	7	5	17	0	0	1	0	1	1	0	1	0	0	0	0
29			0	0	11	12	0	0	0	0	1	1	0	0	0	0	0	0
30			0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0
31			0	0	1	4	0	1	0	0	0	1	0	1	1	0	0	0
32			0	0	8	11	0	0	0	1	1	0	0	0	0	0	0	0
33			0	0	14	14	0	0	0	0	0	1	0	1	0	0	0	0
34			7	8	6	4	1	1	1	1	1	0	0	1	0	0	0	0
35			0	0	8	9	0	0	0	0	1	1	0	1	0	0	0	0
36		Beng Kork	2	0	25	17	0	0	0	0	1	1	0	0	0	0	0	0
37			1	5	2	2	0	0	1	0	0	1	0	0	0	0	0	0
38			4	3	7	8	0	0	0	0	0	1	0	0	1	0	0	0
39			0	0	2	3	0	0	0	0	1	1	0	0	1	0	0	0
40			9	11	3	9	0	0	0	0	1	1	0	1	0	0	0	0
41			15	21	6	6	0	1	0	0	1	0	0	1	1	0	0	0

42			0	0	5	7	0	0	0	0	0	1	0	0	1	0	0	0
43			4	6	2	2	0	0	0	0	1	0	0	1	1	0	0	0
44			0	0	5	9	0	0	1	0	1	1	0	0	1	0	0	0
45			7	15	10	11	0	0	0	0	1	1	0	1	1	0	0	0
46			1	0	1	1	0	0	0	1	1	1	0	0	0	0	0	0
47			1	3	5	4	0	0	0	0	1	0	0	0	0	0	0	0
48			0	0	2	7	0	0	0	0	1	1	0	0	0	0	0	0
49			0	1	8	12	1	0	1	1	1	1	1	0	1	0	0	0
50			1	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0
51			1	1	4	8	0	0	0	0	0	1	0	0	1	0	0	0
52			0	0	3	5	1	1	0	0	0	1	0	1	0	0	0	0
53			0	0	1	1	0	0	0	0	1	1	0	1	0	0	0	0
54			0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
55			0	0	9	9	0	0	0	0	1	1	0	0	0	0	0	0
56			1	2	3	2	0	0	0	0	0	1	0	0	0	0	0	0
57			0	1	2	4	0	0	0	1	1	0	0	0	0	0	0	0
58			1	0	5	9	1	1	1	0	0	1	0	1	0	0	0	0
59			0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
60			0	2	1	3	0	0	0	0	1	0	0	0	0	0	0	0
61			0	0	1	5	0	1	0	0	1	1	0	0	0	0	0	0
62			0	0	5	5	0	0	0	0	0	0	0	1	0	0	0	0
63			1	0	15	20	0	0	1	0	1	0	0	0	0	0	0	0
64			0	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0
65			2	4	10	6	1	1	1	0	1	1	0	0	0	0	0	0
66		Phsa	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67			0	1	27	29	0	0	0	0	0	1	0	1	0	0	0	0
68			0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69			3	5	27	29	0	0	0	0	1	0	1	0	0	0	0	0
70			0	0	7	12	0	1	0	0	0	0	0	0	0	0	0	0
71			0	0	2	5	0	0	0	0	0	1	0	0	0	0	0	0
72			10	12	33	41	0	1	0	0	0	1	1	1	0	0	0	0
73			0	1	2	2	0	0	0	0	0	0	0	1	0	0	0	0
74			1	2	8	8	0	0	1	0	0	1	0	0	0	0	0	0
75			1	0	75	81	1	1	0	1	1	1	0	0	0	0	0	0
76			2	1	3	3	0	0	0	1	1	1	0	0	0	0	0	0
77			0	0	8	16	0	0	0	0	1	1	1	0	0	0	0	0
78			0	0	9	13	0	0	0	0	1	1	0	0	0	0	0	0
79			0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
80			0	0	0	0	1	0	0	0	1	0	0	1	1	0	0	0
81			1	1	0	0	0	0	1	0	1	1	1	0	0	0	0	0
82			0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0
83			0	0	3	5	0	0	0	0	0	0	0	0	0	0	0	0
84			7	4	2	5	0	0	1	0	0	0	0	0	0	0	0	0
85			1	1	5	8	0	0	1	1	0	1	0	1	0	0	0	0
86			0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
87			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

88			0	0	6	6	0	0	0	0	1	1	0	0	0	0	0	0
89			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90			0	0	5	9	0	1	0	0	0	1	0	1	0	0	0	0
91		Phsa Paav	6	2	38	41	1	1	0	0	1	1	0	1	0	0	0	0
92			0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
93			14	4	27	30	1	0	0	0	1	0	0	0	0	0	0	0
94			1	1	5	6	0	0	0	0	1	0	0	0	0	0	0	0
95			1	1	10	10	0	0	0	0	1	0	0	0	0	0	0	0
96			0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0
97			0	0	7	8	0	0	0	0	0	0	0	1	0	0	0	0
98			0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0
99			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100			0	2	9	9	0	1	0	0	1	1	0	0	0	0	0	0
1	Takeo	Donkeo	2		0		0	0	1	0	0	0	0	0	0	0	0	0
2			11		4		0	0	0	0	0	0	0	0	0	0	0	0
3			2		0		0	0	1	0	0	0	0	0	0	0	0	0
4			1		1		0	0	0	0	0	0	0	0	0	0	0	0
5			0		0		0	0	0	0	0	0	0	0	0	0	0	0
6			0		4		0	0	0	0	0	0	0	0	0	0	0	0
7			0		5		0	0	0	0	0	0	0	0	0	0	0	0
8			4		0		0	0	0	0	0	0	0	0	0	0	0	0
9			7		3		0	0	0	0	1	0	0	0	0	0	0	0
10			1		6		0	0	0	0	1	0	0	0	0	0	0	0
11			0		0		0	0	0	1	1	0	0	0	0	0	0	0
12			1		0		0	0	0	0	0	0	0	0	0	0	0	0
13			0		0		0	0	0	0	0	0	0	0	0	0	0	0
14			0		0		0	0	0	0	0	0	0	0	0	0	0	0
15			0		0		0	0	1	0	1	0	0	0	0	0	0	0
16			2		0		0	0	0	0	0	0	0	0	0	0	0	0
17			0		5		0	0	0	0	0	0	0	0	0	0	0	0
18			8		23		0	0	0	0	0	0	0	0	0	0	0	0
19			0		1		0	0	0	0	0	0	0	0	0	0	0	0
20			3		0		0	0	0	1	1	1	0	1	0	0	0	0
21			1		0		0	0	0	0	1	1	0	0	0	0	0	0
22			0		0		0	0	0	0	1	0	0	0	0	0	0	0
23			3		7		0	0	0	0	1	1	0	0	0	0	0	0
24			8		0		0	0	0	0	1	1	0	0	0	0	0	0
25			1		0		0	0	0	0	0	0	0	1	0	0	0	0
26		Sampoung	2		0		0	0	0	0	0	0	0	0	0	0	0	0
27			0		0		0	0	0	0	1	1	0	0	0	0	0	0
28			4		0		0	0	0	0	0	1	0	0	0	0	0	0
29			0		0		0	0	0	0	1	0	0	0	0	0	0	0
30			4		27		0	0	0	0	0	0	0	0	0	0	0	0
31			0		0		0	0	0	0	0	0	0	0	0	0	0	0
32			0		0		0	0	0	0	1	0	0	0	0	0	0	0
33			5		11		0	0	0	0	0	0	0	0	0	0	0	0

34			0		28		0	0	0	0	0	0	0	0	0	0	0	0
35			0		25		0	0	0	0	0	0	0	0	0	0	0	0
36			13		0		0	0	0	0	0	1	0	1	0	0	0	0
37			2		0		0	0	0	0	0	0	0	0	0	0	0	0
38			0		13		0	0	0	1	0	0	0	0	0	0	0	0
39			1		0		0	0	0	0	1	1	0	0	0	0	0	0
40			2		9		0	0	0	0	1	1	0	0	0	0	0	0
41			6		13		0	0	0	0	0	0	0	0	0	0	0	0
42			1		1		0	0	0	0	0	0	0	0	0	0	0	0
43			0		0		0	0	0	0	1	0	0	0	0	0	0	0
44			0		31		0	0	0	0	1	0	0	0	0	0	0	0
45			9		0		0	0	0	0	1	0	0	0	0	0	0	0
46			8		0		0	0	0	0	0	0	0	0	0	0	0	0
47			0		2		0	0	0	1	1	0	0	0	0	0	0	0
48			0		12		0	0	0	0	1	0	0	0	0	0	0	0
49			1		8		0	0	0	0	1	0	0	0	0	0	0	0
50			0		21		0	0	0	0	1	0	0	0	0	0	0	0
51			9		2		0	0	0	0	0	0	0	0	0	0	0	0
52			0		0		0	0	0	0	1	1	0	0	0	0	0	0
53		Angtasoum	0		0		0	0	0	1	1	0	0	0	0	0	0	0
54			0		15		0	0	0	0	1	0	0	0	0	0	0	0
55			4		0		0	0	0	0	0	0	0	0	0	0	0	0
56			0		0		0	0	0	0	0	0	0	0	0	0	0	0
57			0		4		0	0	0	0	0	0	0	1	0	0	0	0
58			0		3		0	0	0	0	1	0	0	0	0	0	0	0
59			7		5		0	0	0	0	0	1	0	0	0	0	0	0
60			0		14		0	0	0	0	1	0	0	0	0	0	0	0
61			39		4		0	0	0	0	1	0	0	0	0	0	0	0
62			2		0		0	0	0	0	0	0	0	0	0	0	0	0
63			0		0		0	0	0	0	1	0	0	0	0	0	0	0
64			5		16		0	0	0	0	1	0	0	0	0	0	0	0
65			0		3		0	0	0	0	1	0	0	0	0	0	0	0
66			0		0		0	0	0	1	0	1	0	0	0	0	0	0
67			0		0		0	0	0	0	0	1	0	0	0	0	0	0
68			0		1		0	0	0	0	1	0	0	0	0	0	0	0
69			5		9		0	0	0	0	1	1	0	0	0	0	0	0
70			3		0		0	0	0	0	1	0	0	0	0	0	0	0
71			10		12		0	0	0	0	1	1	0	0	0	0	0	0
72			0		9		0	0	0	1	0	0	0	0	0	0	0	0
73			0		0		0	0	0	1	1	0	0	0	0	0	0	0
74			0		1		0	0	0	1	0	0	0	0	0	0	0	0
75			0		0		0	0	0	1	0	1	0	0	0	0	0	0
76			8		30		0	0	0	0	1	1	0	0	0	0	0	0
77			4		12		0	0	0	0	1	0	0	0	0	0	0	0
78		An	1		0		0	0	0	1	0	0	0	0	0	0	0	0
79			0		0		0	0	0	0	1	1	0	0	0	0	0	0

80			1		16		0	0	0	0	0	0	0	0	0	0	0	0
81			0		32		0	0	0	0	0	0	0	0	0	0	0	0
82			10		2		0	0	0	0	1	0	0	0	0	0	0	0
83			5		8		0	0	0	0	1	0	0	0	0	0	0	0
84			1		0		0	0	0	0	1	0	0	0	0	0	0	0
85			12		2		1	0	0	0	1	0	0	0	0	0	0	0
86			8		2		0	0	0	0	1	0	0	0	0	0	0	0
87			3		0		0	0	0	0	1	0	0	1	0	0	0	0
88			2		19		0	0	0	0	1	0	0	1	0	0	0	0
89			0		0		0	0	0	0	0	0	0	0	0	0	0	0
90			0		0		0	0	0	0	0	0	0	0	0	0	0	0
91			0		0		0	0	0	0	0	0	0	0	0	0	0	0
92			0		0		0	0	0	1	0	0	0	0	0	0	0	0
93			0		0		0	0	0	0	1	1	0	0	0	0	0	0
94			0		0		0	0	0	0	1	0	0	0	0	0	0	0
95			0		0		0	0	0	0	0	0	0	0	0	0	0	0
96			0		0		0	0	0	0	1	0	0	0	0	0	0	0
97			0		0		0	0	0	0	0	0	0	0	0	0	0	0
98			0		0		0	0	0	0	0	0	0	1	0	0	0	0
99			0		0		0	0	0	0	0	0	0	0	0	0	0	0
100			0		0		0	0	0	0	0	0	0	0		0	0	0
total	5	19	262		380		85	98	121	72	296	218	44	128	49	24	5	9
%			51.47		74.65		16.69	19.25	23.77	14.14	58.15	42.82	8.64	25.14	9.62	4.71	0.98	1.76

APPEDIX B: **The data of faecal examination**

N_0	Province	Market	*A. galli*	*H. gallinarum*	*Spirurid* egg	*Capillaria* spp.	*Strongyloides*	Cestodes egg	*E. revolutum*	*Notocotylus*	*Eimeris* spp.
1	Kampong Speu	Sang Kar Sei	1	1	0	0	1	0	0	0	1
2			0	1	0	0	1	0	0	0	1
3			0	0	0	0	0	0	0	0	1
4			0	1	0	0	1	0	0	0	1
5			0	0	0	0	1	0	0	0	0
6			0	0	0	0	0	0	0	0	0
7			0	0	0	0	1	0	0	0	0
8			1	1	0	0	1	0	0	0	0
9			0	1	0	0	1	0	0	0	1
10			0	1	0	0	1	0	0	0	1
11			0	1	0	0	1	0	0	0	1
12			0	1	0	0	1	0	0	0	1
13			1	1	0	0	1	0	0	0	1
14			0	0	0	0	1	0	0	0	1
15			0	1	0	0	1	0	0	0	1
16			1	1	0	0	1	1	1	1	1
17			1	1	0	0	0	1	1	1	1
18			0	1	0	0	1	0	0	0	0
19			0	1	0	0	1	0	0	0	1
20			1	1	0	0	0	0	0	0	1
21		Udong	0	0	0	0	0	0	0	0	1
22			0	0	0	0	1	0	0	0	0
23			0	0	0	0	1	0	0	0	0
24			1	0	0	0	0	0	0	0	1
25			1	1	0	0	1	0	0	0	1
26			0	0	0	0	0	0	0	0	0
27			0	1	0	0	1	0	0	0	1
28			1	0	0	0	1	0	0	0	1
29			0	0	0	0	0	0	0	0	0
30			0	0	0	0	0	0	0	0	0
31			0	0	0	0	1	0	0	0	1
32			0	0	0	0	1	0	0	0	0
33			0	0	0	0	1	0	0	0	0
34			0	0	0	0	0	0	0	0	0
35			1	1	0	0	1	0	0	0	1
36			0	0	0	0	0	0	0	0	0
37			0	0	0	0	0	0	0	0	0

38			0	0	0	0	0	0	0	0	0
39			0	1	0	0	0	0	0	0	0
40			0	0	0	0	0	0	0	0	0
41			0	1	0	0	1	0	0	0	1
42			0	0	0	0	1	0	0	0	0
43			0	0	0	0	1	0	0	0	1
44			0	0	0	0	0	0	0	0	0
45			0	1	0	0	1	0	0	0	0
46			0	1	0	0	0	0	0	0	0
47			0	0	0	0	1	0	0	0	0
48			0	0	0	0	1	0	0	0	0
49			1	1	0	0	1	0	0	0	0
50			1	1	0	0	1	0	0	0	0
51			0	0	0	0	1	0	0	0	0
52			0	0	0	0	1	0	0	0	0
53		Chba Mon	1	1	0	0	1	0	0	0	1
54			1	1	0	0	1	0	0	0	0
55			1	0	0	0	1	0	0	0	0
56			1	0	0	0	1	0	0	0	0
57			1	1	0	0	0	0	0	0	1
58			0	0	0	0	1	0	0	0	0
59			0	0	0	0	0	0	0	0	0
60			1	1	0	0	1	0	0	0	1
61			0	0	0	0	0	0	0	0	1
62			1	0	0	0	0	0	0	0	0
63			0	0	0	0	1	0	0	0	1
64			1	1	0	0	1	0	0	0	1
65			1	1	0	0	1	0	0	0	0
66			0	0	0	0	0	0	0	0	1
67			0	1	0	0	1	0	0	0	1
68			1	1	0	0	0	0	0	0	0
69			0	0	0	0	0	0	0	0	0
70			0	0	0	0	1	0	0	0	1
71			0	0	0	0	1	0	0	0	1
72			0	0	0	0	0	0	0	0	0
73			0	0	0	0	0	0	0	0	0
74			0	0	0	0	0	0	0	0	0
75			0	0	0	0	0	0	0	0	0
76			0	0	0	0	0	0	0	0	0
77			0	0	0	0	0	0	0	0	0
78			0	0	0	0	0	0	0	0	0
79			0	0	0	0	0	0	0	0	0
80			0	0	0	0	0	0	0	0	0
81			0	1	0	0	0	0	0	0	0
82			0	1	0	0	0	0	0	0	0
83			1	1	0	0	1	0	0	0	1

84			0	1	0	0	1	0	0	0	0
85			0	0	0	0	1	0	0	0	0
86			1	1	0	0	1	0	0	0	1
87			0	0	0	0	1	0	0	0	0
88			0	1	0	0	1	0	0	0	0
89			0	0	0	0	1	0	0	0	0
90			1	1	0	0	0	0	0	0	1
91			1	1	0	1	1	0	0	0	1
92			0	1	0	0	1	0	0	0	1
93			0	1	0	0	0	0	0	0	0
94			1	1	0	0	1	0	0	0	1
95			0	1	0	0	1	0	0	0	1
96			0	1	0	0	1	0	0	0	1
97			0	1	0	0	0	0	0	0	1
98			0	1	0	0	1	0	0	0	1
99			0	1	0	0	0	0	0	0	0
100			0	0	0	0	1	0	0	0	0
101			1	1	0	0	0	0	0	0	1
102			0	1	0	1	1	0	0	0	1
1	Kandal	Kor Kee	1	1	1	0	0	0	0	0	1
2			0	1	0	0	0	0	0	0	0
3			1	0	0	0	0	0	0	0	0
4			1	1	1	0	0	0	0	0	0
5			0	1	0	0	0	0	0	0	1
6			0	0	0	0	0	0	0	0	1
7			0	1	0	0	0	1	0	0	0
8			1	1	0	0	0	0	0	0	1
9			0	1	1	0	0	0	0	0	1
10			1	1	0	0	0	0	0	0	0
11			1	1	0	1	1	1	0	0	1
12			1	1	0	0	0	0	0	0	0
13			0	1	0	0	0	0	0	0	0
14			0	0	0	0	0	1	0	0	0
15			0	1	1	0	0	0	0	0	0
16			0	1	0	0	0	0	0	0	1
17			0	1	0	0	0	1	0	0	1
18			0	1	0	0	0	0	0	0	0
19			1	1	1	1	0	0	0	0	0
20			1	1	0	0	0	0	1	0	0
21			1	1	0	0	0	0	0	0	1
22			0	1	0	0	0	0	1	0	1
23			0	1	0	0	0	0	0	0	0
24			0	0	0	0	0	0	0	0	0
25			0	1	0	0	0	0	0	0	1
26			1	1	0	0	0	0	0	0	0
27			1	1	0	0	0	0	0	0	1

28			0	1	0	0	0	0	0	0	1
29			0	1	1	0	0	0	0	0	0
30			0	0	0	0	0	0	0	0	1
31			0	1	0	0	0	0	0	0	0
32			0	1	0	0	0	0	0	0	0
33			0	1	0	0	0	0	0	0	1
34			1	1	0	0	0	0	0	0	1
35			0	1	0	0	0	0	0	0	0
36		Saang	0	1	1	0	0	0	0	0	0
37			0	0	0	0	0	0	0	0	0
38			0	1	0	0	0	0	0	0	0
39			0	1	0	0	1	0	0	0	1
40			0	1	1	1	1	0	0	0	0
41			0	0	0	0	1	0	0	0	1
42			0	1	0	1	0	0	0	0	0
43			0	1	0	1	1	0	0	0	1
44			1	1	0	0	1	0	1	0	1
45			1	1	1	1	0	0	0	0	1
46			1	1	0	1	0	0	0	0	0
47			0	1	0	0	1	0	0	0	1
48			1	0	1	0	1	0	0	0	1
49			0	1	0	0	1	0	0	0	1
50			1	1	0	0	1	0	0	0	0
51			0	1	1	0	0	0	0	0	0
52			1	1	0	0	0	0	0	0	0
53			0	1	0	0	0	0	0	0	0
54			1	1	0	1	0	0	0	0	0
55			0	0	0	1	1	0	0	0	1
56			0	0	0	1	0	0	0	0	1
57			1	0	0	1	0	0	0	0	0
58			1	1	0	0	1	0	0	0	1
59			1	1	0	0	0	0	0	0	1
60			1	1	0	0	1	0	0	0	0
61		Kor Tum	0	1	0	1	1	0	0	0	1
62			0	0	0	0	1	0	0	0	0
63			0	1	0	0	1	0	0	1	1
64			0	0	1	0	1	0	0	1	1
65			0	1	0	0	1	1	0	0	0
66			1	0	0	0	1	0	0	0	1
67			0	1	0	0	1	0	0	0	1
68			1	1	0	0	0	0	0	1	1
69			1	1	0	0	0	0	0	0	1
70			0	1	0	0	1	0	0	0	1
71			1	1	1	0	1	0	0	0	1
72			0	1	0	0	1	0	0	0	1
73			1	1	0	0	1	1	0	0	1

74			1	1	0	1	1	1	0	0	1
75			0	1	0	0	0	0	0	0	0
76		Takhmou	1	1	0	1	0	1	0	0	1
77			1	1	1	1	1	0	0	0	1
78			1	1	0	0	0	0	0	0	1
79			0	0	0	0	1	0	0	0	1
80			0	1	0	0	1	0	0	0	0
81			0	1	0	0	1	0	1	0	0
82			1	1	0	0	1	0	1	0	0
83			1	1	0	0	1	0	0	0	1
84			1	1	0	0	0	0	0	0	0
85			1	1	0	0	1	0	0	0	1
86			0	1	0	0	1	0	0	0	0
87			0	0	0	1	1	0	0	0	1
88			1	1	1	0	1	0	0	0	1
89			0	1	0	0	1	1	0	0	1
90			1	1	0	0	1	0	0	0	1
91			1	1	0	0	1	0	0	0	1
92			1	1	0	0	0	0	0	0	0
93			1	1	0	0	1	0	0	0	1
94			0	1	1	0	1	0	0	0	1
95			1	1	1	0	0	0	0	0	0
96			0	1	1	0	0	0	0	0	0
97			0	1	0	0	0	0	0	0	1
98			1	1	0	0	0	0	0	0	0
99			1	1	0	0	1	0	0	0	1
100			0	0	1	0	1	0	0	0	0
101			1	1	0	0	1	0	0	0	1
102			1	1	0	0	1	0	0	0	1
102			1	1	1	0	1	0	0	0	1
103			1	1	0	0	1	0	0	0	0
104			1	1	1	0	1	0	0	0	0
105	Prey Veng	Neak Lioung	1	1	0	0	1	1	0	0	1
1			1	1	0	0	1	1	0	0	1
2			1	1	0	0	0	0	0	0	1
3			1	1	0	0	1	0	0	0	1
4			1	1	0	0	1	0	0	0	1
5			0	0	0	0	1	0	0	0	1
6			0	0	0	0	0	1	0	0	1
7			0	1	0	0	1	0	0	0	1
8			0	0	0	0	1	0	0	0	0
9			1	0	0	1	0	0	0	0	0
10			0	1	0	0	0	0	0	0	0
11			0	0	0	0	1	0	1	0	0
12			1	1	0	0	1	0	0	0	1
13			1	1	0	0	0	0	0	0	1

14			1	1	0	1	1	0	1	0	1
15			0	1	0	0	1	1	0	0	1
16			0	1	0	0	1	0	0	0	1
17			0	1	0	0	1	0	0	0	0
18			0	1	0	0	1	1	0	0	1
19			0	1	0	0	1	0	0	0	0
20			0	0	0	0	1	1	0	0	0
21			1	1	0	0	1	0	0	0	0
22			1	1	0	0	1	0	0	0	1
23			1	0	0	0	1	0	1	0	0
24			0	0	0	0	1	0	0	0	1
25			1	1	0	0	1	0	0	0	0
26			1	1	0	0	1	1	0	0	1
27			0	0	0	0	0	0	0	0	0
28			0	0	0	0	1	0	0	0	0
29			0	0	0	0	1	0	0	1	1
30			1	1	0	0	1	0	0	0	1
31			1	1	0	0	1	0	0	0	1
32			0	1	0	0	1	1	0	0	1
33			1	1	0	0	1	1	0	0	1
34			1	1	0	0	1	0	0	0	1
35		Prey Veng	1	1	0	0	1	1	0	0	1
36			1	1	0	0	1	0	0	0	1
37			0	1	0	1	1	0	0	0	0
38			0	0	0	0	1	0	0	1	1
39			0	1	0	0	1	0	0	1	1
40			1	1	0	0	1	0	0	1	1
41			1	1	0	0	1	0	0	0	1
42			0	0	0	0	1	0	1	0	1
43			0	1	0	0	1	0	0	0	1
44			0	0	0	0	1	1	0	0	1
45			0	1	0	0	1	0	1	0	1
46			0	0	0	0	1	0	0	0	0
47			1	1	0	0	1	0	0	0	1
48			1	1	0	0	1	0	0	0	1
49			1	1	0	0	1	0	0	0	1
50			1	1	0	0	1	0	0	0	1
51			0	1	0	0	1	0	0	0	1
52			1	1	0	0	1	0	0	0	1
53			1	1	0	0	1	0	0	0	1
54		Bar Phnom	0	0	0	0	1	0	0	0	0
55			1	0	0	0	1	0	0	0	1
56			0	0	0	0	0	0	1	0	0
57			1	1	0	0	1	0	0	0	1
58			1	1	0	0	1	0	1	0	1
59			1	1	0	0	1	1	1	0	1

60			0	1	0	0	1	0	0	0	1
61			0	1	0	0	1	0	1	0	1
62			1	0	0	0	1	1	0	0	0
63			0	0	0	0	1	0	0	0	1
64			1	1	0	0	1	0	0	0	1
65			0	1	0	0	1	0	0	0	1
66			0	0	0	0	1	0	1	0	1
67			1	1	0	0	1	0	0	0	1
68			0	1	0	0	1	0	0	0	1
69			1	1	0	1	1	1	0	0	0
70			0	1	0	0	1	0	0	0	0
71			0	0	0	0	0	0	0	0	1
72			1	1	0	1	1	1	0	0	1
73			0	0	0	0	0	0	0	0	0
74			1	1	0	0	1	0	0	0	1
75			0	1	0	0	1	1	0	0	1
76			0	0	0	0	1	0	0	0	0
77			0	0	0	0	1	0	0	0	0
78			1	1	0	0	1	1	0	1	0
79			1	1	0	0	1	0	0	0	0
80			0	0	0	0	1	0	0	0	0
81			0	0	0	0	1	0	0	0	1
82		Phea Raeng	1	1	0	0	1	0	1	0	1
83			1	1	0	0	1	0	0	0	1
84			0	0	0	0	1	0	0	0	1
85			0	0	0	0	1	0	0	0	0
86			0	0	0	0	0	0	0	0	0
87			1	1	0	0	1	1	0	0	1
88			0	1	0	0	1	0	0	0	0
89			0	1	0	0	0	0	0	0	1
90			0	0	0	0	1	0	0	0	1
91			1	1	0	1	1	0	0	0	1
92			0	0	0	0	1	1	0	0	0
93			0	0	0	0	1	0	0	0	1
94			0	0	0	0	1	0	0	0	0
95			1	1	0	0	0	0	0	0	0
96			0	1	0	1	0	0	0	0	1
97			0	0	0	0	1	0	0	0	0
98			0	1	0	0	1	0	0	0	1
99			1	1	0	0	1	0	0	0	1
100			0	0	0	0	1	0	0	0	1
101			0	1	0	0	1	0	0	0	1
102			1		0	0	1	0	0		1
1	Ka		0	0	0	0	1	1	0	0	1
2			0	0	0	0	1	0	0	0	0
3		B.	1	1	0	0	0	1	0	0	1

4			1	1	0	1	1	1	0	0	1
5			1	1	0	1	1	1	0	0	1
6			1	1	0	1	1	0	0	0	1
7			1	1	0	0	1	0	0	0	1
8			0	0	0	1	1	0	0	0	1
9			1	1	0	0	0	0	0	0	1
10			1	1	0	1	1	0	0	0	1
11			1	1	0	0	1	0	0	0	1
12			1	1	0	0	0	0	0	0	0
13			1	1	0	1	1	1	0	0	1
14			0	0	0	0	1	0	0	0	1
15			1	1	0	1	0	0	0	0	1
16			1	1	0	1	1	0	0	0	1
17			1	1	0	1	1	0	0	0	1
18			1	1	0	0	0	0	0	0	0
19			1	1	0	0	0	0	0	0	0
20			1	1	0	1	1	0	0	0	1
21			1	1	0	0	1	0	0	0	1
22			1	0	0	0	0	0	0	0	1
23			1	1	0	0	1	0	0	0	1
24			1	1	0	0	1	0	0	0	1
25			0	1	0	0	1	0	0	0	1
26			1	1	0	1	1	0	0	0	1
27			1	1	0	0	1	0	0	0	1
28			1	1	0	0	1	0	0	0	1
29			1	1	0	0	1	0	0	0	1
30			1	1	0	1	1	0	0	0	1
31			0	0	0	0	1	0	0	0	1
32			1	1	0	0	1	0	0	0	1
33			1	1	0	1	1	0	0	0	1
34			1	1	0	0	1	0	0	0	1
35		Phsa Chen	1	1	0	0	1	0	0	0	0
36			1	1	0	0	1	0	0	0	1
37			0	0	0	1	1	1	0	0	1
38			1	1	0	0	1	0	0	0	1
39			1	1	0	0	1	0	0	0	1
40			0	0	0	0	1	0	0	0	1
41			1	1	0	0	1	1	0	0	1
42			1	1	0	0	1	0	0	0	1
43			1	0	0	0	1	0	0	0	1
44			1	1	0	0	1	0	0	0	0
45			0	1	0	0	1	0	0	0	1
46			0	1	0	0	0	0	0	0	0
47			0	0	0	0	1	0	0	0	0
48			0	0	0	0	1	0	0	0	1
49			0	1	0	0	1	0	0	0	1

50			0	1	0	0	0	0	0	0	0
51			1	1	0	0	1	1	0	0	0
52			0	0	0	0	0	0	0	0	0
53			1	1	0	0	1	0	0	0	1
54			0	0	0	0	1	0	0	0	1
55			0	1	0	0	1	0	0	0	1
56			1	0	0	0	1	0	0	0	1
57			0	1	0	0	1	1	0	0	1
58			0	0	0	0	1	0	0	0	1
59			0	0	0	0	1	0	0	0	1
60			0	0	0	0	1	1	0	0	1
61			0	0	0	0	1	0	0	0	1
62			0	0	0	0	1	0	0	0	0
63			0	0	0	0	1	0	0	0	1
64			1	0	0	0	1	1	0	0	0
65		Phsa Skun	1	1	0	0	1	0	0	0	0
66			1	0	0	0	0	0	0	0	1
67			1	1	0	0	1	0	0	0	0
68			0	0	0	0	0	0	0	0	1
69			1	1	0	0	1	0	0	0	1
70			0	0	0	0	1	0	0	0	1
71			0	0	0	0	1	0	0	0	1
72			0	0	0	0	1	0	0	0	1
73			0	0	0	0	1	0	0	0	1
74			0	0	0	0	1	1	0	0	1
75			0	0	0	0	1	0	0	0	1
76			0	0	0	0	1	0	0	0	1
77			0	0	0	0	1	0	0	0	1
78			1	0	0	0	1	0	0	0	1
79			1	1	0	0	0	1	0	0	1
80			0	0	0	0	1	0	0	0	1
81			0	0	0	0	1	0	0	0	1
82			1	0	0	0	0	0	0	0	0
83			0	0	0	0	1	0	0	0	1
84			1	0	0	0	0	0	0	0	1
85			1	1	0	0	1	1	0	0	0
86			0	0	0	0	0	0	0	0	0
87			0	0	0	0	0	0	0	0	0
88			0	0	0	0	1	0	0	0	0
89			0	0	0	0	0	0	0	0	0
90		Phsa Paav	0	0	0	0	1	0	0	0	0
91			0	1	0	0	1	1	0	0	1
92			0	0	0	0	1	0	0	0	0
93			1	1	0	0	1	0	0	0	1
94			1	0	0	0	1	0	0	0	0
95			0	0	0	0	1	0	0	0	1

96			0	0	0	0	0	0	0	0	1
97			1	1	0	0	1	0	0	0	1
98			0	1	0	0	1	0	0	0	0
99			0	0	0	0	0	0	0	0	1
100			1	1	0	0	1	0	0	0	1
Total	4	15	178	256	24	39	278	54	16	9	249
%			43.52	62.59	5.86	9.53	67.97	13.20	3.91	2.20	60.88

VITA

My name is Sum Sumuth. I was born in 02nd January 1989, in Angkor village, Praek Phtul commune, Angkor Borey district, Takeo province, Kingdom of Cambodia. I graduated from Hun Sen Angkor Borey high school in 2007. During my high school time, I was the village of animal health worker.

I graduated my Bachelor of Science in Veterinary Medicine in 2011 from Faculty Veterinary Medicine, Royal University of Agriculture (RUA), Cambodia.

In my university's lifetime, I had been a volunteer at Farm Animal Research Station of RUA in 2008- 2010 and Cambodia Pony Organization. During 2009 to 2011, I had been an assistance in epidemiological parasitology in the animal in Cambodia project. Since 2011, I am a staff of FVM, RUA, Cambodia.

Afterwards, I got scholarship (Chulalongkorn University Graduate Scholarship Program for ASEAN Countries) from Chulalongkorn University for two years for pursuing in master degree level. During my research, I presented full thesis by poster presentations in CUVC conference in Bangkok, Thailand, 2015.