بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of Graduate studies

Prevalence and Risk Factors Of Bovine Paramphistomiasis In Sharg Elneel locality ,Khartoum State.

نسبة الإصابة وعوامل الخطر لمرض دودة الكرش في الأبقار بمحليه شرق النيل ولاية الخرطوم

السودان,

By;

Bakhita Sir alkhatim Suleiman

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Supervisor:

Professor: Siham Elias Sulimam

Department of veterinary medicine College of veterinary medicine , Sudan University

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بِسم الله الرحمن الرحيم

{أَوَلَمْ يَرَوْا أَنَّا خَلَقْنَا لَهُمْ مِمَّا عَمِلَتْ أَيْدِينَا أَنْعَاماً فَهُمْ لَهَا مَالِكُون }

سورة يس الاية (71)

Dedication

To my father
To my mother

To my brother and sisters

Acknowledgments

Firstly, praise to Almighty Alla for giving me the strength and stamina to finish this work.

With a great touch of pleasure and gratitude, I would like to Express thanks to my supervisor professor Siham Suliman for her advise. I am giving grateful and thanks to professor Mohamed Abdelsalam Abdalla who provided me all guidance's on the beginning of the study.

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List of abbreviations

ELISA	Enzyme linked immune sorbent assay
Mg	Ml gram
Kg	Kilo gram
OR	Odds ratio
° E	East
° N	North
Gm	Gram
° C	Centigrade
Min	minute
Rpm	Round per minute
ml	Millimeter
spp	Species
No.	number
d.f	degree of freedom
X^2	value chi -square value
Exp(B)	odds ratio
P- value	Probability value
C.I	confidence interval
Ref	Reference
OIE	World organization for animal health

Abstract

Across-sectional study was carried out on 263 of cattle in Sharg Elneel locality, Khartoum state, Sudan, during November 2016 – January 2017.

The objectives of this study where to estimate the prevalence of paramphistomiasis in cattle and to investigate the potential risk factors associated with disease. The overall of cattle prevalence was found to be 9.5% when tested by fecal sedimentation test. The prevalence of the infection according to the age was 10.9% in animals equal and less than three years and 8.9% more than three years. The prevalence according to the breed of the animals was 2.6% for local and 14.9% for cross. The prevalence according to the body condition was 7.2% for good condition and 14.6% for poor condition. The prevalence according to previous history of the disease 2.4% yes and 10.8% no. The prevalence according to the other disease 11.1% positive and 8.7% negative. The prevalence according to the treatment of the disease was 8.7% for no used of treatment and 11.1% for used of treatment.

Univariate analysis using the Chi-square, with confidence intervals of 95% at p-value≤ 0.25 was used to identify potential risk factors associated with fecal sedimentation test-positivity forparamphistomiasis in cattle. Significant positive risk factors associated with fecal sedimentation test in the unvaried analysis, there were found to be sex (x2 = 9.683, p-value = - 2.165), bread (x2 = 11.301, p-value = 0.515), previous history of the disease (x2 = 2.820, p-value = 16.481). There were also to be significant risk factors associated with fecal sedimentation test positive in the. The multivariate analysis, using logistic regression, with confidence intervals 95% p-value≤ 0.05 was used to assess the association between identified significant risk factors in the univariate

analysis in a combination towards a positive fecal sedimentation test status for paramphistomiasis in Cattle, the analysis showed no association between the paramphistomiasis in Cattle and in sex (Exp (B) = 1.105), bread (Exp (B) = 0.475), previous history of the disease (Exp (B) = 5.831). It could be conclude that the potential risk factors (sex, bread, previous history of the disease) were showed no significant association with paramphistomiasis.

ملخص الدراسة

أجريت دراسة مقطعية لعدد 263 رأس من الأبقار في ولاية الخرطوم محليه شرق النيل خلال شهر نوفمبر2016 إلى شهر يناير 2017 وكان الهدف من الدراسة هو تقدير معدل انتشار مرض دودة الكرش في الأبقار والتحقق من عوامل الخطر المرتبطة بانتشار مرض دودة الكرش. كان معدل انتشار المرض في كل الحيوانات التي تم فحصها باختبار ترسيب البراز هو 9.5% . كان معدل الانتشار وفقا لسن الماشية 10.9% للحيوانات الأقل أو تساوي ثلاث سنوات و8.9% للحيوانات الأكثر من ثلاثة سنوات. كان معدل الانتشار وفقا لجنس الحيوان2.1 % للذكور و13.8% للإناث, وكان معدل الانتشار وفقا لسلاله الحيوان 2.6% للسلالة المحلية 14.9% لسلاله الهجين . وكان معدل الانتشار وفقا لحالة الجسم 7.2% للحالات الجيدة و14.6% للحالات الغير جيدة . أما بالنسبة لوجود المرض في السابق 2.4% لا يوجد مرض و10.8% يوجد مرض وكان معدل الانتشار وفقا لوجود أمراض أخرى 11.1% للحالات الموجبة و8.7% للحالات السالبة وكان معدل الانتشار وفقا للحيوانات التي تستخدم أدوية 11.1% والتي لم تستخدم أدوية 8.7% . تم التحقق من عوامل الخطر الايجابية المرتبطة بالمرض باستخدام مربع كاي للتحليل في التحليل وحيد المتغير *confidence intervals of 95% at a p-value ≤0.25* حيث كانت عوامل الخطر المرتبطة بانتشار المرض هي :الجنس (x^2=9.683,pvalue=−2.165) وسلالة الحيوان (x^2=11.301,p−value=0.515) ووجود المرض في السابق (x^2=2.820,value=16.481) . باستخدام التحليل بالانحدار اللوجستي *confidence intervals 95% p-value 0.05*. أظهرت النتائج عدم وجود ارتباط إيجابي بين مرض دودة

الكـرش وجـنس الحيـوان (Exp(B)=1.105) وسـلالة الحيـوان (Exp(B)=0.475) ووجـود المرض في السابق (Exp(B)=5.831). أظهرت الدراسة عدم وجود ارتباط بين معدل انتشار دودة الكرش في الأبقار والجنس والسلالة ووجود المرض في السابق.

Introduction

Paramphistomum (rumen fluke disease) is one of the common parasites in the rumen and reticulum of sheep, goats, cattle and water buffaloes. *Paramphistomum* in duodenum and ileum are plug feeders and cause hemorrhage which leads to bleeding and diarrhea. Bleeding for prolonged period may cause anemia, which further weaken the host. Light infection doesn't cause serious damage to the animals, but massive number of immature *Paramphistomum* can migrate through intestinal tract causing acute parasitic gastroenteritis with high morbidity and mortality rates, particularly in young animals. Mature *Paramphistomum spp* are also responsible for ruminitis, irregular rumination, lower nutrition conversion and loss of body condition, decrease in milk production and reduction of fertility (Mogdy*etal.*,2009). Acute paramphistomiasis usually occurs in young cattle less than two years of age and is characterized by listlessness, anorexia and profuse diarrhea develops two to four weeks after infection. The feces are very fluid and may even contain immature flukes. Submandibular edema has been noted in several outbreaks and anemia has also frequently been described. The association between the presence of adult flukes in the rumen and clinical disease has not been well established, although the presence of the parasite is often complicated by other concomitant conditions (associated with animals in poor condition and other parasitic diseases) (Waal, 2011). Paramphistomiasis is worldwide in distribution, but the highest prevalence has been reported in tropical and subtropical regions, particularly in Africa, Asia, Australia, Eastern Europe and Russia. The epidemiology of *Paramphistomum* is determined by several factors governed by parasite host environment interactions. The major epidemiological variable influencing worm burdens of animals is the infection rate from pastures. It is also

influenced by the climatic requirement for egg hatching, development and survival of the larvae in pasture (Melaku and Addis 2012). There is little evidence regarding the pathogenesis of adult flukes to their hosts, but severe damage to the mucosa of the rumen was reported in heavy infection in experimentally infected sheep (Eslami *et al*.,2012). *Paramphistomum* parasite has an indirect life cycle with fresh water snails as the intermediate hosts, e.g. the genus *Bulinus*, *Planorbis*, *Stagnicola* (Figure1). These snails are found in permanent and temporary watercourses, irrigation channels, swamps, dam edges and depressions, they are normally found attached to vegetation in these habitats (NSWDPI, 2007). Adult flukes in the stomach lay eggs that are shed outside with the feces. About 2weeks later miracidia hatch out of the eggs. They swim in the water until they find a suitable snail. They penetrate into the snail and continue development to sporocysts and rediae, which can multiply asexually and produce daughter rediae. Each redia produces several cercariae, the next developmental stage. Out of a single miracidium up to 30 cercariae can develop. Cercariae abandon the snail, swim around and attach to the vegetation where they encyst and become metacercariae, which are infective for final hosts that feed on infested vegetation. Encysted metacercariae do not survive dryness ,but can survive and remain infective for up to 1 year in a humid (Figure2).

Objectives of the study;

-To estimate the prevalence of bovine paramphistomiasis in cattle in Sharg Elneel locality in khartoum state.

-To investigate the potential risk factors associated with the disease.

CHAPTER ONE

Literature review

1.1 Etiology:

Paramphistomum spp are essentially rumen flukes, of which *Paramphistomum cervi* is the most notorious in terms of prevalence and pathogenicity. Infection occurs when ruminants ingest contaminated vegetables and raw meat contain infective metacercaria (Chai *et al*.,2009). The immature flukes are responsible for destroying the mucosa of the gut wall to grow into adults causing tissue obliteration and appearance of clinical symptoms. The adult flukes are quite harmless, as they merely prepare for reproduction (Brown *et al*.,2005).

1.2 Classification:

According to Fischoeder F (1904). *Paramphistoma* was classified as follows:

Kingdom: Animalia

Phylum: Platyhelminthes

Class: Trematoda

Subclass: Digenea

Order: Echinostomida

Family: Paramphistomatidae

Genus: Parampistomum

Cotylophoron

Calicophoron

Explanatum

Gigantocotyle

Ugandocycle

Type species: *P.cervi*

P.cotylophorum

P.microbothrium

P.gotoi

P.grande

P.hiberniae

P.ichikawai

P.epiclitum

1.3 Description:

Paramphistomum means similar on the sides of mouth is given due to the presence of an anterior oral sucker and a posterior larger ventral sucker in adult worms (Boray 1959). The body measure less than a centimeter and covered with ahighly folded tegument, which in turn is provided with sensory papillae. *Paramphistomumspp* are monoecious self-fertilizes having both male and female reproductive systems in the posterior region of the body (Olsen,1974)

1.4 lifecycle;

Their life cycle in direct requiring a definitive host such as ruminants ,and intermediate host such as snail, and free-living of external phases in water and plants. The sexually mature monoecious self-fertilises in the mammalian rumen. and release the eggs along with feces .Eggs hatch in water in to ciliated miracidia then inters the body of intermediate host which are snails belonging to genera Bulinus, Planorbis, Physastagnicola and Pseudosuccinea, then the miracidia lost their cilia to become sporocysts. After a few days the develop up to 8 rediae. which are rabidly liberated. Each readia contains about 15-30 cerceriae .Mature cerceriae are possess by two eye spots and along slender tail ,by which they find aquatic plants or other suitable substrata, to which they get attached and cyst to become

metacerceriae . The mammalian hosts ingest the infective larva. Once inside the duodenum and jejunum ,their cysts are removed .they penetrate the intestinal wall by actively destroying the mucosa and then migrate to the rumen where they grow into adult.

1 - *Bulinustruncatus* 2-Galba truncutula

3-Planorbisplanorbi

Figure1: Intermediate host of *paramphistomum spp*. (Source : http://www. Pharma-unilim.fr(le 15 Octobre 2012.)

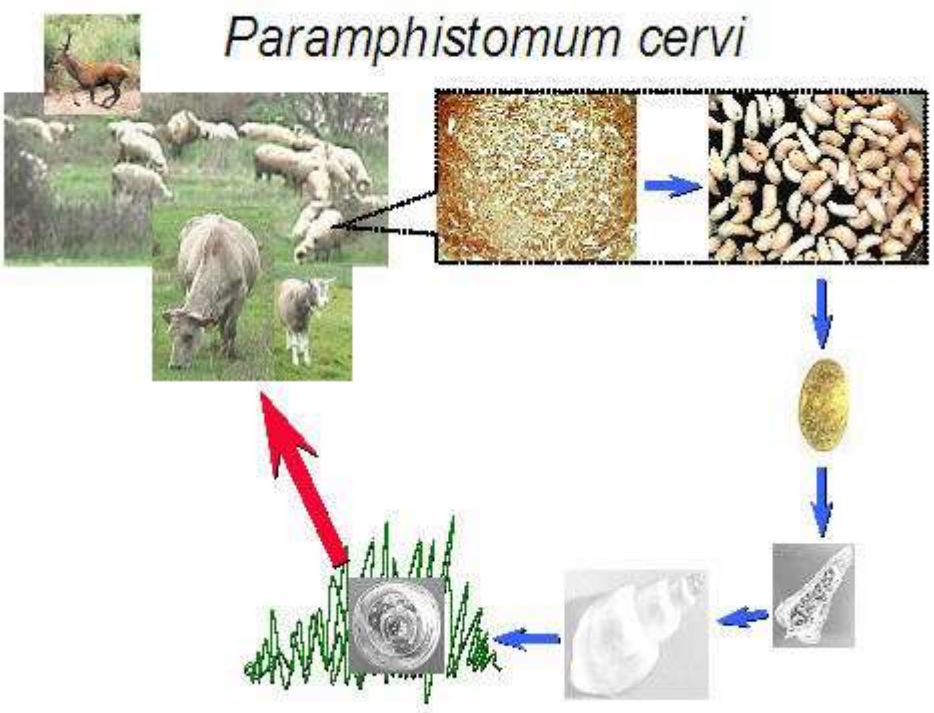

Figure 2: University Studio Press (2001)

1.5 Epidemiology:

Floods, caused by heavy rains, result in the dispersal of snails from permanent water masses, such as lakes and ponds. *Paramphistome* eggs deposited in these areas by grazing animals, hatch and infect the snails. Outbreaks of disease generally occur in the dry months of the year when the receding water uncovers herbage contaminated with encysted metacercariae in these areas. In the United Kingdome, it has been suggested that dispersal of snails by flooding events and changes in farm-management practices may be responsible for the apparent emergence of the parasite (Foster *et al*.,2008). Previous infection and the age of the host animal afford some protection against re infection. Acute disease is usually seen in young animal less than two years of age while older (adult) animals often continue to harbor for snails. Sheep appear susceptible throughout their lives and multiple infections only result in partial immunity to reinfection (Waal 2011).

Cross sectional study was conducted to determine the study was carried out to determine the prevalence and intensity of paramphistomiasis in native sheep from Mazanderan province, in the north of Iran in association with sex, age, breed and season. During the 4 seasons of 2008, at meat inspection the rumen and reticulum of native sheep and mixed breed were examined by naked eye for paramphistomiasis. The result obtained showed over all prevalence rate 33.9% *paramphistomes* per animal, 40.9% in sheep and 25% in mixed breeds, respectively (Eslami *et al*.,2012).

A retrospective study was carried out over a 10- to 12 years period in central France Paramphistomias is showed progressive increase between 1990 and 1999 (from 5.2 to44.7%). The prevalence of natural paramphistomiasis in snails significantly increased from 1996 to 2000 and remained after wards in the same range of values (3.7–5.3) (Mage *et al*., 2006).

A cross sectional study was carried out from October, 2010 to April, 2011 at Hashim Nur's Ethiopian Livestock and Meat Export industrialized abattoir in Debre Zeit, Ethiopia. Ruminants comprising cattle, sheep and goats were subjected to routine post mortem examination for the presence of *Paramphistomum*. The overall prevalence of *Paramphistomum* infection in the study proved to be 28.6 % of which 40.1 % were in cattle, 28.9 % in sheep and 16.7% in goats. The highest prevalence of paramphistomiasis was registered in highland goats, 30.2% compared to those originated from lowland, 15.4%. In the current study the prevalence proved to be higher in adult goats than young goats with prevalence of 30.5 % in adult and 15.1% in young goats. Infection was found to be highest in poor body condition 76.3 %, followed by medium 23.9 % and good 6.9% body conditioned animals. A statistically significant difference ($p<0.05$) of Paramphistomiasis prevalence was observed on the basis of species, body condition, different age groups and agro climatic zones (origins) of shoats(Melaku and Addis .2012).

A cross-sectional study was conducted in north Gondar zone, north west Ethiopia from November-January,2008. Small ruminants (sheep and goats) were examined using standard parasitological procedures. The study revealed that the overall prevalence of helminthiasis was 47.67%. The species level prevalence of helminthiasis was 46.07% and 55% in sheep and goats, respectively. Sex and age of the animals were found to have association with prevalence but significant differences were not found. Therefore during control and treatment of small ruminant helminthiasis a groecology, species, age and sex of the animals should be considered as potential risk factors for the occurrence of the disease in the study areas (Dagnachew*et al*., 2011).

An epidemiological survey of paramphistomiasis in ruminants indifferent districts of Punjab was conducted during the years 2005-2006, New Delhi sponsored project. Fecal samples were collected from different villages of the district of Punjab (Faridkot, Jalandhar, Ludhiana, Mansa, Muktsar, Nawanshahar and Sangroor). The samples were tested for *paramphistome* eggs by sedimentation method. Were found positive for *paramphistome* eggs with an incidence rate of 2.27%. The highest incidence was found in buffaloes 3.16% followed by sheep 2.07%, cattle 1.99% and goats 0.82% in different district of Punjab. Overall, seasonal epidemiology revealed highest incidence during monsoon with the incidence rate of 3.07% followed by1.23% in winter, 0.6% in post-monsoon and 0.56% in summer (Shabih and Juyal,2006).

prevalence in Abyei-area-Sudan in which the prevalence of paramphistomisis in cattle was 11.25%*(Gad kareem et.al.2012).*

A study was conducted to investigate the prevalence and risk factors of paramphistomiasis in Sudan in white Nile state in (Rabak) slaughter house of 156 of cattle during 2014 ,the disease was diagnosed by conventional method, fecal sedimentation test and by using ELISA. The results showed high sero prevalence rate by ELISA test (53.2%) ,compared to much lower prevalence by fecal sedimentation tests(29.5%).The risk factors associated with paramphistomosis were ;

Breed, grazing type ,body condition ,water source, snail presence ,water bodies, knowledge of owner about disease ,manure disposal and other disease with fecal sedimentation test and sex, water source ,vegetation , manure disposal, Schistosomaiasis and other disease (Motasim.,2014).

A study to investigate the prevalence and potential risk factors of paramphistomiosis in Sudan in Khartoum in Bahri on kadaru slaughter house to

330 of cattle during 2014-2015 .the disease was diagnosed by fecal sedimentation test and the prevalence (12.7)% .the risk factors were;

Sex, age, breed, body condition ,grazing type, source of animals, water source ,snail presence ,water bodies, vegetation ,knowledge of owner about disease, manure disposal, *Fasciola*, *Schistisoma*, other disease and treatment of the disease (Reem 2015).

A study was conducted to investigate the prevalence and potential risk factors of paramphistomiosis in Khartoum state in Omdorman (Ganawa) slaughter house in 333 animals of cattle during 2015 are the disease was diagnosed by fecal sedimentation test .the result showed prevalence of 21.9% and the risk factors associated with paramphistomosis were ;

Sex, age, breed, body condition ,grazing type, source of animals, water source ,snail presence ,water bodies, vegetation knowledge of owner about disease, manure disposal, *Fasciola*, *Schistisoma*, other disease and treatment of the disease (Halla 2015)

1.6 Geographic distribution:

Paramphistoma is considered as worldwide in prevalence. It is most commonly found in tropical and subtropical regions, including Australia, Asia, Africa, Easter Europe, and Russia. The most debilitating cases are reported in Europe from Bulgaria, Italy, France, and Poland, also in Asia from Thailand, India, and China. The parasitic infection was first described from Punjab, India (Boray, 1959).

1.7 Clinical signs:

Small numbers of *paramphistomes*, adult or immature fluke, don't show any signs. Heavy infection with the immature flukes may decreased appetite, listlessness and weight loss fluid, foul-smelling diarrhea and

dehydration may terminate in death of the animal. Moderate infections with the immature fluke may cause reduced weight gains or milk production, or ill-thrift. Immature fluke live in the small intestine of ruminants where they attach themselves to the intestinal mucosa with powerful suckers. In large numbers, they destroy part of the mucosa and cause acute inflammation of the intestine (NSW DPI 2007).

1.8 Diagnosis:

Under most situations, infection is hard to recognize because the symptoms are mild or even absent. There is not yet a standard diagnostic can be used. Therefore, manual diagnosis is done at many levels. Diagnosis basically relies on combination of postmortem analyses, clinical signs displayed by the animals. In heavy infection, symptoms are easily observed in sheep and cattle as they become severely anorexics or inefficiently digest food, and become unthrifty. Copious fetid diarrhea is an obvious indication, as the soiling of hind legs and tails with fluid feces are readily noticeable (Kumar, 1998). Even though it is not always the case, immature flukes can be identified from the fluid excrement. On rare occasions, eggs can be identified from stools of suspected animals (Olsen, 1974). In developing countries the diagnosis and prognosis is often hindered by multiple infection with other trematodes, such as *Fasciola hepatica* and schistosomes, because these flukes are given primary importance due to their pervasive nature (Phiri *et al*., 2006). Enzyme linked immune sorbent assay (ELISA) is being practiced as the most effective diagnostic technique for detection of anti-parasitic antibodies (Shabih *et al*., 2006). Indirect plate enzyme-linked immune sorbent assay was standardized and evaluated for its effectiveness in immune diagnostic

of paramphistomiasis in experimental and clinical cases in sheep, goat, cattle and buffaloes by using somatic whole adult antigen of *Paramphistomum epiclitum* (Kaur *et al*., 2009)

1.9 Postmortem:

At postmortem, marked hemorrhagic enteritis with large numbers of the immature worm parasites could be observed on the mucosa or contents of the duodenum and upper ileum as well as subcutaneous edema and gelatinous fatty degeneration. Extensive catarrhal or hemorrhagic duodenitis or jejunitis with destruction of associated glands and lymph nodes are the main histopathological features.Immature flukes may be found embedded in the duodenal mucosa (Kusiluka *et al*., 1996)

1.10 Treatment and prevention:

There is no especial drug for treatment and control However, some drugs were found to be effective for treatment of the disease. Include resorantel, oxyclozanide, clorsulon, ivermectin, niclosamide, bithional and levamisole (Bowman and Georgi 2008). An in vitro demonstration shows that plumbagin exhibits high efficacy on adult flukes (Saowakon *et al*.,2013). Drugs effective against the immature flukes are recommended for drenching. For this reason oxyclozanide is advocated as the drug of choice. It effectively kills the flukes within a few hours and it is effective against the flukes resistant to other drugs. The commercially prescribed dosage is 5 mg/kg body weight or 18.7 mg/kg body weight in two divided dose within 72 hours. (Hugh-Jones *et al*.,2008).

CHAPTER TWO

Materials and Methods

2.1 Study Area:

This study was conducted on 8 farms in Sharg Elneel locality Khartoum State the capital city of the Sudan. It lies between longitudes 31.5 to 34 °E and latitudes 15 to 16 °N population of the state was estimated at 5,274,321 in 2008 census of about 639,598 urban and 5,274,321 metro. The potential of Khartoum area for grazing is low. Grazing, therefore, is mostly dependent on the farms and water sources located on outside the state. The estimated cattle number in Khartoum state is 38.3% of the Sudan's livestock (M.A.R..F.P.,2014).

The climatic condition in Khartoum state like most of Sudan has very dry climate and the climate stays hot throughout the year .

2. 2 Study design;

Cross sectional study which provided information on occurrence of paramphistomiasis *(martin et al ,1988).*

2.3 Sample Size;

The sample size was 263 samples of this study the expected prevalence of parmphistomiasis and the estimation based on previous study carried out by Halla (2015) who has estimate the prevalence of disease in Omdorman locality, Khartoum state, Sudan at 21.9 % (Halla 2015).

Sample size was calculated according the formula by Thrusfield,M,(2007) n=(263)

$N = (1.96)^2 x\ pe_{xp}\ (1-pe_{xp}) / d2$

Where;

N=numberofsample size, pe_{xp}=expected prevalence,

d^2=Absolute precision.

Methodology;

2.4 Inspection of animal:

Assess their general health status, during

inspection examination ,detail records about the species, bread, sex, age ,origin and body condition of the animal were recorded, general physical examination of animals we conducted.

2. 5 Fecal examination ;

Fecal samples approximately 20 gram where collected directly from the rectum of the animal in clean plastic container after labeling with specific identification number. Each sample was transported to parasitology research laboratory university of sudan of science and techmology .Fecal samples were examined by sedimentation method for the presence of fluke eggs using the method described by Adjoju et al.2008.

The technique was per formed on 10g of feces to which 200ml water was added and mixed .the mixture was filtered 3 time throught aspecific sieve. The filtrate was allowed to stand for 10-1000rpm for 3 min .after centrifugation, the supernatant was decanted and drop of the sediment was

tested microscopically. Trematode eggs were identified of the basis of morphology (Souls by,1982).

2.6 Individual risk factors:

Potential individual risk factors and their categories were designed to be as follow:

Sex (male, female), age (adult, young), breed (local, cross) and body condition (good, poor).

2.7 Management risk factors:

Management risk factors include: grazing type (indoor, outdoor), water source (tap, river), snail presence (yes, no), contaminated water (yes, no), vegetation (yes, no), knowledge of owner about disease (yes, no), manure disposal (yes, no), other disease (positive, negative) and treatment of the disease (yes, no) .

2.8 Analysis of the results:

Results of the study were analyzed using statistical package of social science (SPSS). First, descriptive statistical analysis was displayed infrequency distribution and cross tabulation tables. Univariate analysis was performed using chi-square for qualitative data. P-value ≤0.25 was considered as significant association and the risk factor then selected to enter the multivariate analysis. Multivariate analysis: Forward or backward stepwise logistic regression was used to analyze the data and to investigate association between potential risk factor and the prevalence of paramphistomiasis. *p-value* ≤0.05indicated significant association between paramphistomiasis and the risk factors.

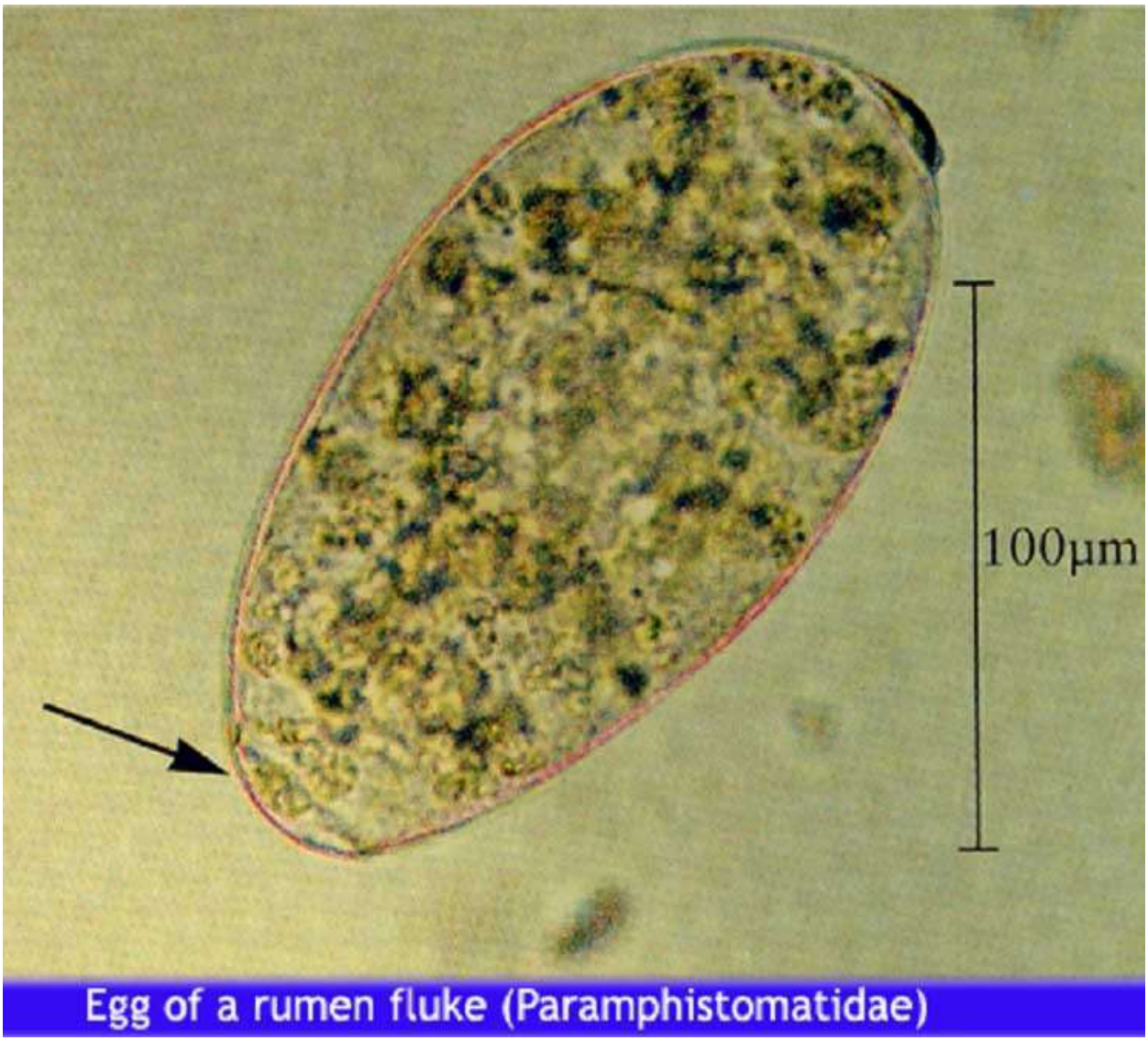

Figure 3: Eggs of *Paramphistomum* (*P*) *cerv* (wall, 2012).

CHAPTER FOUR

Results

From the 263 examined cattle, 25(9.5%) were found to be positive by the presence of the fluke's eggs in the fecal samples collected from these animals. The eggs were observed under the light microscope as a part of the fecal sedimentation method (table 3.1).

Table (3-1) Discrebution of paramphistomiasis infection among 236 cattle examined by fecal sedimentation test in Sharg Elneel locality Khartoum state;

	Frequency	**Percent**	**Valid Percent**	**Cumulative percent**
Positive	25	9.5	9.5	9.5
Negative	238	90.5	90.5	100
Total	263	100.0	100.0	

3.1 Age of animal:

From the 263 samples were collected from different ages categorized as follows, young animals 101(38.4%), adult animals 162(61.6%) (table 3.2). From the 101 young animals 11(10.9%) were found to be positive for *paramphstome spp*, While from 162 adult animals 14(8.9%) were found to be positive for *paramphstome spp*. Using fecal sedimentation method (table 3.3).Chis-qure test (table 3.4)showed no significant association between paramphstomiasis and age of animal (p-value= 0.578) .

3.2 Sex of animal:

Different sex categorized as following :male 96(36.5%) animals ,female 167(63.5%) animals .From 96 male 2(2.1%) were found positive for paramphstoma spp. while from 167 female 23(13.8%) were found to be positive from *paramphistoma spp* . Using fecal sedimentation method (tabule3.4).Chis-qure test showed significant association between paramphstomiasis and sex of animal (p- value=-2.165).

3-3 bread:

As shown in table (3.2) bread were local 115(43.7%) animals ,cross 148(56.3%) animals . positive for *paramphstoma spp* were 3(2.6%). while from 148 cross 22(14.9%) were found to be positive from *paramphistoma spp* . Using fecal sedimentation method (table 3.3).Chis-qure test (table 3.4) showed significant association between paramphstomiasis and bread of animals (p- value=-0.515) .

3.4 body condition:

In table (3-4) good condition animals 180 were (68.4%), poor condition animals 83(31.4%) (table 3.2). from The 180 good condition animals were found13 were(7.2%) to be positive for *paramphstome spp* , Whith from 83 poor condition animals were found 12(14.6%) to be positive for *paramphstome spp*. (table 3.3). Chi-squre test showed (table3.4) no significant association between paramphstomiasis and body condition of animals (p- value= 16.48).

3-5 Previous history of the disease:

Previous history of the disease table (3.2) were found 24(10.8%) to be positive While from 41no animals were found 1(2.4%) to be positive. Using fecal sedimentation method (table 3.3).Chi-squre test (table3.4) showed significant

association between paramphstomiasis and previous history of the disease (p-value= 16.481) .

3.6 Grazing type:

In grazing type (table 3.2) as follows, indoor 173(65.8%).Outdoor 90(34.2%). from The 173 indoor animals grazing were found 15(8.7%)to be positive for *paramphstome spp*, while from 90 outdoor animals grazing were found 10(11.1%) to be positive for *paramphstome spp*. (table 3.3).Chi-squre test (3.4) showed no significant association between paramphstomiasis and grazing type of animals (p-value= 1.766) .

3.7 Water source:

From the 263 samples were collected from water source (table 32). All animals were drinking from taps .Chi-squre test did not show significant difference because water source was constant .

3.8 Presence of snails:

From the 263 samples were collected from presence of snails(table3.2).All animals with no presence of snails. chi-squre test did not show significant difference because presence of snails was constant (table 3.2).

3.9 contamination of water:

No significant association between paramphstomiasis and contamination of water (table3.2).

3.10 Vegetation:

In chi-squre test did not show significant difference between paramphstomiasis and vegetation (table 3.2).

3.11 Knowledge of owner about disease:

From the 263 samples were collected from different Knowledge of owner about disease categorized as follows, Knowledge of owner about disease was ,215(81.7%) said yes, 48(18.35) said no. From the 215 said yes 17(7.9%) animals were found to be positive for *paramphstome spp*. While from48 no Knowledge of owner about disease 8(16.7%) animals were found to be positive for *paramphstome sp* (table 3.3).Chi-squre test (table 3.4) showed that significant association Paramphstomiasis and knowledge of owner about disease (p- value= 13.006).

3.12 Manure disposal:

All animals with manure disposal. Chi-sgure test did not show significant different between paramphstomiasis and manure disposal (table 3.2).

3.13 Other diseases:

Positive other disease 90(34.2%) animals, negative other disease 173(65.8%) animals (table3.3) .Chi-squre test showed (table 3.4) that no significant association between paramphstomaisis and other disease (p-value= 0).

3.14 Treatment of disease:

Treatment of disease categorized as follows, using of treatment 90(34.2%) animals, no using treatment 173(65.8%) (table 3.2). From the 90 said yes for treatment of disease 10(`11.1%) animals were found to be positive for *paramphstome spp*, while from173 not treated of disease 15(8.7%) animals were found to be positive for *paramphstome spp* (table3.3).Chi-squre test showed (table3.4) no significant association between paramphstomiasis and treatment of disease (p- value= 0).

This study showed no significant association (table 3.5) between paramphistomiasis and three potential risk factors; sex ,bread and pervious history of the disease in multivariate analysis. The odds ratio (Exp - B) to the risk factor sex was 1.105 in female with confident interval 95% exponent –B (0.24-1.883). The odds ratio (Exp - B) to the risk factor bread was 0.475 in cross with confident interval 95% for exponent –B (0.073-3.073). The odds ratio (Exp -B) to the risk factor previous history of the disease was 5.831 in yes with confident interval 95% for exponent –B (0.658-43.988).

Table (3-2) Summary of frequency distribution of 236 cattle in Khartoum state examind for paramphistomiasis by fecal sedimentation test according to potential risk factors:

Risk factors	**Frequency**	**Relative frequency**	**Cumulative frequency**
Age			
Young	102	38.8	38.8
Adult	161	61.2	99.6
Total	263	100.0	
Sex			
Male	96	36.5	36.5
Female	167	63.5	100.0
Total	263	100.0	
Bread			
Local	115	43.7	43.3
Cross	148	56.3	100.0
Total	263	100.0	
Body condition			
Boor	82	31.2	31.2
Good	181	68.8	100.0
Total	263	100.0	
Previous history of disease			
Yes	222	84.8	84.8
No	41	15.6	100.0

Total	263	100.0	
Grazing type			
Indoor	173	65.8	65.8
Outdoor	90	34.2	100.0
Total	263	100.0	

Water source			
Tap	174	66.2	66.2
River	89	33.8	100.0
Total	263	100.0	
Snail presence			
No	263	100.0	100.0
Yes	0		100.0
Total	263	100.0	
Contamination of water			
yes	263	100.0	100.0
no	0		100.0
total	263	100.0	
Vegetation			
Yes	263	100.0	100.0
No	0		100.0
Total	263	100.0	
Manure disposal	263	100.0	100.0

Yes	0		100.0
No	263	100.0	
Total			
Knowledge of owner About disease			
Yes	214	81.4	81.4
No	49	18.6	100.0
Total	263	100.0	
Other disease			
Yes	90	34.2	34.2
No	173	65.8	100.0
Total	263	100.0	
Treatment of the disease			
Yes	90	34.2	34.2
No	173	65.8	100.0
Total	263		

Table (3-3) Summary of cross tabulation for the rate of paramphistomiasis in each category of potential risk factors in 263 cattle form in Khartoum state examined by fecal sedimentation test:

Risk factors	No. of inspected	No. of effected (%)
Age		
Young	101	11(10.9)
Adult	162	14(8.9)
Sex		
Male	96	2(2.1)
female	167	23(13.8)
Bread		
Local	115	3(2.6)
Cross	148	22(14.9)
Body condition		
Poor	83	12(14.6)
Good	180	13(7.2)

Previous history of the disease		
Yes	222	24(10.8)
no	41	1(24)
Water source		
Tap	174	16(2.9)
River	89	9(10.1)
Grazing type		
Indoor	173	15(8.7)
Out door	90	10(11.1)
Snail presence		
Yes	263	25(9.5)
No	0	
Contamination of water		
Yes	263	25(9.5)
No	0	
Vegetation		
Yes	263	25(9.5)
No	0	
Manure disposal		
Yes	263	25(9.5)
No	0	

Knowledge of owner about the disease		
Yes	215	17(9.5)
No	48	8(16.7)
Other disease		
Positive	90	10(11.1)
Negative	173	15(8.7)
Treatment of the disease		
Yes	90	10(11.1)
No	173	15(8.7)

Table (3-4) Summary univariate analysis for the association between paramphistomasis and potential risk factors in 263 cattle examined in Khartoum state by feacal sedimentation method using chi squre test:

Risk factors	**No.of inspected**	**No.of effected (%)**	**d.f**	**X^2 value**	**P- value**
Age					
Young	101	11(10.9)	1	0.366	0.578
Adult	162	14(8.9)			
Sex					
Male	96	2(2.1)	1	9.683	-2.165
female	167	23(13.8)			
Bread					
Local	115	3(2.6)	1	11.301	-0.515
Cross	148	22(14.9)			

Body condition **Boor** **good**	83 180	12(14.6) 13(7.2)	1	3.703	0.438
Previous history of the disease **Yes** **No**	222 41	24(10.8) 1(2.4)	1	2.820	16.481
Water source **Tap** **River**	174 89	16(9.2) 9(10.1)	1	0.058	-14.290
Grazing type **Indoor** **outdoor**	173 90	15(8.7) 10(11.1)	1	0.410	1.766
Snail presence **Yes** **No**	263 0	25(9.5)	1	0	-
contamination of					

water **Yes** **No**	 263 0	 25(9.5)	1	0	-
Vegetation **Yes** **No**	 263 0	 25(9.5)	1	0	-
Manure disposal **Yes** **No**	 263 0	 25(9.5)	1	0	-
Knowledge of owner about disease **Yes** **No**	 215 48	 17(9.7) 8(16.9)	1	3.573	13.006
Other disease **Positive** **Negative**	 90 173	 10(11.1) 15(8.7)	1	0.410	-

Treatment of the disease					
Yes	90	10(11.1)			
No	173	15(8.7)	1	0.410	-

Table (3-5) Table Multivariate analysis for the association between paramphistomiasis and potential risk factors in 263 cattle examined at Sharg Elneel locality by fecal sedimentation test:

Risk Factors	**No. inspected**	**No. infected**	**Exp (B)**	**p-value**	**95%cl lower**	**For Exp (B) Upper**
Sex						
Male	96	2(2.1)	Ref			
Female	167	23(13.8)	1.105	-1.54	0.024	1.883
Bread						
Local	115	3(2.6)	Ref			
Cross	148	22(14.9)	0.475	-0.74	0.073	3.073
Previous history of the disease						
Yes	222	24(10.8)	5.831	1.683	0.658	43.988
No	41	1(2.4)	Ref			

CHAPTER FOUR

Discussion

Results of the present study have increased knowledge on the epidemiology of paramphistomiasis in cattle at Sharg Elneel locality in Khartoum state of the Sudan, investigated by fecal sedimentation method and questionnaires .Fecal sedimentation method showed that the prevalence rate of paramphistomiasis was considerably high in the study area. There for this study was conducted to estimate the prevalence rate of paramphistomiasis in cattle and to investigate potential risk factors associated with the occurrence of paramphistomiasis in Khartoum state. In this study, the overall prevalence rate of egg of *paramphistomes* in cattle fecal samples collected from Sharg Elneel locality in Khartoum state were 9.5% (25\263) by fecal sedimentation method.

The result obtained from fecal sedimentation method in the present study was lower than prevalance reported by Eslami (2012) in north of Iran prevalence reported is 33.9% and in north gander zone in north west Ethiopia was 47.64% (2011) and . (2012) in Ethiopian reported prevalence of 28.9% in cattle and Gad Kareem and Emalik (2012) in Abyei-area in Sudan reported 11.25%(18\160) in cattle. White Nile state (Rabak) the prevalence 29.5% (46\156) by Motasim (2014). Reem (2015) in Sudan Khartoum Bahari (Kadaro) slaughter house the prevalence reported 12.7% (42\288). In Sudan Omdorman (Ganawa) slaughter house reported the prevalence rate was 21.9(72\333). However the prevalence rate reported in the present study was higher than the prevalence reported in Central France (3.7-5.3%) by Shabih and Sugal (2006)in India who reported a prevalence of 3.4% (22\651).

This could be due to the differences in the tested sample size (n),practicing of traditional grazing and geographical regions. Knowledge of risk factors associated with paramphistomiasis in cattle is an important pre requisite for the design and implementation of effective control strategies and for management programs that can lead to the control and eradication of disease .Knowledge of risk factors and their association and contributions to the occurrence and spreading of paramphistomiasis among cattle population also is good aid for clinical diagnosis and for determining the epidemiology and patterns of disease .Few studies in the Sudan have addressed risk factors associated with positivity to paramphistomiasis in cattle .In the current study ,univariate analysis using chi-squre with confidence interval of 95% at p-value $\leq$ 0.25 was used to identify potential risk factors associated with fecal sedimentation method positively to paramphistomiasis in cattle. Significant risk factors association with fecal sedimentation method positive in univariate analysis were sex (x^2=9.683 p=-2.165), bread (x^2=11.301,p=-0.515) ,previous history of the disease (x^2=2.820 ,p=16.481).The maltivarite analysis using logistic regression with confidance interval of 95% and p-value $\leq$ 0.05 was used to assess the association between identified significant risk factors in univariate analysis in positive fecal sedimentation method status for paramphistomiasis in cattle .However, some potential risk factors with were regarded to be important with p-value $\leq$0.25 the univarite analysis were also entered in to the multivariate analysis .This analysis showed be association between fecal sedimentation method negative status for paramphistomiasis .

Conclusion;

From the results of this study it can be concluded that cattle paramphistomasis according to fecal sedimentation in Khartoum state in Sharg Elneel locality is high prevalence rate (9.5%).Based on the results of the study the risk factors is no associated with paramphistomiasis in cattle by fecal sedimentation method.

Recommendation;

The study shows the need for;

1-More studies on potential risk factors enhance the spread and transmission of paramphistomasis in cattle in Sudan.

2-Integrated control and eradication program should be launched as recommended by OIE.

3-Extention and communication program should be implemented to enable cattle and other live stock owners to understand the importance of the disease.

4-The scheme of initiation of regional network for surveillance control and eradication of the important disease in the surrounding Africa countries

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Appendices 1

Questionnaire:

Investigation of paramphistomiasis in Khartoum State.

Conducted by: The preventive medicine Department of Sudan University of science and technology, Faculty of veterinary medicine.

Locality_____ date _____

Animal owner _____

Herd.Code_____

Address _____ __

1-The individual risk factors:

1-Age :(years)

Young ( ) Adult ( )

2-sex:

Male ( ) Female ( )

3-Breed:

Local ( ) Cross ( )

4-Body condition:

Poor ( ) Good ( )

5- Previous history of the disease:

Yes ( ) No ( )

Comment:

……

……

……

……

2-Management risk factors;

6-Grazing type:

Indoor ( ) Outdoor ( )

7-water source:

Tap ( ) River ( )

8-snail presence:

Yes ( ) No ( )

9-water bodies:

Yes ( ) No ( )

10- Vegetation:

Yes ( ) No ( )

11- Knowledge of owner about disease:

Yes ( ) No ( )

12- manure disposal:

Yes ( ) No ( )

13- Other disease:

Positive ( ) Negative ( )

14-Tretment of disease:

Yes ( ) No ( )

Comment:……..

Appendices 2

Distribution of paramphastomasis infection

	Frequency	Percent	Valid percent	Cumulative percent
Positive	25	9.5	9.5	9.5
Negative	263	90.5	90.5	100
total	238	100.0	100.0	

Frequency distribution

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	young	101	38.4	38.4	38.4
	adult	162	61.6	61.6	100.0
	Total	263	100.0	100.0	

Sex

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	96	36.5	36.5	36.5
	female	167	63.5	63.5	100.0
	Total	263	100.0	100.0	

Bread

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	local	115	43.7	43.7	43.7
	cross	148	56.3	56.3	100.0
	Total	263	100.0	100.0	

body condition

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	boor	82	31.2	31.2	31.2
	good	180	68.4	68.4	99.6
	10.00	1	.4	.4	100.0
	Total	263	100.0	100.0	

pervious history of the disease

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	222	84.4	84.4	84.4
	no	41	15.6	15.6	100.0
	Total	263	100.0	100.0	

grazing type

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	indoor	173	65.8	65.8	65.8
	outdoor	90	34.2	34.2	100.0
	Total	263	100.0	100.0	

water source

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	tap	174	66.2	66.2	66.2
	river	89	33.8	33.8	100.0
	Total	263	100.0	100.0	

snail presence

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	263	100.0	100.0	100.0

knowledge of owner about disease

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	214	81.4	81.4	81.4
	no	48	18.3	18.3	99.6
	10.00	1	.4	.4	100.0
	Total	263	100.0	100.0	

manure disposable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	263	100.0	100.0	100.0

other disease

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	posative	90	34.2	34.2	34.2
	negative	173	65.8	65.8	100.0
	Total	263	100.0	100.0	

treatment of the disease

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	90	34.2	34.2	34.2
	no	173	65.8	65.8	100.0
	Total	263	100.0	100.0	

sedimentation test

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	posative	25	9.5	9.5	9.5
	negative	238	90.5	90.5	100.0
	Total	263	100.0	100.0	

Appendices 3
Cross tabulation tables

			age		Total
			young	adult	
sedimentation test	posative	Count	11	14	25
		% within sedimentation test	44.0%	56.0%	100.0%
		% within age	10.9%	8.6%	9.5%
	negative	Count	90	148	238
		% within sedimentation test	37.8%	62.2%	100.0%
		% within age	89.1%	91.4%	90.5%
Total		Count	101	162	263
		% within sedimentation test	38.4%	61.6%	100.0%
		% within age	100.0%	100.0%	100.0%

			sex		Total
			male	female	
sedimentation test	posative	Count	2	23	25
		% within sedimentation test	8.0%	92.0%	100.0%
		% within sex	2.1%	13.8%	9.5%
	negative	Count	94	144	238
		% within sedimentation test	39.5%	60.5%	100.0%
		% within sex	97.9%	86.2%	90.5%
Total		Count	96	167	263
		% within sedimentation test	36.5%	63.5%	100.0%
		% within sex	100.0%	100.0%	100.0%

			bread		Total
			local	cross	
sedimentation test	posative	Count	3	22	25
		% within sedimentation test	12.0%	88.0%	100.0%
		% within bread	2.6%	14.9%	9.5%
	negative	Count	112	126	238
		% within sedimentation test	47.1%	52.9%	100.0%
		% within bread	97.4%	85.1%	90.5%
Total		Count	115	148	263
		% within sedimentation test	43.7%	56.3%	100.0%
		% within bread	100.0%	100.0%	100.0%

			body condition			Total
			boor	good	10.00	
sedimentation test	posative	Count	12	13	0	25
		% within sedimentation test	48.0%	52.0%	0.0%	100.0%
		% within body condition	14.6%	7.2%	0.0%	9.5%
	negative	Count	70	167	1	238
		% within sedimentation test	29.4%	70.2%	0.4%	100.0%
		% within body condition	85.4%	92.8%	100.0%	90.5%
Total		Count	82	180	1	263
		% within sedimentation test	31.2%	68.4%	0.4%	100.0%
		% within body condition	100.0%	100.0%	100.0%	100.0%

			pervious history of the disease		Total
			yes	no	
sedimentation test	posative	Count	24	1	25
		% within sedimentation test	96.0%	4.0%	100.0%
		% within pervious history of the disease	10.8%	2.4%	9.5%
	negative	Count	198	40	238
		% within sedimentation test	83.2%	16.8%	100.0%
		% within previous history of the disease	89.2%	97.6%	90.5%
Total		Count	222	41	263
		% within sedimentation test	84.4%	15.6%	100.0%
		% within previous history of the disease	100.0%	100.0%	100.0%

			grazing type		Total
			indoor	outdoor	
sedimentation test	posative	Count	15	10	25
		% within sedimentation test	60.0%	40.0%	100.0%
		% within grazing type	8.7%	11.1%	9.5%
	negative	Count	158	80	238
		% within sedimentation test	66.4%	33.6%	100.0%
		% within grazing type	91.3%	88.9%	90.5%
Total		Count	173	90	263
		% within sedimentation test	65.8%	34.2%	100.0%
		% within grazing type	100.0%	100.0%	100.0%

			water source		Total
			tap	river	
sedimentation test	posative	Count	16	9	25
		% within sedimentation test	64.0%	36.0%	100.0%
		% within water source	9.2%	10.1%	9.5%
	negative	Count	158	80	238
		% within sedimentation test	66.4%	33.6%	100.0%
		% within water source	90.8%	89.9%	90.5%
Total		Count	174	89	263
		% within sedimentation test	66.2%	33.8%	100.0%
		% within water source	100.0%	100.0%	100.0%

			snail presence	Total
			no	
sedimentation test	posative	Count	25	25
		% within sedimentation test	100.0%	100.0%
		% within snail presence	9.5%	9.5%
	negative	Count	238	238
		% within sedimentation test	100.0%	100.0%
		% within snail presence	90.5%	90.5%
Total		Count	263	263
		% within sedimentation test	100.0%	100.0%
		% within snail presence	100.0%	100.0%

			contamination of water	Total
			no	
sedimentation test	posative	Count	25	25
		% within sedimentation test	100.0%	100.0%
		% within contamination of water	9.5%	9.5%
	negative	Count	238	238
		% within sedimentation test	100.0%	100.0%
		% within contamination of water	90.5%	90.5%
Total		Count	263	263
		% within sedimentation test	100.0%	100.0%
		% within contamination of water	100.0%	100.0%

			vegetation	Total
			yes	
sedimentation test	posative	Count	25	25
		% within sedimentation test	100.0%	100.0%
		% within vegetation	9.5%	9.5%
	negative	Count	238	238
		% within sedimentation test	100.0%	100.0%
		% within vegetation	90.5%	90.5%
Total		Count	263	263
		% within sedimentation test	100.0%	100.0%
		% within vegetation	100.0%	100.0%

			knowledge of owner about disease			Total
			yes	no	10.00	
sedimentation test	posative	Count	17	8	0	25
		% within sedimentation test	68.0%	32.0%	0.0%	100.0%
		% within knowledge of owner about disease	7.9%	16.7%	0.0%	9.5%
	negative	Count	197	40	1	238
		% within sedimentation test	82.8%	16.8%	0.4%	100.0%
		% within knowledge of owner about disease	92.1%	83.3%	100.0%	90.5%
Total		Count	214	48	1	263
		% within sedimentation test	81.4%	18.3%	0.4%	100.0%
		% within knowledge of owner about disease	100.0%	100.0%	100.0%	100.0%

			manure disposable	Total
			yes	
sedimentation test	posative	Count	25	25
		% within sedimentation test	100.0%	100.0%
		% within manure disposable	9.5%	9.5%
	negative	Count	238	238
		% within sedimentation test	100.0%	100.0%
		% within manure disposable	90.5%	90.5%
Total		Count	263	263
		% within sedimentation test	100.0%	100.0%
		% within manure disposable	100.0%	100.0%

			other disease		Total
			posative	negative	
sedimentation test	posative	Count	10	15	25
		% within sedimentation test	40.0%	60.0%	100.0%
		% within other disease	11.1%	8.7%	9.5%
	negative	Count	80	158	238
		% within sedimentation test	33.6%	66.4%	100.0%
		% within other disease	88.9%	91.3%	90.5%
Total		Count	90	173	263
		% within sedimentation test	34.2%	65.8%	100.0%
		% within other disease	100.0%	100.0%	100.0%

			treatment of the disease		Total
			yes	no	
sedimentation test	posative	Count	10	15	25
		% within sedimentation test	40.0%	60.0%	100.0%
		% within treatment of the disease	11.1%	8.7%	9.5%
	negative	Count	80	158	238
		% within sedimentation test	33.6%	66.4%	100.0%
		% within treatment of the disease	88.9%	91.3%	90.5%
Total		Count	90	173	263
		% within sedimentation test	34.2%	65.8%	100.0%
		% within treatment of the disease	100.0%	100.0%	100.0%

Appendices 4

Chi-squre test tables

ages

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.366[a]	1	.545
Continuity Correction[b]	.151	1	.697
Likelihood Ratio	.361	1	.548
Fisher's Exact Test			
Linear-by-Linear Association	.364	1	.546
N of Valid Cases	263		

Sex

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.683[a]	1	.002
Continuity Correction[b]	8.371	1	.004
Likelihood Ratio	11.895	1	.001
Fisher's Exact Test			
Linear-by-Linear Association	9.646	1	.002
N of Valid Cases	263		

bread

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.301[a]	1	.001
Continuity Correction[b]	9.921	1	.002
Likelihood Ratio	12.983	1	.000
Fisher's Exact Test			
Linear-by-Linear Association	11.258	1	.001
N of Valid Cases	263		

Body condition

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.703[a]	2	.157
Likelihood Ratio	3.568	2	.168
Linear-by-Linear Association	2.078	1	.149
N of Valid Cases	263		

Previous history of the disease

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.820[a]	1	.093
Continuity Correction[b]	1.931	1	.165
Likelihood Ratio	3.717	1	.054
Fisher's Exact Test			
Linear-by-Linear Association	2.809	1	.094
N of Valid Cases	263		

Water source

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.058[a]	1	.810
Continuity Correction[b]	.000	1	.986
Likelihood Ratio	.057	1	.811
Fisher's Exact Test			
Linear-by-Linear Association	.057	1	.811
N of Valid Cases	263		

Snail present

	Value
Pearson Chi-Square	.[a]
N of Valid Cases	263

a. No statistics are computed because snail presence is a constant.

Contamination of water

	Value
Pearson Chi-Square	.[a]
N of Valid Cases	263

a. No statistics are computed because contamination of water is a constant.

vegetation

	Value
Pearson Chi-Square	.[a]
N of Valid Cases	263

a. No statistics are computed because vegetation is a constant.

Knowledge of owner about the disease

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.573[a]	2	.168
Likelihood Ratio	3.228	2	.199
Linear-by-Linear Association	.530	1	.467
N of Valid Cases	263		

Manure disposal

	Value
Pearson Chi-Square	.[a]
N of Valid Cases	263

a. No statistics are computed because manure disposable is a constant.

Other disease

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.410[a]	1	.522
Continuity Correction[b]	.175	1	.675
Likelihood Ratio	.401	1	.526
Fisher's Exact Test			
Linear-by-Linear Association	.408	1	.523
N of Valid Cases	263		

Treatment of the disease

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.410[a]	1	.522
Continuity Correction[b]	.175	1	.675
Likelihood Ratio	.401	1	.526
Fisher's Exact Test			
Linear-by-Linear Association	.408	1	.523
N of Valid Cases	263		

Appendices 5
Multivariate analysis table

s

Risk factors		B	S.E.	Wasld	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	sex(1)	-1.542-	1.114	1.917	1	.166	.213	.024	1.883
	bread(1)	-.713-	.950	.564	1	.453	.475	.073	3.073
	Previous history of the disease	1.654	1.070	2.389	1	.122	5.83	.658	43.988