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Veterinary Public Health in Ethiopia: Current Status and Prospects

Bayleyegn Molla*

1. Introduction

Veterinary public health (VPH) stems from veterinary medicine, considered as “the broadest and most comprehensive of the health professions”, the ultimate objective of which is to promote well being and the quality of human life (2). VPH provides the linkage between agriculture and public health. It is a discipline that deals with the contributions of veterinary medicine to public health. The term describes the concept of the responsibility of veterinary medicine for the health of the public. In its widest sense, VPH is defined as a component of public health activities devoted to the application of professional veterinary skills, knowledge and resources to the protection and improvement of human health and nutrition. Veterinary services are powerful tools for improving human health and nutrition by controlling and preventing zoonoses, decreasing malnutrition, improving hygiene and sanitation thereby protecting the consumer and dealing with other risk factors which require the collaboration between physicians and veterinarians. The final objective of veterinary medicine does not lie in curing animals from disease, it lies very definitely in improving human nutrition and health as stated in the 1978 Alma Ata Declaration (4, 5, 10).

Very recently, a new definition for VPH was suggested as “the contributions to the complete physical, mental and social well being of humans through an understanding and application of veterinary medicine science” by a Study Group on Future Trends in Veterinary Public Health jointly organized by FAO, OIE and WHO in 1999 in Teramo, Italy (7). This was suggested in order to meet the challenges ahead in VPH. Veterinary medicine has a long and distinguished history in contributing to the maintenance and promotion of public health. It is a well-known fact that health is multi-dimensional which as a result requires interdisciplinary and inter-sectoral health policy and practice. Therefore the improvement of health and well being of the population requires more than the services delivered by the public health sector alone. The contributions of agriculture, animal health and production, food industry, education, environmental sciences are vital particularly in developing countries of the world with weak
infrastructures and limited resources. It is through this multi-disciplinary concept that WHO established a VPH unit 50 years back.

2. Veterinary Public Health activities

Many animal-related problems that negatively affect human health and economy exist in all countries of the world including zoonoses, food-borne diseases and pollution of the environment from animal sources. VPH activities involve a diverse range of functions within public health which reflect the broad community interest between veterinary and human medicine and indicate the opportunities for profitable interaction. They are often interrelated. Inevitably there are many areas where VPH activities overlap with those of veterinary services that are primarily concerned with the promotion of animal health in relation to economic animal production, especially where the two activities belong to separate administrations. It is important that neither should be considered in isolation; maximum integration must be ensured if services are to be comprehensive. The public health veterinarian is responsible for a variety of functions that are far from being mutually exclusive. The followings represent VPH activities in different sectors (6, 8, 10).

2.1 Zoonoses (diagnosis, surveillance, control, prevention and eventual eradication)

Zoonoses are important components of the public health activities and one of the three most important areas of veterinary public health (zoonoses, veterinary food hygiene and liaison activities). Zoonoses are defined as “... those diseases and infections (the agents of) which are transmitted between animals and man and vice versa”. It is interaction of agent, host (degree of susceptibility), and the environment (epidemiological triad) they share. This determines whether or not transmission of the agent will be successful leading to infection, and ultimately occurrence of disease.

Zoonoses are responsible for:

- Widespread illness and death among humans
- Undermine animal health and productivity
- Reduce the production of food (meat, milk, eggs, etc.), wool and work output of draught
- Increase imports of food: burden on national budget
- Economic losses due to limitation of export of animals and animal products.
Classic important zoonoses recognized today include anthrax, brucellosis, tuberculosis, salmonellosis, rabies, cysticercosis, hydatidosis, trichinellosis, toxoplasmosis, etc.

Emerging zoonoses: new zoonotic diseases, not observed before, not diagnosed before. Examples: RVF, Ebola haemorrhagic fever, Enterohaemorrhagic Escherichia coli (EHEC) O 157:H7, Salmonella enteritidis, Campylobacter etc.

Re-emerging zoonoses: appearance after 10 – 20 years of complete absence or manifestation in large numbers than usual. Examples: TB, leptospirosis, plague (Yersinia pestis), yellow fever, rabies, etc.

Associated risk factors with emerging and re-emerging zoonoses are
- Deforestation
- Global warming/pollution,
- HIV/AIDS,
- Population movements
- Molecular changes of organisms.

Specific activities in veterinary food hygiene

Food “... any substance whether processed, semi-processed or raw, which is intended for human consumption including drink and any other substance which has been used in its manufacture, preparation or treatment. Food does not include tobacco or substances used only as drugs”.

Food hygiene another branch of VPH which is defined as “all measures necessary to ensure the safety, soundness and wholesomeness of food at all stages from its growth, production or manufacture up to its final consumption”.

The objectives of food hygiene are:
- To ensure the supply of sound, safe and wholesome food for the consumer
- To improve the quality of food
- To prevent outbreak of food-borne diseases
- To improve the shelf-life (keeping quality) of food

The activities of veterinary food hygiene are:
- Prevention and control of zoonoses and other diseases transmitted by food of animal origin
• Ante-mortem and post-mortem inspection of met and poultry
  ❖ Slaughterhouses are important in the establishment of a surveillance program
  ❖ Requires presence of well trained veterinarians to supervise and confirm meat inspection findings: should not entirely depend on a technician
  ❖ There must be Lab. Facilities in all major slaughterhouses
  ❖ Linkage and extension of animal health and disease monitoring at the farm and slaughterhouse is a must and more beneficial in a modern animal production
• Inspection of food premises, their operations and products including processing, storage and distribution.
• Prevention and control of chemical residues in food, including veterinary drug residues.
• Supervision of food export-import from the hygienic point of view
• Cooperation with epidemiological services in surveillance, collection, evaluation and distribution of data and dissemination of information

The importance of supervision of the inspection and protection of food within VPH is rapidly increasing because of:
  ❖ The increase of world population
  ❖ Development of food technology
  ❖ Increased national and international food trade
  ❖ Increased environmental pollution

From viewpoint of food technology and hygiene, 3 groups of micro-organisms differentiated according to their effect:
  ➔ Micro-organisms used for the production of certain food items
  ➔ Spoilage organisms
  ➔ Pathogenic organisms

Both spoilage and pathogenic organisms are important from food hygiene point of view. Based on optimum temperature required for growth and multiplication, microorganisms are grouped as

<table>
<thead>
<tr>
<th>Group of Bacteria</th>
<th>Minimum $T^0$</th>
<th>Optimum $T^0$</th>
<th>Maximum $T^0$</th>
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<tr>
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<tr>
<td>Thermophilic</td>
<td>45</td>
<td>55</td>
<td>85</td>
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</tbody>
</table>
Practical applications of food hygiene include

- To avoid contamination of food by microorganisms at all
- To prevent multiplication of microorganisms
- To reduce or eliminate the microorganisms, e.g., heating of food, disinfections of premises, equipment, etc.

Traditional food safety assessments are based on the experience that sick food animals, dirt in food production and sale, failures during processing can be directly connected with food-borne infections and intoxications.

Legal requirements have been set for various areas of concern, e.g. Legislation on meat inspection, milk hygiene, hygienic requirements, microbiological standards, etc.

Food safety assessment has to take into consideration the entire food chain starting from living food animals and its environment, the raw material (meat, milk, eggs, etc) followed by processing, production, preparation, distribution to retail outlets and final consumers.

Surveillance of food-borne diseases includes regular checks of food animals, monitoring of various food items and disease in humans. The control of residues is another activity of VPH requiring specific analytical skills and methods.

Food control strategies at different situations (Gerigk, 1999)

Three situations exist:

**Situation A**
- Lack of basic hygiene including food hygiene
- Lack of potable water
- High morbidity and mortality
- High rate of illiteracy
- Subsistence farming
- No industrial development
- No market economy

**Situation B**
- Some basic hygienic practice and food hygiene
- Supply of potable water
- Medium morbidity and mortality
- Some degree of literacy
• Some agricultural development
• Some industrial development
• Development of market economy

Situation C
• Good basic hygienic practices and food hygiene
• Plenty of potable water low morbidity and mortality
• High rate of literacy
• Well-developed agriculture
• Well-developed industry
• Well-developed market economy

Priorities to be given in case of situation A:
• Improvement of basic sanitation (water supply, waste disposal)
• Consumer education on simple food hygiene measures
• Training in proper use of agricultural chemicals
• Educational programs for illiterate people
• Utilisation of PHC programs for food hygiene education
• Quality control

Priorities to be given in case of situation B:
• Education of consumers
• Advise and training of food handlers in food hygiene matters Legal control (microbiological, chemical, etc)
• Food fraud and control of food standards

Priorities to be given in case of situation C:
All facets of food control have to be taken into account

Administration of food control services

In order to enforce effective food control, the corresponding infrastructure must be available:
⇒ An administration which plans, coordinates and supervises food control activities
⇒ A field service which carries out the inspection of food plants.
⇒ Food control laboratories which examine food samples and any other relevant materials

Tasks of the field service are:
❖ Registration of all food plants including reassurance
❖ Licensing of food plants
- Inspection of these plants, particularly to check hygiene conditions
- Inspection of food and taking samples (routine samples, samples of suspected foods)
- Epidemiological investigation in food establishments in cases of foodborne diseases
- Investigation of consumers’ complaints
- Enforcement of food regulations
- Provision of advice to food personnel and consumers on matters of food law, food hygiene, etc

2.3 Activities related to the environment

- Control of zoonoses of environmental origin (e.g. anthrax, salmonellosis, etc)
- Safe collection and disposal of dead animals, condemned meat and of other animal wastes, and the control of environmental population in animal settlements and animal industries.
- Preservation of urban and rural environment by controlling wild animals and bird populations
- Zoonoses control in non-production animals (wild life and pests)

2.4 Miscellaneous activities

Other activities in area of biomedical research are development of improved diagnostic methods and research on the production of biological products and ecological and epidemiological research on reservoirs of infection

Emergency actions include intervention and preventive measures in outbreaks of exotic diseases and natural and man-made disasters.

VPH activities have also social applications as the use of companion animals in aiding persons with mental illness, hygienic aspects of man-pet relationship to prevent health risks and promotion of improved man-animal relationship (animal welfare).

2.5 VPH activities in maintaining the liaison role

In addition to the other highest priority program areas of VPH units (zoonoses and food protection) is maintaining the various forms of liaison for the development of high quality services at each level of government. The liaison is with other government institutes, professional groups and farmer as well as consumer
organizations (10). Of these, by far the most important is that between the public health services and veterinary services located elsewhere within the governmental structure. For its realization, the liaison role is dependent completely upon the availability of individuals in public health:

- Who are highly knowledgeable about veterinary medicine,
- Who are broadly acquainted with the veterinary profession and
- Who can cooperate easily with other veterinarians in different government services and in different walks of professional life.

Liaison, by its very nature, involves a two-way channel of communication. It facilitates cooperative and understanding and encourages creative efforts. The public health services, for the development of high quality VPH programs at each level of government, should maintain such liaison with:

- Livestock and agricultural agencies (both public and private)
- Veterinary schools and other veterinary institutes
- Animal related industries, etc.
- Many other units including epidemiology, surveillance, environment control and laboratory services.

The VPH functions as can be seen are many, however, all are towards the protection and improvement of human health and nutrition.

3. Organisation of VPH activities

The participation of veterinary medicine in public health and its impact upon human health have been greatest in countries where an appropriate administrative structure, in the form of VPH unit, has been created specially for this purpose. It provides the essential focus for VPH efforts. There is no consensus on the most appropriate location of VPH units within the ministerial structure of individual countries. Options include placement in the Ministry of Agriculture of Public Health (5, 10).

Each has its own merits and demerits which may vary considerably from country to country. Thus, the decision as to the most appropriate ministerial placement for a VPH unit must be left to the country concerned. Where the veterinary services are not located under the Ministry of Public Health, which is the situation in most countries, it is essential that the parent ministries such as agriculture or livestock pay adequate attention to the consumer aspects of animal disease control and food hygiene. VPH activities can be attributed to different ministries within a
government. For example in VPH unit under the Ministry of Agriculture, other departments may also be involved (e.g. from the Ministries of Public Health, Environment Protection, the Interior, or even from specialized non-ministerial committees).

Within the competent Ministry, VPH activities may be “split up” with problems related to zoonoses, food safety, quality control, residues of drugs, protection of the environment assigned to different services. Communication channels should be established between ministries, departments, services and sections to ensure the coherence of public health actions. Furthermore, VPH activities should be decentralized and assigned to regional bodies (7, 9). In general, however, a central body retains authority for problems of national importance (relating, for instance, to the major zoonoses, control of veterinary drugs and research and training programme). Whatever location is selected, the VPH unit:

* Must be properly provided with professional staff support and equipment
* Should be responsible for the planning and preparation of VPH programme within the country
* Should also be responsible for the execution of specific programme either solely or jointly with other government departments, as appropriate.
* Arrangements must be made for effective inter-ministerial liaison where more than one ministry is involved in a VPH programme (9, 10).

VPH in Africa is not regarded as a component of public health services. The majority of public health authorities pay little attention to the concept of organized community effort or another disciplinary approach to public health problems. Many of the health units have little or no coordinating relationship with other government units including veterinary units involved in human welfare. Most of the health officials prefer to undertake VPH services exclusively, in spite of the shortage or lack of expertise of the medical personnel involved, particularly regarding food hygiene including meat inspection and zoonoses control (1, 3).

The lack of understanding of the veterinarians’ potential contribution to public health is exacerbated by the shortage and skilled veterinary manpower, deficient infrastructures and logistics and inadequate orientation of many veterinarians to their broader responsibilities in public health.

In Africa there are no formal mechanisms in the public health services whereby public health veterinarian could participate in the organization and implementation of VPH activities, except in few instances. In Uganda where a veterinarian with a postgraduate degree in public health has been employed by the Ministry of Public Health to take charge of the veterinary aspect of human sleeping sickness.
Ethiopia, one veterinarian with MSc degree in VPH (my classmate) had been employed in the Ministry of Public Health and was in charge of environmental sanitation and food hygiene activities.

In most African countries, veterinary activities with an impact on public health are normally carried out by animal health service of the veterinary section of the Ministry of Agriculture. Some VPH units have been created but these operate within the veterinary services and such there activities remain isolated from the main stream of public health programmes. The VPH functions in most African countries are limited to the control of zoonoses and inspection of foods of animal origin (1, 3).

4. Conclusions

The most serious constraints in developing an effective VPH programme in developing countries at national level are:

• Lack of public health veterinarians adequately trained in VPH
• Absence of the necessary infrastructure for field and laboratory operations
• Lack of adequate legislation in the area of VPH
• The presence of other prioritized devastating livestock diseases
• Lack of adequate means of assessing the magnitude of the social and economic consequences of zoonoses, foodborne diseases and other VPH problems for national health and economic development.
• Lack of mechanisms at the national level to effectively identify and mobilize available resources in different sectors for use in VPH programmes
• Insufficient funds from national, international and private sources to initiate or continue VPH programmes.
• Absence or lack of collaboration between physicians and veterinarians in identifying, and tackling VPH problems at a national level
• Little or no coordination and no clear distribution of responsibilities.

5. References


An overview of the Livestock Marketing Authority and Development Constraints

*Tadesse Hailemariam*

Introduction

Livestock are vital to subsistence and economic development of Ethiopia. Of the many functions that the livestock sector may provide the following may deserve mentioning.

- Provide a year-round flow of essential products
- Sustain the employment and income of millions of people and contribute draught power and manure for crop production
- Important source of food and cash
- Produce non-feed items such as hides, skins, wool, transportation and fuel
- Convert crop residues and fiber materials of no value into protein of high quality
- Serve as banking and insurance facilities often provide a substantial higher return than alternative investments.
- Play a socio-cultural role eg. Marriage gifts etc.
- Help in the weed control-sheep for example are used to reduce undergrowth in forests and thus lessen the risk of bush fire. Moreover, in some countries such as Kenya and Tanzania cattle are allowed to graze under a coconut and cashew plantations thereby providing dung for the crop and eliminates the need for weeding.
- Make use of marginal land and support human life where crop farming may not be possible.
- Major source of revenue and export earning for many countries.

Ethiopia being a country with huge livestock population is estimated to produce annually about 259,000 tones of beef, 148,850 tones of meat of small ruminants, 76,560 tones of chicken and 925,850 tones of milk (Hoste, 1997), 21,000 tones of honey; 5,000 tones of wax and 13,000 tones of fish. More over, from the estimated slaughtered animals (2.1 million cattle; 9.5 million sheep and 6 – 7 million goats, about 1.2 million hides; 9 million sheep skin and 5 million goat skins is collected and processed tanneries annually. (MoA, 1997)

* (DVM, MSc Agric. Ext.)

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EVA Proceeding
Apart from the 15% and 33% contribution of this sub sector to national and agricultural GDPs respectively, hides and skins are also known to contribute about 14-16% of the countries annual export earning while other livestock products and live animal fetch about 1 – 2% of the export earnings (MoA, 1997).

Compared to the huge livestock resource and the geographical proximity of the country to the potential middle-east markets the export trade achievements made so far are very minimal. Moreover, the per-capita consumption of meat and milk (7.8kg and 14.4 liter respectively) (MoA, 1996) is only 15.6% 7.2% of the United Nations Food and Agricultural Organization recommendations which are 50kg of meat and 200 litres of milk (Kyomo, 1997).

It is therefore quite important that sufficient emphasis be given to this sub-sector so as to improve the quality and quantity of the product that may satisfy the domestic requirement and increase the foreign exchange revenue.

Major Livestock Development Constraints

Among the constraints of the livestock sub sector:-

- Traditional management and feeding practices
- Prevalence of livestock diseases
- Illegal trading across the neighboring countries
- Lack of marketing infrastructure is the major one.

Marketing problems

Supply

Absence of accurate or reliable data on the type and number of our livestock resource made planning of the resource to be supplied for the domestic and export markets difficult.

Presence of livestock diseases

- Cause mortality and production loss
- Restrict our export trade
- Impede bred & production improvement programs

Inconsistent supply of livestock items of quantity and quality which may be associated with
- Absence of modern ranches
- Recurrence of severe drought
- Lack of producers’ awareness on marketing concepts.
- Illegal trading along the border frontiers

- About 300,000 sheep and goats and 150,000 cattle are estimated to be smuggled to the neighboring countries annually (LMA, 2000). This will severely affect the country’s foreign earning.

Absence of appropriate livestock breeding policy

Breeding improvement and selection was not made on important production traits which in turn limited the productivity of our livestock.

**Infrastructure**

Absence/shortage/ of marketing places, stock routes, staging points, quarantine stations and slaughter facilities. Moreover, uncontrolled stock movement, absence of price by grading system; absence of grading standards; lack of reliable and consistent market information network; lack of market research and promotion activities; manpower shortage and lack of credit facilities are among the problems to be mentioned.

**Major Livestock Marketing and Development Activities**

In the past 40 years, the Ethiopian government has accomplished many activities to promote the contribution of the livestock sub-sector to the economy. Among the activities accomplished some are outlined as follows:

- Establishment of the Livestock and Meat Board in 1956 E.C. by the Proclamation No. 212/56
  - Of the major activities that the Board had accomplished:
    - Livestock and livestock products market studies.
    - Improvement of some domestic market places and establishment of new market places.
    - Implementation of market development projects

Within the Board’s live time, the following achievements were recorded.

- 54 modern livestock markets construction
- 159 abattoirs and hides and skins sheds construction
2500km. Stock route construction
Establishment of 2 quarantine stations.
Unfortunately, these establishments did not function properly after the termination of the Board and the transfer of its duties and responsibilities to other institutions.

- The 3rd Livestock Development Project (1967 – 1984 E.C) has played its role through cooperative livestock fattening program.
- The Livestock and Livestock products Marketing Department (MoA, 1977 – 1981 E.C), which was established after the collapse of the Livestock and Meat Board has accomplished many notable activities through marketing data collection and provision of advisory services.
- Dairy Rehabilitation and Development Project (1978 – 1986 E.C) has distributed imported heifers to peasant associations around some big cities such as Addis Ababa.
- Ethio-82-Col Project (1974 – 1977 E.C) had established milk collection centers around Addis Ababa at 120km radius and 4 milk distribution centers in Addis Ababa.
- Small Holders Diary Development Project (1987 – 1992 E.C) has been distributing improved heifers and forage seeds.
- Hides and Skins Development Project (1982 – 1987 E.C) through the cooperation of the United Nations Industry Development Organization (UNIDO) had contributed through
  - Promotion of hides and skins extension services
  - Investigation of skins diseases that caused quality deterioration
  - Conducted study on the possible mechanisms of applying price by grading

Export and import Trading Activities

Ethiopia is known to export livestock and livestock products to a number of countries. In the past 11 years (1990/82 – 1990/91 E.C), the country on the average has got about 153 million Birr (Table 1). On the other hand from 1980/81 – 1990/91 E.C., the country on the average had spent about 9.4 million Birr annually to import animal and animal products (Table 2).

According to the data collected from the Ethiopian Export Trade Promotion Agency (Table 3), the country had earned about 482.6 million Birr in the year
1990/1991 E.C. from export commodities. From this figure we can see that the export earning of hides and skins has dropped from its 2nd place to 4th place which may show the importance of giving consideration to the livestock sector.

Table 1. Value of Export Earning from Livestock & Livestock Products in Thousands Birr

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<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Live Animal</td>
<td>10,911.23</td>
<td>18,747.36</td>
<td>1,419.56</td>
<td>3,466.02</td>
<td>7,515.35</td>
<td>5,626.42</td>
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<td>2,461.96</td>
<td>5,249.69</td>
<td>3,877.74</td>
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<tr>
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<td>Meat</td>
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<td>655.19</td>
<td>156.08</td>
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<td>Total</td>
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</tbody>
</table>

Table 2. Value of Imported Livestock Products in Thousands Birr

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Live Animal</td>
<td>1,995.72</td>
<td>538.12</td>
<td>51.6</td>
<td>200.67</td>
<td>61.73</td>
<td>0.40</td>
<td>10.26</td>
<td>196.87</td>
<td>70.84</td>
<td>4.41</td>
<td>3,084.18</td>
<td>308.42</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meat</td>
<td>12,834.18</td>
<td>18,079.92</td>
<td>2,329.90</td>
<td>5,309.03</td>
<td>11,604.36</td>
<td>2,554.26</td>
<td>3,446.26</td>
<td>6,077.59</td>
<td>7,523.25</td>
<td>14,010.11</td>
<td>83,796.39</td>
<td>8,376.94</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fish</td>
<td>0.72</td>
<td>1.47</td>
<td>645.70</td>
<td>5.08</td>
<td>19.64</td>
<td>-</td>
<td>120.39</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>793.0</td>
<td>79.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Leather &amp; Leather</td>
<td>1,858.80</td>
<td>84.28</td>
<td>166.76</td>
<td>3,398.32</td>
<td>211.74</td>
<td>3.15</td>
<td>70.26</td>
<td>88.55</td>
<td>77.82</td>
<td>62.34</td>
<td>6,022.02</td>
<td>602.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Products</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>93,668.59</td>
<td>9,366.90</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>16,689.42</td>
<td>18,703.79</td>
<td>3,147.52</td>
<td>8,913.10</td>
<td>11,897.54</td>
<td>2,558.34</td>
<td>3,647.17</td>
<td>6,363.01</td>
<td>7,671.91</td>
<td>14,076.86</td>
<td>99.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Leather &amp; Leather</td>
<td>76.9</td>
<td>96.7</td>
<td>74.0</td>
<td>59.6</td>
<td>97.5</td>
<td>99.9</td>
<td>94.5</td>
<td>84.7</td>
<td>98.0</td>
<td>99.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Products Share in %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

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Table 3. Comparison of the livestock Sub-sector Export Earning Contribution with other sub-sector (1990/92 E.C)

<table>
<thead>
<tr>
<th>Export Item</th>
<th>Value of Export Earning in Thousands USD</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Livestock and Livestock Products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Hides &amp; Skins</td>
<td>30,776</td>
<td>6.38</td>
</tr>
<tr>
<td>1.2 Meat</td>
<td>4,307</td>
<td>0.89</td>
</tr>
<tr>
<td>1.3 Wax</td>
<td>1,065</td>
<td>0.22</td>
</tr>
<tr>
<td>1.4 Civet Musk</td>
<td>500</td>
<td>0.10</td>
</tr>
<tr>
<td>1.5 Live animals</td>
<td>477</td>
<td>0.09</td>
</tr>
<tr>
<td>1.6 Livestock Feed &amp; Fish</td>
<td>146</td>
<td>0.03</td>
</tr>
<tr>
<td>1.7 Shoe</td>
<td>107</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>Sub total</strong></td>
<td><strong>37,378</strong></td>
<td><strong>7.74</strong></td>
</tr>
<tr>
<td>2 Coffee</td>
<td>275,201</td>
<td>57.02</td>
</tr>
<tr>
<td>3 Chat</td>
<td>59,233</td>
<td>12.27</td>
</tr>
<tr>
<td>4 Oil Crop</td>
<td>40,862</td>
<td>8.47</td>
</tr>
<tr>
<td>5 Minerals</td>
<td>27,201</td>
<td>5.64</td>
</tr>
<tr>
<td>6 Pulses Crops</td>
<td>14,405</td>
<td>2.98</td>
</tr>
<tr>
<td>7 Spices</td>
<td>5,297</td>
<td>1.10</td>
</tr>
<tr>
<td>8 Vegetable, fruit and flower</td>
<td>9,371</td>
<td>1.94</td>
</tr>
<tr>
<td>9 Cereals including injera</td>
<td>3,384</td>
<td>0.70</td>
</tr>
<tr>
<td>10 Textile</td>
<td>1,627</td>
<td>0.34</td>
</tr>
<tr>
<td>11 Sugar &amp; Tea</td>
<td>1,056</td>
<td>0.22</td>
</tr>
<tr>
<td>12 Others</td>
<td>7,617</td>
<td>1.58</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>482,632</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

Source: Ethiopian Export Trade Promotion Agency

**The need for establishing the Livestock Marketing Authority**

From our export trade achievements and lower per capita consumption of meat and milk, one can easily understand that something has to be done to curve the situation. This is more justifiable when we consider our huge livestock resource and the country’s suitable closer location closer to the potential middle-east livestock markets.
The main factor for the collapse of many of the livestock marketing activity achievements recorded by the terminated Livestock and Meat Board is the absence of one national responsible institute that can undertake the activities.

With this understanding, the Ethiopian Government had established the Livestock Marketing Authority by Proclamation No. 117/1998 with the objective of promoting domestic and foreign marketing of animal, animal products and by-products through increased quantity and improved quality.

Establishment

The Livestock Marketing Authority was established on June 16th 1998 as an autonomous Federal Government body by Proclamation No. 117/1998.

The Authority is managed by a board of management whose members are drawn from different ministries and organizations but accountable to the Prime Minister. The Authority strives to accomplish its duties and responsibilities of regulating, controlling and coordinating the supply and marketing of the hitherto and under utilized and untapped potential resource of the animal sub-sector using properly its well qualified and well experienced man power.

Duties and Responsibilities

- Initiate policies, laws and regulation that can promote the country’s animal, animal products and by-products marketing.
- Issue quality control directives on exportable and importable animal, animal products and by-products and follow up their trading activities.
- Establish and encourage the establishment of staging points for domestic and export trade stock with the necessary facilities and follow up the means of transport for trade stock.
- Establish quarantine stations for use in the export and import of animal, animal products and by-products, provide quarantine service in cooperation with the Ministry of Agriculture.
- Promote the organization of livestock markets, abattoirs, hides and skins shed and expansion of their services.
- Supervise the construction of export animal, animal products and by-products processing plants in accordance with international requirements and constructional standards and issue certificate of competence.
- Issue criteria that ought to be fulfilled by domestic import and export trades engaged in animal, animal products and by-products trading activities and provide information to concerned bodies.
- Seek ways and means of promoting and expanding animal, animal products and by-products markets in foreign countries by establishing commercial relationships with different countries.
- In cooperation with appropriate bodies and institutions, designate directions for trade stock movement, issue stock movement directives and follow-up the implementation.
- Collect, analyze and disseminate information on the current demands and international market situation to producers, domestic and foreign consumers and traders.
- Encourage the condition of research and study on animal, animal products and by-products marketing, disseminate research results to beneficiaries and when necessary conduct studies with a view to enhancing the marketing of animal, animal products and by-products.
- Encourage and provide support to promote the development of animal, animal products and by-products.
- Follow up the preservation of hide and skin quality from slaughtering to marketing.
- Give technical support and advice to the regions by creating relationship with them.

Organization

The Livestock Marketing Authority is structured as under:

- A managing board bestowed with the powers and duties of deciding on policy issues, directing and supervising the activities of the authority.
- Manager, accountable to the management board, who is the chief executive of the authority
- Two technical departments which are in charge of quality control and promotion of domestic and export marketing of animal, animal products and by-products.
- And four support rendering services, namely Planning & Programming, Administration and Finance, Audit and Legal Service.

At present the Authority has about 65 man power of which 36 are supportive and 29 technical staff members.

Working Relationship

In order to accomplish its duties and responsibilities efficiently and to play its lead role in creating enabling environment for stakeholders to generate foreign currency
for the country commensurate to animal, animal products and by-products to be exported, the authority will establish conductive working relationship with the appropriate government organizations, the private trade and various embassies within and out side Ethiopia.

Annex 1: Number of Tanneries & their location

<table>
<thead>
<tr>
<th>Name of Tanneries</th>
<th>Location</th>
<th>Ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addis Ababa Tannery</td>
<td>Addis Ababa</td>
<td>Government</td>
</tr>
<tr>
<td>Awash Tannery</td>
<td>Addis Ababa</td>
<td>Private</td>
</tr>
<tr>
<td>Bale Tannery</td>
<td>Debre Zeit</td>
<td>Private</td>
</tr>
<tr>
<td>Blue Nile Tannery</td>
<td>Addis Ababa</td>
<td>Private</td>
</tr>
<tr>
<td>Kombolcha Tannery</td>
<td>Kombolcha</td>
<td>Government</td>
</tr>
<tr>
<td>Dessie Tannery</td>
<td>Addis Ababa</td>
<td>Private</td>
</tr>
<tr>
<td>Dire Tannery</td>
<td>Addis Ababa</td>
<td>Private</td>
</tr>
<tr>
<td>Ethiopian Pickling</td>
<td>Addis Ababa</td>
<td>Private</td>
</tr>
<tr>
<td>Ethiopian Tannery</td>
<td>Modjo/Ejersa</td>
<td>Government</td>
</tr>
<tr>
<td>Hora Tannery</td>
<td>Debre zeit</td>
<td>Private</td>
</tr>
<tr>
<td>Mersa Tannery</td>
<td>Mersa</td>
<td>Private</td>
</tr>
<tr>
<td>Modjo Tannery</td>
<td>Modjo</td>
<td>Government</td>
</tr>
<tr>
<td>Shoa Tannery</td>
<td>Modjo</td>
<td>Private</td>
</tr>
<tr>
<td>Walia Tannery</td>
<td>Addis Ababa</td>
<td>Private</td>
</tr>
<tr>
<td>Getachew Mekonnen Hide &amp; Skin processing</td>
<td>East Shoa</td>
<td>Private</td>
</tr>
<tr>
<td>Amhed Dawelbeit</td>
<td>East Harrerge</td>
<td>Private</td>
</tr>
<tr>
<td>Ahmed Dawelbeit</td>
<td>East Shoa</td>
<td>Private</td>
</tr>
<tr>
<td>Hafde Pvt. Ltd. Co.</td>
<td>West Shoa</td>
<td>Private</td>
</tr>
<tr>
<td>Sheba Tannery S.C.</td>
<td>Tigray/Wukro</td>
<td>Private</td>
</tr>
</tbody>
</table>

Number of hide and skin traders by Tannery

<table>
<thead>
<tr>
<th>Name of Tannery</th>
<th>No. of Traders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addis Ababa Tannery</td>
<td>13</td>
</tr>
<tr>
<td>Walia Tannery</td>
<td>29</td>
</tr>
<tr>
<td>Shoa Tannery</td>
<td>37</td>
</tr>
<tr>
<td>Mojo Tannery</td>
<td>284</td>
</tr>
<tr>
<td>Total</td>
<td>363</td>
</tr>
</tbody>
</table>
References


Veterinary Sciences in Public Health Operation

Tsegaye Kidanemariam *

Introduction

The term Veterinary mostly refers to the practicing of medicines of animals other than man. Veterinary science can also refer to any activity concerned with animal health, animal breeding or production, management of their products and with other similar performances (1). In this review article, veterinary science is used in the latter context. When the profession of veterinary science is applied in public health operations, it becomes a veterinary public health programme which is a strong wing or component of the general public health activities (1, 2). Similarly, those members of professionals who are capable of practicing the arts and sciences of curing animal diseases, animal husbandry, care and management of animal products and breeding and improvement of farm animals can be taken as public health veterinarians as far as they work to promote public health programmes (1). This review article is not to cover all contributions of veterinary science in public health operations. It shall rather touch the major roles briefly so as to stir more attention to the matter.

According to World Health Organization (WHO), health is not the absence of diseases or physical disabilities alone. It also includes one’s mental and social well-being (3). So, adequate food supply, shelter and clothings and mental freedom are essential factors for mankind to be fully healthy. Objectives of any public health programme should, therefore, be to attain physical fit, mentally sound and socially stable citizen. Veterinary Science has indispensable roles to play in attaining these objectives.

Thousands of millions of peoples in the world suffer from deficiency of protein and other nutrients and several millions of them die every year (4). Malnutrition that victimizes millions of lives in the world have, therefore, been a real challenge to public health programs especially in developing countries. It is the application of modern veterinary science in livestock production that enables to obtain adequate supply of food of best protein sources, and this is the key step available for a public health programme to combat the challenge it faces (1, 5). Such veterinary science applications like provision of veterinary, medical services modern animal husbandry practices and veterinary researches are those which improve the world

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food supply which saves millions of live by alleviating deficiency disease problems.

Laboratory animals are indispensable tools in biomedical researches, in trainings of biomedical professionals and in tests or evaluations of biological and chemicals or public health and veterinary importance. There are also specialized laboratory animals which serve as sources of sterile organs or tissues which can be used in different biomedical activities. Laboratory animals are also essential agents to detect dangerous levels of gases in mines, aflatoxins in food, harmful radiations in space and many other environmental pollutions of microbial or chemical origins (6, 7). In order to obtain the optimum benefit out of them, laboratory animals should be of an appropriate quality. These animals which have a significant public health importance are selected, produced and conditioned for experiment by a specialized branch of veterinary science known as laboratory animals go to medical professions and they can be taken as the valuable gifts of veterinary science to public health operation.

Veterinary researches can be extrapolated to improve human health. The discovery of the diagnostic use of tuberculin for tuberculosis the development of BCG vaccine from bovine bacillus and the finding of chemotherapy for tuberculosis, are a few examples to demonstrate that veterinary research results play significant roles in improving human health. This extrapolation is what is known as a comparative medicine which is the study of health and disease phenomena in all species of animals. It is mainly to make use of all veterinary information or research results to promote human health (1). Thus, veterinary science has also a significant share of tasks in promoting human health through a comparative medicine which is actually taking advantage of veterinary researches to combat human health problems.

Zoonoses are diseases naturally transmitted between man and other vertebrate animals. (1). The task of controlling zoonotic diseases is an important component of public health activities. Dealing with the control and management of these diseases is another essential roles of veterinary profession in public health operation. The best method of controlling zoonotic diseases is to primarily control them in some animal populations (1, 2). This method is best applied by veterinarians for they are professionally capable of handling animal diseases. The role of veterinary science in controlling such hazardous zoonoses like anthrax, bovine tuberculosis, rabies, and similar others clearly show that veterinary science carries out a huge load of work in executing public health programmes and ensure human health.
Food-borne diseases are important health problems in many parts of the world. The problem is more serious in foods of animal origins for they are convenient for microbial growth and even capable of transmitting zoonotic diseases (9). Food inspection is the appropriate measure in combating or preventing these health risks of food-borne diseases. Inspection of meat, dairy products, poultry, fish and other foods of animal origin is best done by public health veterinarians.

The breeding and care of pet animals which provide people a very good ground for healthful exercise and recreation is another veterinary science contribution. Such pet animals are used to treat or prevent mental problems, assist to develop humanness and gentleness in children and some pets even assist elderly in some of their life activities (1, 7).

Sometimes veterinarians can also directly participate in health service activities. Because they are mostly assigned in rural areas, veterinary professionals can provide health education and even emergency health services to the rural people (1).

It is therefore, these valuable roles of veterinary science that constitute a veterinary public health program without which a public health program is invalid, because it is not only difficult but also impossible for public health programs to achieve their objectives without incorporating the skill and knowledge of veterinary science.

References

World Health Organization (WHO); the veterinary contribution to public practice, WHO Technical Report Series No. 573, 1975.

Schwab, C.W; Veterinary Medicine and Human Health; Williams and Wilkins, 1969.


Rabies Situation in Addis Ababa and its surroundings

Eshetu Y., Bethlehem Ns., Yosef B., Badeg Z. and Mokoro B.*

Abstract

An attempt was made to assess the prevalence of rabies in Addis Ababa and during the last five years, a total of 7833 dogs were examined, out of which 1148 (14.66%) were found to be positive for rabies. To that effect post-exposure anti-rabies treatment was given to 11,196 people and a total of 175 fatal human rabies cases were registered.

Although cats, cattle and wild animals were incriminated as sources for human infections, stray dogs were found to be the major causes for the incidence. The significance of the disease and the role of dogs as a source of infection is discussed.

* Ethiopian Health and Nutrition Research Institute (EHNRI), P.O. Box 1242, Addis Ababa
Case study of Anthrax in Mago National Park (Southern Ethiopia)

Fekadu Shiferaw, Sintayehu Abdicho and Abraham Gopilo

An outbreak of disease was reported in Mago National Park in September 1999. About 1531 lesser kudus (Tragelaphus imberbis) were reported dead and gerenuk, warthog, hartbeest, waterbuck, bushbuck, dikdik, leopard, hyena and others were also reported dead with less number. Cattle, sheep and goats of pastoralists surrounding park were also dead. The people who handled the meat of sick animals were sick.

A team was sent to the park twice to investigate the disease and blood smear taken from five lesser kudus were stained with Giemsa and Methylene blue and became positive for anthrax. Culture, which was done from spleen, became positive for B. anthracis.

Disease control in wildlife is not easy. However based on our capacity and resource the following measures were recommended and carried out to control the disease, after which mortality totally ceased.

- Burning and burying of dead carcasses
- Immediate identification of dead carcasses by intensive survey before opened by vultures and carnivores
- Rotational burning of the whole park
Pilot Study on Bovine Tuberculosis in Cattle and its Implication in man in Selected Sites of Ethiopia

Gobena Ameni**, Tesfu Kassa**, Alemayehu Regassa** and Endrias Zewdu***

Abstract

A cross-sectional survey was conducted in dairy cattle, and dairy workers in selected sites of Ethiopia to determine the prevalence of bovine tuberculosis in cattle and its potential risk in cattle handlers (owners and dairy workers) using comparative intradermal tuberculin test, questionnaire survey and culturing of sputa and milk. The overall prevalence was 35%. The highest prevalence was recorded in Eastern Shewa while the lowest was recorded in Wolaita Soddo. The rate of reactors was higher (P < 0.05) in government owned large scale dairy farms than in privately owned small scale dairy farms. Out of 30 milk samples drawn from reactor cows 4 strains of Mycobacterium bovis M. bovis) were isolated on the basis of growth characteristics and biochemical tests. Similarly, 2 strains of M. bovis were isolated from the sputa of dairy workers using the same methodologies. The result of questionnaire survey conducted at Wolaita Soddo on households who own cattle indicated statistically significant (P < 0.05) association between reactor cattle and confirmed TB patients among family members of cattle owners. In conclusion, the involvement of the government in the issue of bovine tuberculosis was underlined and possible control methods were forwarded considering the status of the country.

Key words/phrases: Dairy Cattle, Cattle handlers, Mycobacterium bovis.

1. Introduction

Bovine tuberculosis (BTB) is an infectious disease of cattle caused by Mycobacterium bovis (M. bovis). It is zoonotic and transmitted to human by aerogenous route and/or through consumption of infected milk and other cattle products. The world Health Organization (WHO) estimates human tuberculosis (TB) incidence and death for 1990-1999 to be 88 million and 3 million, respectively, with most cases in developing countries (O’ Cosivi et al., 1998). Zoonotic TB is present in animals in many developing countries where surveillance and control activities are often inadequate or unavailable (WHO, 1993; OIE, 1996).
Ethiopia is one of these countries and many epidemiological and public health aspects of the infection remain largely unknown. This study was undertaken to generate baseline data on BTB in cattle and its implication on public health in selected sites of Ethiopia.

2. Materials and Methods

2.1 Study area

The study was conducted in 2250 cattle, on 8 large scale and 333 small dairy farms in Eastern Shewa, North Shewa, West Shewa, South Wello and Wolaita Soddo. Shewa is the Central Province of Ethiopia in which the Addis Ababa is located. The major source of milk for Addis Ababa comes mainly from those dairy farms located in Shewa Province. Similarly, dairy farms in Southern Wello are supplying milk to Dessie and Kombolcha towns. Wolaita Soddo is one of the highly populated areas of Ethiopia and small scale dairy farms are the main source of milk for the population there. The following dairy farms were included in this study: Debere Ziet Military Center, Debere Ziet State Dairy Farm, Deber Ziet Agriculture Research Center, Ziway Children’s Village, Wolaita small scale dairy farms, Cheshire Home (Holeta), Ambo College of Agriculture, Ambo small scale dairy farms, Mulo Dairy Farm (Chancho), Chancho small scale dairy farms, Fitche small scale dairy farms, Sebeta small scale dairy farms, Cheffa Dairy Farm, Kombolcha small scale dairy farms, Dessie small scale dairy farms and Debre Berhan small scale dairy farms.

2.2 Single intradermal tuberculin test

The skin of the mid-neck was clipped and the thickness of the skin fold was measured. An aliquot of 0.1 ml 20000 IU/ml bovine purified protein derivative (PPD) (Bovituber, AN Strain, /Rhone- Merieux) was injected intradermally into the site. After 72 hr. of injection, the thickness of the skin fold at the site was measured again. Results were expressed as change in skin thickness before and after injection of the tuberculin. Accordingly, an increase in skin thickness less 2mm, between 2 and 4 mm either inclusive or greater than 4 mm was considered as negative, doubtful or positive using.

2.3 Questionnaire survey

Questionnaire survey was conducted on a total of 280 households who own small-scale dairy farms (110 in Soddo and 170 in Fitche). The farmers were interviewed on the habit of milk and meat consumption, recent history of tuberculosis in their
family member, the degree of contact that their families have with cattle, whether they have the same sheltering with their animals or not. Similarly, questions dealing with the degree of occurrence of tuberculosis in general and tuberculosis lymphadenitis in particular were directed to the heads of TB departments in Fitche and Soddo Hospitals.

2.4 Milk Culture

About 45 ml of milk sample was drawn from the four quarters of each of 30 tuberculin positive dairy cows (20 from Debre Zeit Military Camp and 10 from Cheffa Dairy Farm, Wello) under aseptic conditions towards the end of milking. Milk samples were transported fresh to the Armauer Hansen Research Institute (ARHI), centrifuged at 3000 rpm for 10 minutes at room temperature. The supernatants were decanted and the sediments were decontaminated with NaOH; centrifuged again in the same condition as before and neutralized with H\textsubscript{2}SO\textsubscript{4}. After neutralization each sediment was inoculated onto two Lowenstien – Jensen media) one with pyruvate and the other without pyruvate). The culture was incubated at 37\textdegree C in slant position for one week. Further incubation was done at the same temperature for 8-12 weeks in upright position. Observation for bacterial growth was being made weekly. The growth of white, transparent, Moist, flat and non-pigmented friable colonies on the pyruvate-enriched medium indicated the primary cultures of \textit{M. bovis}. Ziehl–Neelsen staining was made from the culture and confirmed the presence of acid fast bacilli. Niacin test was conducted on the isolates and was used as confirmatory diagnosis.

2.5 Sputum culture

Morning sputum sample were collected from 19 dairy workers in infected dairy farms into sterile universal tubes and transported to AHRI for culturing. They were decontaminated with 3% NaOH (1:3 ratio), shaken properly and centrifuged at 3000 rpm at room temperature for 15 minutes. The supernatant was taken off and the rest was mixed well and neutralized with H\textsubscript{2}SO\textsubscript{4} plus bromocresol purple until the dye turned from purple to yellow. Two Lowenstien –Jensen) one with pyruvate, the other without it) were incubated with the sediment and incubated at 37\textdegree C done in slant position for one week. Further incubation was made in upright position at the same temperature for 8-12 weeks. Growth of organism with colony characteristics described above on the pyruvate-enriched medium was noted. Niacin test was conducted on the isolates and was as a confirmatory diagnosis.
3. Result

3.1 Rate of infection in different farms

Table 1 shows the percentages of doubtful and positive reactors. The overall percentage of positive reactors was 24% (713 reactors out of 2953); the highest was being recorded in Debre Zeit State Dairy Farm. Similarly, 387 animals were doubtful reactors.

Table 1. Percentage of doubtful and positive reactors on farm bases.

<table>
<thead>
<tr>
<th>Name of the Farm</th>
<th>Doubtful</th>
<th>Positive</th>
<th>% Positive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
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<td>32</td>
<td>36%</td>
<td>89</td>
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<tr>
<td>Ambo Small scale dairy farms</td>
<td>33</td>
<td>23</td>
<td>19%</td>
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<td>5</td>
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<td>79%</td>
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<tr>
<td>Small scale dairy farms (Dissie and Kombolcha)</td>
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<tr>
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<td>Chancho small Scale dairy farms</td>
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<td>Soddo small scale dairy farms</td>
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<tr>
<td>Total</td>
<td>387</td>
<td>713</td>
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</table>

Figures 1 & 4 show the percentage of positive and doubtful reactors in individual large and small-scale dairy farms, respectively. Classification of the farms into two groups (large and small) on the basis of the herd size indicated higher percentage (51%) in large-scale farms (Figs. 2 & 3). The percentage of reactors was relatively lower (9%) in small scale dairy farms. On the other hand, the percentage of doubtful reactors was higher in small scale farms than in large scale farms.
Figure 1: Number of positive and doubtful reactors in large scale dairy farms

![Bar chart showing the number of positive and doubtful reactors in large scale dairy farms.](chart1.png)

- **Name of the farms**
  - Mull State Dairy Farm (Mull
  - Cheffra Dairy Farm (South Weir
  - Ambo College of Agriculture
  - Cheshire Home (Koleta
  - Zeway (Alagae Dairy Farm
  - Debret Zeit Military Camp
  - Debret Zeit State Dairy Farm
  - Debret Zeit Agricultural Research Co.

**Figure 2:** Percentage of positive reactors in the two types of farms

![Pie chart showing the percentage of positive reactors in large and small scale farms.](chart2.png)

- **Large scale farms**
- **Small scale farms**
Figure 3: Percentage of doubtful and positive reactors in small and large scale farms

![Bar chart showing percentage of reactors in small and large scale dairy farms]

Type of the farms

Figure 4: Positive and doubtful reactor in small scale dairy farms

![Bar chart showing number of animals in different farms]

Name of the farms
3.2 Public health implication

Out of 30 milk samples collected and cultured from tuberculin positive dairy animals, *M. bovis* was isolated from 4 on the basis of growth characteristics and niacin test. Similarly, 2 strains of *M. bovis* were isolated from the sputa of 2 dairy workers on the basis of growth characteristics and niacin test. The result of an interview conducted on 110 households in Soddo Town indicated that 23 (21%) had a case/cases of tuberculosis in their families of which 11 (48%) had reactor cattle. This study also showed that most of the families have the habit of drinking raw milk and milk products, and also do share the same housing with their cattle. The result of similar study conducted in Fitche Town revealed that of the total 170 households who own cattle, 14 (8.23%) had TB case(s) in their families. In these 14 households, 17 confirmed TB cases (smear and chest X-ray examination) were recorded; of the 17, 15 were pulmonary TB while 2 were extra-pulmonary TB.

4. Discussion

The percentage of reactors recorded by the present study (24%) laid between the values reported previously by Ragassa (1999) in small scale dairy farms, and Ameni (1996) and Kiros (1998) in large scale dairy farms. This is because both small and large-scale farms were included in the present study. Comparisons of percent reactors in large scale farms were included in the present study. Comparison of percent reactors in large and small-scale farms found in the same area indicated large percent reactors in large-scale farms. This is mainly because of the increment in the chance of infection with *M. bovis* as the herd size increases (O’Reilly and Dabom, 1995). Furthermore, these large-scale dairy farms are mainly owned by governments and live under sub-optimum management systems. It was indicated that prevalence of BTB is significantly lower in the local and privately owned animals as compared with the exotic breeds and government managed (OIE, 1996).

The present study showed a considerable occurrence (21%) of tuberculosis in the families cattle owners and the high number, almost 50% of their cattle, were found to be reactor. Additionally, given the social conditions of the people of the country there have been an apparent wide spread habit of drinking raw milk and its products.

Hence, the existence of infection in the family member of cattle breeders and cattle suggests that either can act as a source of infection for the other (Daborn and Grange,, 1993). The disease transmission may be cyclical cow-to-man-to-cow (O’Cosivi, *et al*, 1998). As noticed in the present study the close physical
contact that exists between the owner and his/her cattle especially during the night time, consumption of raw milk and its products facilitates the transmission of the disease (WHO, 1993; Cosivi et al., 1998; Pritchard, 1988). Cosivi et al (1998) and O’Reilly and Daborn (1995) indicated that pulmonary as well as extra-pulmonary cases of human TB of animal origin are always problematic in areas where cattle TB is prevalent and no control mechanism is available.

The results of the present study have underlined the important of the disease in cattle and its potential risk in man. Therefore, in view of the socioeconomic condition of the country, the use of cattle and the consumption habit of people concerning dairy and dairy products, the following recommendations have been forward:

The effective control and eradication program is test – and –slaughter procedure. Due to financial constraints, and lack of infrastructure, the test – and slaughter procedure cannot be applied in Ethiopia. The alternate and possible recommendation are:

**Regulation and rules:** The involvement of government in the issue of BTB is underlined. The problem of BTB should be considered as a national problem and the government as well as professionals needs to be concerned focusing to the following areas:

**Further research:** Research on BTB both in man and animals should initiated and encouraged, priorities should be given to the epidemiological patterns and zoonotic significance of the disease. After knowing the extent of the disease in the country the professional in collaboration with the governments policy makers should look for the kind of control programs that can be implemented under the situation of Ethiopia. The control programs can be designed on national basis or mainly targeted to the dairy farms.

**Better dairy designment:** Suffocation and overstocking should be avoided, the different herd structures must be penned separately, watering and feeding should be separate for the different herd groups, calves need to be separated from their dams as early as possible.

**Promotion of small scale dairy farms:** The expansion of small-scale dairy farms is advantageous both in terms of disease control and management. Therefore, establishment of small-scale dairy farms needs to be encouraged and promoted.
Vaccination: Recent immunological advance have indicated that lower doses of BCG preferentially stimulated appropriate immune response for protection against *Mycobacterium* species in cattle and the trial made in New Zealand have come up with a promising result with vaccine efficacy of 50-70%. This should also be tried under Ethiopia condition.

Milk pasteurization: Pasteurization of milk has high credit in reducing the rate of infection in human begins. Pasteurization centers should be established and regulated properly. Milk from dairy farms should undergo pasteurization before distribution to the consumer. The temperature and the apparatus need to be checked regularly. Public education of boiling milk before consumption is also paramount important in reducing the risk to human.

Abattoir surveillance: Abattoir surveillance should be carried out in every slaughterhouse across the country to reduce human infection and to look for the distribution of the disease in the country. The data obtained from abattoir has to be used by the epidemiological service to assess the prevalence BTB in Ethiopia and used to propose subsequent investigations.

Collaboration between veterinary and medical personnel: Effective collaboration between Medical and Veterinary personnels is a prerequisite for the investigation of zoonotic importance of *M. bovis*.

Acknowledgments

This project is partly supported by the Research and Publication Office of the Addis Ababa University and partly by the Faculty of Veterinary Medicine. We like to express our gratitudes to the managers of each of the dairy farms for their giving us access to their farms and animals. We do also appreciate the cooperation of heads of households for their willingness to respond to our questions. Moreover, our thanks go to institutions like the Ambo College of Agriculture, Kombolchas Regional Laboratory, Soddo Regional Laboratory and Northwestern Shewa Zone of Oromia Agricultural department for their facilitation of this study.
Reference:

Ameni, G. 1996. Bovine tuberculosis: evaluation of diagnostic tests, prevalence and zoonotic importance (Ethiopia). Faculty of Veterinary Medicine, Addis Ababa University. DVM thesis.


WHO. 1993. Report of the WHO meeting on zoonotic tuberculosis with the meeting participation of FAO Geneva, 1-26
An Epidemiological survey of Bovine Brucellosis in the Eastern Amhara Regional State (EARS)

Fekadu Kebede, 1999*

Abstract

Brucellosis is caused by the organism of the genus Brucella and affects a wide range animal species including man. Especially Br. Abortus is specific species for cattle and causes abortion during late pregnancy.

Eventhough, the economic and human health importance of the disease is enormous the epidemiological picture in the extensive farm of the sub-region is not clearly defined. Therefore, this study aims at investigating the distribution of the disease and creates an epidemiological zonation based on the disease status of the area.

A stratified multistage sampling was applied on sex based and geographical feature of the sub-region. A total of 3644 blood serum with related questionnaires were collected from 190 Peasant Associations (PAs) representing 19 weredas from two ecological zones.

The collected serum samples were analyzed by using RBPT for screening test and positive samples were retested by CFT.

The summary of the survey has been done on the following data:

1. The prevalence rate of bovine brucellosis
2. Frequency of parturition and comparison between two eco-zones
3. Summary of abortion
4. Crude calf mortality
5. Test agreement between RBPT & CFT

1.1 According to the result the prevalence rate of bovine Brucellosis in the high land eco- zone was found 0.21% and in the low land it was 3%, the over all prevalence of the disease in EARS was found 1.8%. There is a significant statistical difference between two ecological zones (P < 0.05).

* Kombolcha Regional Veterinary Laboratory
1.2 Frequency of parturition gives the number of calves born by individual cows. The highest frequency of parturition was seen in the low land ecozone which was three where as in the highland it was one. The two ecozones have shown that a significant difference in their frequency of parturition \((1 - 4, \& >/5)\), i.e. \((P < 0.05)\).

1.3 The overall abortion rate in the EARS was found 3.2%. The abortion rate of the high land and low land ecozones were 1.4% with 2.7 mean number of lactation and 3.9% with 3.4 mean number of lactation respectively. The relation of the disease and abortion were found independent \((P > 0.05)\) and there is no significant difference of abortion in months of pregnancy \((1 - 3, 4 - 6 \& > 6)\), \((P > 0.05)\).

1.4 The mortality of calves was found 6.5% and 13.4% in the high land and low land eco-zones respectively.

1.5 The test agreement between RBPT & CFT was found good, that is 82%.

Since, brucellosis is causing a serious public health problem and a significant production losses in the area where the disease is prevalent a strict control measure should be applied to prevent the spreading of the disease. This will be achieved through sanitary measure and radical measure (test and slaughter in low prevalent areas like the low land eco zone of EARS).
Salmonella Enteritidis: An emerging zoonosis

Mohammed Nasir*, Bayleyegn Molla* and Zeleke Dagnachew*

Abstract

Poultry and poultry products are often blamed as the cause of salmonellosis in humans. Salmonella enteritidis is an emerging problem in almost all countries in Africa. Both outbreaks and single cases salmonellosis due to S. Enteritidis are predominantly attributed to the consumption of eggs and egg products containing the organism. Here we report an outbreak of salmonellosis due to S. Enteritidis phage type 4 in a poultry farm in which more than 23.8% of the imported flock (n = 11,200 broiler chicks) died within 20 days of arrival and all the remaining broiler chicks (n = 7800) were stumped out.

Introduction

A large human population in the world today is insufficiently supplied with quality protein in the diet. This is practically true for a larger part of under developing countries including Ethiopia. Poultry occupy a unique position through its contribution to the supply of valuable food proteins as well as generate income to the families in developing countries. The recent estimate of Ethiopian chicken population is about 58 million (FAO, 1993) out of which only one percent is found in large and small scale industrial management. Different poultry diseases have been recorded in Ethiopia. The major economic loses are due to Newcastle disease, salmonellosis, nutritional deficiency, coccidiosis, mycoplasmosis, fowl pox, etc.

Poultry are often blamed as being the cause of salmonellosis in humans. Infected eggs, egg products or contaminated carcasses have been recognized as major causes of such food poisoning in the world. However, in nearly all cases unhygienic and incorrect kitchen practices are identified as sources of contamination of Salmonella from various meat and meat products (Sluis, 1996). Moore (1895) reported the first authentic case of paratyphoid infection in domestic poultry when he described an outbreak of infectious enteritis in pigeons. Paratyphoid infection refers to infection by any serotype of salmonellae other than S. Pullorum, S. Gallinarum and Arizona paracolon group (Bains, 1979).
Salmonellae are one of the most important group of bacteria of the family Enterobactericeae responsible for diseases in poultry and other animals including man. The Salmonella comprise over 2300 serotypes some of which infect several species of animals where as others infect a specific group of animals like birds (Coutts, 1981). Out of the known serotypes in the Salmonella group, more than 200 have so far been isolated from poultry. The number of new types isolated is increasing. Exotic serotypes from time to time, some of them appear to become established in an area, breeding flocks or hatchery may give rise to outbreaks (Boxland et al., 1982). A recent example is S. Enteritidis.

According to Nottermans (1996), S. Enteritidis is an emerging problem in almost all countries of the industrialized world and the pathogen has been reported from different countries of Africa. Both out breaks and single cases are related predominantly to the consumption of contaminated eggs and egg products. The organism has the potential for transovarial transmission and thus the ability to contaminate the internal contents of the eggs.

Since 1986 there has been a dramatic increase in human food poisoning in Europe including the United Kingdom attributed to the consumption of eggs contaminated with S. enteritidis. During 1988 there was unprecedented increase in the isolation of S. enteritidis from broiler chickens. The fact that there has been a corresponding increase of this particular seroval in many countries of the world has given too much speculation about the source and mode of spread in chickens (O'Brein, 1990). The present study reports and recent outbreak of salmonellosis due to S. enteritidis phage type 4 in a poultry farm in Ethiopia.

**Materials and methods**

Study animals and history: On May 15, 1999 a total of 11220 day old chicks were imported from Kenchich, LTD, Kenya. They were stocked at Lemlem poultry farm house No. 1 and 2. The chicks belong to Arbor Acres breed.

Clinical and laboratory examinations: Clinical examination of the chicks was carried out standard procedures. Sick and dead birds were submitted to FVM and NVI for bacteriological examinations. The bacteriological examinations were carried out following the technique recommended by the International organization for Standardisation (ISO, 6579, 1990) to isolate and identify Salmonella species. As per request of the Kenchic LTD, bacterial isolate sample was sent to Veterinary Laboratories Agency, Weybridge, Surrey, United Kingdom for confirmation and serotyping.
Results

Clinical signs: The clinical signs observed include tendency to stand in one position with head lowered, eyes closed, wings dropping, ruffled feathers, marked anorexia, and increased water intake; profuse watery diarrhoea pasting of the vent and a tendency of the birds to huddle together near the source of heat.

Post-mortem lesions: Swollen liver, emaciation, dehydration, coagulated yolks, congested liver and spleen with haemorrhagic streaks or pinpoint necrotic foci, congested kidneys and pericarditis with adhesions, enteritis with coecal cores.

Mortality rate: About 22% of the chicks died within 20 days (Table 1 and Fig. 1) and 7800 chicks were stumped out immediately as it was confirmed to be S. Enteritidis.

Laboratory findings: Laboratory investigations at both institutes confirmed that the chicks were infected with Salmonella group D.

The results of the Central Veterinary Laboratory (VLA). Weybridge indicated that the samples sent were S. Enteritidis phage type 4 (antigenic structure 9, 12: gm) positive.
Table 1: Daily mortality rate pattern

<table>
<thead>
<tr>
<th>Actual date</th>
<th>Age</th>
<th>House No. 1*</th>
<th>House No. 2*</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mortality</td>
<td>%</td>
<td>Mortality</td>
<td>%</td>
</tr>
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<td>24</td>
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<td>31 May 99</td>
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<tr>
<td>Total</td>
<td>1266</td>
<td>1254</td>
<td>2520</td>
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</tbody>
</table>

Discussion

Considering the effect of the disease that can produce in the future production of the enterprise and the potential public health hazard, all the shipment had been destroyed and the necessary sanitary measures taken. There are numerous entry points for Salmonella in commercial integrated poultry operations including breeder flocks, hatchery, feed litter, water, insects, wild birds, rodents, other animals, man etc. With this concept it was found to be essential as sources of infection. The mortality pattern noticed during the outbreak in chicks brought from Kenchic clearly indicated the starting point of the infection to be either the hatchery or breeding stock.

Cuttis (1981) reported that in most outbreaks highest mortality occur between 5 to 10 dys post hatching suggesting that the infection was egg transmitted and disseminated incubators. When infection is acquired latter (at brooding house) losses start late with pick mortality occurring possible at late as 2 to 3 weeks of age. Snoeyenbos (1978) also indicated that in some instances evidence of the disease is
not observed until the 5th to 10th days after hatching. The disease gains momentum during the following 7 to 10 days. If the infection originated at the hatchery, mortality begins to increase from the 4th day, most commonly the 5th day onwards (Bains, 1979). When infection originates in the incubator from infected eggs, chicks may be found dead within a day or so of hatching and the disease spreads rapidly in few days generally reaching the peak about the 7th day (Gordon, 1982).

Horizontal or carry over transmission was not acceptable in this particular case because.

1. Only chicks 4 days older than imported ones from Kenya were housed in house number 4. These chicks were getting the same feed and management as the imported chicks. The mortality in this group was low and no evidence of Salmonella infection was obtained upon laboratory examinations.

2. The other evidence that the source of infection from Kenchic other poultry farms imported broiler chicks from Kenchic 15 days after our shipment were found to be positive for Salmonella.

Breeder flocks and hatcheries represent the earliest and probably the most critical control points in an integrated operation. The so-called “top-down” approach is essential in the eradication of *S. Enteritidis*. Salmonella free day old chicks must be placed from breeder flocks which are monitored regularly and certified as free of infection. The isolation of *S. Enteritidis* phage type 4 emphasises the threat to public health and a vast economic loss to the poultry production sector.

References


Bovine Cysticercosis in Animals Slaughtered in Nekemte Municipality Slaughter House

Ahmed Ibrahim

Introduction

Bovine cysticercosis is the infestation of the intermediate host- cattle with cystic or larval stage *Cysticercus bovis* of the cestode parasite *Taenia saquinata*, the tapeworm of man (2,4,12).

The parasitic nature of *C. bovis*, its pathogenicity and life cycles were not described until the year 1782 by Goeze (6,12).

The relationship between *C. bovis* and *T. Saquinata* was described beyond any shadow of drought in 1855 and 1861 (6,12).

Since then it was recoqnized that cysticerocosis is an important economic as well as zoonotic problem in various parts of the world (6,12).

Cysts of *C. bovis* can be found anywhere in the carcass meat and viscera, but there seems to be a special affinity toward some parts which are described as “sites of predilection” (6,8,12).

The presence of the cysts in the carcass and viscera can be detected by visual inspection of the carcass and by making different incisions into the muscles and organs during the routine meat inspection.

The lack of clinical signs in the bovine intermediate host even in highly endemic areas make the postmortem procedure much more relevant.

The previous works in the country indicated different prevalence rates of bovine cysticercosis and different site of predilection. This study was therefore undertaken with the following objectives.

1. To find the prevalence rate of bovine cysticercosis.
2. To determine the epidemiological variable that maintains the problem.
3. Asses economic losses resulted from the disease.
4. Establish predilection sites.
Material and Methods

Study Area

The study was done in Nekemte Municipality slaughter house which kills on an average of 4000 heads of cattle.

Nekemte is the capital town of former Wollega administrative region, but now divided into western and eastern Wollega zones of Oromia region.

The administrative region has a total area of 42,632 km² and total human population of 2.4 million. The livestock population of the region includes cattle 1.9 million, Sheep 300,000, Goats 200,000, Horse 20,000, Mule 20,000, Donkey 80,000 and Poultry 800,000.

The dominant cattle breed in the area are Horo and Abigar type. Exotic breeds are rare in the region Wollega is generally known for its dense forests and different vegetations compassed of tall tropical rain forest, tall grasses and bushes. There are many important rivers and streams in the region.

Animals

The Nekemte slaughter house kills both male and female bovine animals. The animals are very old and have almost completed their productive life as draught Oxen and milking cows.

The animals come from Gutuwayn Awraja and its surrounding. They brought to the slaughter house after 12.00 noon for ante-mortem examinations. During the ante-mortem examination history of the individual animal was taken by listing such details as origin of the animal, its age and sex. Then a separate number was given to each animal so that its carcass is identified after slaughtering.

Study In The Slaughter House

Every slaughtering day from October 16, 1987 to March 17, 1990, visits were made to the slaughter house and a total of 1,355 animals slaughtered on 86 occasion were inspected at autopsy for the presence of cysticerci.

The method adopted during the postmortem inspection was those employed in the normal routine inspection was those employed in the normal routine inspection of

Furthermore, the Meat Control Act of Kenya 1973 (as stated by Nyaga, 1979 and used by Amsalu 1989 Ethiopia) was followed.

In cases where cysticerci was found in any of the expected sites or organs thorough examination of the whole carcass and offal was performed.

The location, nature and number of cysts were recorded in positive cases.

The cysts were then removed with the surrounding tissue for laboratory examination.

**Study In the Laboratory**

Viability of the cysts were tested by incubating them at 37°C in 30% ox bile in saline for 1-2 hrs. The scolices were removed, compressed between two slides and examined under the microscope to see whether they are armed or not.

**Study Of Human Taeniasis**

Records of diagnosed human taeniasis at Nekemte hospital and health centers was consulted to see the incidence rate of the disease.

Similarly sells record of state drug store private pharmacies were examined to see the level of human anticestodal drug consumption.

Interviews were conducted in the local market to assess the type and relative abundance of the traditional human anticestodal drugs use in the area.

**Data Analysis**

The prevalence of Bovine cysticercosis, frequency distribution of *C. bovis* in different sites, relative importance of the sites in revealing the cysts, degree of infestation, and relative importance of the sites in revealing dead or live cysts were calculated.

The economic losses of *C. bovis* were calculated on the bases of the local market prices.
RESULTS

Table I. Frequency Distribution of Cysticercus Bovis in different sites in 286 Animal Infested

<table>
<thead>
<tr>
<th>No</th>
<th>Organs or parts infested</th>
<th>Number of cattle</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Heart</td>
<td>255</td>
<td>78.67</td>
</tr>
<tr>
<td>2</td>
<td>Shoulder muscles</td>
<td>221</td>
<td>77.27</td>
</tr>
<tr>
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<td>Tongue</td>
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</tr>
<tr>
<td>4</td>
<td>Masselers</td>
<td>144</td>
<td>50.34</td>
</tr>
<tr>
<td>5</td>
<td>Hind quarters</td>
<td>103</td>
<td>36.01</td>
</tr>
<tr>
<td>6</td>
<td>Neck muscles</td>
<td>71</td>
<td>24.82</td>
</tr>
<tr>
<td>7</td>
<td>Diaphragm</td>
<td>59</td>
<td>20.62</td>
</tr>
<tr>
<td>8</td>
<td>Long ismusdorsi</td>
<td>57</td>
<td>19.92</td>
</tr>
<tr>
<td>9</td>
<td>Intercostal muscles</td>
<td>32</td>
<td>11.18</td>
</tr>
<tr>
<td>10</td>
<td>Liver</td>
<td>15</td>
<td>5.24</td>
</tr>
<tr>
<td>11</td>
<td>Hump</td>
<td>1</td>
<td>0.34</td>
</tr>
</tbody>
</table>

Table II. Distribution Of Cysticercus Bovis in Different Organs or Parts in Ingested Animals

<table>
<thead>
<tr>
<th>No</th>
<th>No Organs or parts infested</th>
<th>Number of Systs</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shoulder muscles</td>
<td>938</td>
<td>30.98</td>
</tr>
<tr>
<td>2</td>
<td>Heart</td>
<td>669</td>
<td>22.10</td>
</tr>
<tr>
<td>3</td>
<td>Tongue</td>
<td>367</td>
<td>12.12</td>
</tr>
<tr>
<td>4</td>
<td>Masselers</td>
<td>300</td>
<td>9.91</td>
</tr>
<tr>
<td>5</td>
<td>Hind quarters</td>
<td>272</td>
<td>8.98</td>
</tr>
<tr>
<td>6</td>
<td>Diaphragm</td>
<td>152</td>
<td>5.02</td>
</tr>
<tr>
<td>7</td>
<td>Neck muscles</td>
<td>150</td>
<td>4.95</td>
</tr>
<tr>
<td>8</td>
<td>Long ismusdorsi</td>
<td>93</td>
<td>3.07</td>
</tr>
<tr>
<td>9</td>
<td>Intercostal muscles</td>
<td>63</td>
<td>2.08</td>
</tr>
<tr>
<td>10</td>
<td>Liver</td>
<td>22</td>
<td>0.72</td>
</tr>
<tr>
<td>11</td>
<td>Hump</td>
<td>1</td>
<td>0.03</td>
</tr>
</tbody>
</table>
Table III. Number of Dead and Live Cysts in Different Organs or Parts in 286 Infested Animals

<table>
<thead>
<tr>
<th>No</th>
<th>Organs or Parts Involved</th>
<th>Number of dead cysts</th>
<th>%</th>
<th>Number of Live cysts</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shoulder muscles</td>
<td>145</td>
<td>15.45</td>
<td>793</td>
<td>84.55</td>
</tr>
<tr>
<td>2</td>
<td>Heart</td>
<td>230</td>
<td>34.38</td>
<td>439</td>
<td>65.62</td>
</tr>
<tr>
<td>3</td>
<td>Tongue</td>
<td>92</td>
<td>25.05</td>
<td>275</td>
<td>74.95</td>
</tr>
<tr>
<td>4</td>
<td>Masseters</td>
<td>85</td>
<td>28.33</td>
<td>215</td>
<td>71.67</td>
</tr>
<tr>
<td>5</td>
<td>Hind quarters</td>
<td>61</td>
<td>22.422</td>
<td>211</td>
<td>77.58</td>
</tr>
<tr>
<td>6</td>
<td>Diaphragm</td>
<td>48</td>
<td>31.57</td>
<td>104</td>
<td>68.43</td>
</tr>
<tr>
<td>7</td>
<td>Neck Muscles</td>
<td>21</td>
<td>14.00</td>
<td>129</td>
<td>86.00</td>
</tr>
<tr>
<td>8</td>
<td>Long Ismusdorsi</td>
<td>16</td>
<td>17.20</td>
<td>77</td>
<td>82.80</td>
</tr>
<tr>
<td>9</td>
<td>Intercostal muscles</td>
<td>19</td>
<td>30.03</td>
<td>44</td>
<td>69.97</td>
</tr>
<tr>
<td>10</td>
<td>Liver</td>
<td>17</td>
<td>77.27</td>
<td>5</td>
<td>22.73</td>
</tr>
<tr>
<td>11</td>
<td>Hump</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table IV. Sex of Infested Animals out of the total 1355 Animals Examined

<table>
<thead>
<tr>
<th></th>
<th>Total slaughtered</th>
<th>Carriers</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>311</td>
<td>36</td>
<td>2.65</td>
</tr>
<tr>
<td>Male</td>
<td>1044</td>
<td>250</td>
<td>18.45</td>
</tr>
<tr>
<td>Total</td>
<td>1355</td>
<td>286</td>
<td>21.00</td>
</tr>
</tbody>
</table>

The variation is statistically significant P>0.01.

Table V. Age Of Infected Animals Out Of The Total 1355 Animals Examined

<table>
<thead>
<tr>
<th></th>
<th>Total slaughtered</th>
<th>Carriers</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 4 years</td>
<td>95</td>
<td>52</td>
<td>3.83</td>
</tr>
<tr>
<td>4 Years &amp; above</td>
<td>1260</td>
<td>234</td>
<td>17.27</td>
</tr>
<tr>
<td>Total</td>
<td>1355</td>
<td>286</td>
<td>21.00</td>
</tr>
</tbody>
</table>

The difference is statistically significant, P>0.01.
Table VI. Traditional Anticestodal Drugs Used For The Treatment Of Human Taeniasis In Wollega Administrative Region

<table>
<thead>
<tr>
<th>No</th>
<th>Local name</th>
<th>Scientific name</th>
<th>Parts of the</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kosso</td>
<td>Hyginia Abyssinia</td>
<td>Flowers</td>
</tr>
<tr>
<td>2</td>
<td>Enkoko</td>
<td>Erebelia schlaperi</td>
<td>Fruits</td>
</tr>
<tr>
<td>3</td>
<td>Meter</td>
<td>Clenus ioloidus</td>
<td>Seeds</td>
</tr>
<tr>
<td>4</td>
<td>Dubafre</td>
<td>Cucurbila pepo</td>
<td>Seeds</td>
</tr>
<tr>
<td>5</td>
<td>Bisana</td>
<td>Corton macrustachys</td>
<td>Bark</td>
</tr>
</tbody>
</table>

Table VII. The two Modern Anticestodal Drugs commonly used in Wollega Administrative Region and their sell during the Five Months

<table>
<thead>
<tr>
<th>Drug</th>
<th>Sell in Birr</th>
<th>Number of people</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Niclosamide</td>
<td>2060.30</td>
<td>3766</td>
<td>46</td>
</tr>
<tr>
<td>Dichlorophen</td>
<td>1365.80</td>
<td>4583</td>
<td>54</td>
</tr>
<tr>
<td>Total</td>
<td>3426.10</td>
<td>8349</td>
<td>100</td>
</tr>
</tbody>
</table>

Discussion

The Prevalence of Bovine cysticercosis (21%) obtained in this study was significant when compared to 9.7% (Amsalu Damissie 1989) in gonder 13.2% (Abel Mersie, 1995) in Eastern Ethiopia, 30% (Haile Mariam S.) in Ethiopia 28.43% (Pandey V.S. and Mbemba Z.Z., 1976) in Zaire 1.2% (A.B. Gotbi and H.M. Saliman, 1975) in Sudan, and 6.11% (Fuad Mohammed, 1986) in Asmara, Eretrea.

The underlying reasons for this finding encompass all possible social, environmental and epidemiological situations known to be suitable for the maintenance of the human taeniasis and bovine cysticercosis.

The life cycle of *Taenia saginata* is exclusively synanthropic and depends upon a man- cattle relationship that ensures exposure of both (12).

Epizootiological factors for the high prevalence obtained in the study includes:

Animal Rearing in the region is traditional and semi-intensive livestock owners are poor farmers with high level of illiteracy in the health and hygienic aspects.
Sanitation level is poor, thus the same open ground is used for defecation and grazing. These conditions created a close relationship of man and animal—the suitable situation for the maintenance of the human taeniasis and Bovine cysticercosis.

Improper meat inspection performed by nonprofessional with wide backyard slaughtering is another factor exposed the people to the consumption of measly beef. Majority of the people in Wollega administrative region have habits and customs of eating raw meat (KURT) and undercooked meat (TBSE and KITFO). In such preparations the cysticerci are not killed and man therefore become infected.

In the study, the cysts of *C. bovis* were encountered in 11 different sites of the bovine carcase and viscera. This result is comparable to 15 sites (Omer, 1975) in Sudan and 12 sites (Ginsberg, et al 1956) in Kenya.

However, the sites can be definitely higher than this, because there is a practical limit to the number and intensity of the incisions made during the meat inspection as this will reduce market price of the carcass.

Heart was found to be the most frequented site and revealed the cyst in 78% of the total cases. This was followed by shoulder muscle, tongue, Masseters and hindquarters in which the cysts were defected in 77.3%, 63.0%, 50.4% and 36.0% of the total cases respectively.

These findings are in agreeable with the findings of A.B. OMAR (1975, Sudan) but slightly differ from that of Ginsberg and Cameroon (1956, Kenya) Demissie, (1989, Ethiopia) and Hailemariam (1972-1979, Ethiopia) reported that tongue was the most frequented organ.

When it comes to the Distribution of the cysts in the 11 sites, shoulder muscle become first by containing about 31% of the total cysts. Heart and tongae were followed by revealing 22.1% and 12.1% of the total cysts. These results generally agree with previous workers in confirming that shoulder muscles, heart and tongue are the most important sites of *C. bovis*.

From all the cysts 76.14% were viable. The higher proportion of the viable cyst were observed (in decreasing order) on the neck muscles, shoulder muscles longismusdorsi and tongue. An interesting point here is that all these sites are the most preferable sites for the preparation of the “Kurt” (raw), “Tibse” and “Kitfo” (under cooked).
Records of Nekemte hospital and health center indicated that Human taeniasis were very low, but consumption of anticestodal drugs were high, (Table VII). This is explained by the fact that most people take these drugs and traditional treatment on the bases of self diagnosis. C. bovis causes large losses resulted from reduced carcass value due to incisions condemnation of total or parts of the carcass exclusion of the country from international livestock market, cost of drugs, pain and discomfort caused by adult parasite in man drug toxicity particularly with traditional drugs as proper dose is unknown.

Therefore, it is worth to note that bovis cysticercosis is an important parasitic disease that have economic and public health significance, and deserve due attention.

**Conclusion and Recommendation**

The result obtained in this preliminary survey of bovine cysticercosis was significant. Method and purpose of animal keeping, living and eating habits of the people and level of sanitation in the study area are some of the epidemiological factors that are conducive to the maintenance and stability of cysticercosis.

Poor meat inspection exercise and backyard slaughtering of animals also contributed to the high prevalence of bovine cysticercosis obtained in the study. Therefore, the main objective of the control program is to prevent the exposure of both man and cattle by the intermediate C. bovis and eggs of the adult T. Saginata respectively.

Some of the specific recommendations include general health education and proper disposal of waste materials (use of public latrines). Meat Inspection – strict application of all the rules and regulations which also prohibit backyard slaughtering. A concrete program to study the epidemiology and effect control of cysticercosis in bovine and taeniasis in man, the collaboration of veterinary and medical services is necessary.

**References**


Epidemiological Study on Sylvatic Hydatid Disease in North Queensland

Desalegn Lidetu

Abstract

An investigation was undertaken into the epidemiology of hydatidosis in feral pigs in the Charters Towers region of North Queensland. The aim was to determine the prevalence of the disease in feral pigs.

Data were collected from surveys conducted at a game chiller depot from September 1989 to October 1991 on 238 carcasses of mature feral pigs. The prevalence of E. granulosus hydatid cysts in feral pigs was found to be 31.1%. The predilection sites of cysts were livers (23%) and lungs (62%), with more cysts in lungs (252) than livers (48). The fertility of cysts was 70.1%. There was no significant difference in sex between infected and non-infected feral pigs. There was also no significant difference in size (mean diameters 31mm) between fertile and non-fertile cysts in lungs. The high prevalence rate and fertility of cysts in feral pigs confirm that feral pigs can take part in the sylvatic cycle of the parasite in the region.

The public health significance of this observation is potentially very important. Hunters’ dogs that may be fed with offal from killed feral pigs or scavenged from dead feral pigs could get infection and perpetuate the life cycle of the parasite within and around urban centers. From this study we speculate that the sylvatic pig form may be a potential source of human cases of hydatidosis.

1. Introduction

The parasites that cause hydatid cysts are members of the genus Echinococcus, which are cyclophyllidean cestodes belonging to the family Taeniidae. Only four species are accepted and regarded as valid taxonomically. These are E. granulosus, E. multilocularis, E. oligarthrus, and E. vogeli (Thompson, 1986). All the tapeworms of these species are small in size ranging from 2 – 7mm. The disease which is caused by these parasites has a broad geographical distribution, with highly endemic areas in the Soviet Union, in Mediterranean countries, Africa, Latin America, Australia and New Zealand and China (Soulsby, 1986). Studies to establish the prevalence of hydatid disease in animals depend mainly on collection...
of data in slaughter-houses. In wildlife, reliable and accurate records on the study of this disease depend on the number of animals, which can be killed for the survey.

The maintenance of *E. granulosus* in wild or feral animals without the involvement of man or domestic ungulates demonstrates the existence of sylvatic cycles. There is evidence and confirmation of the sylvatic cycle in Australia, North America and in East and South Africa (Rausch, 1986). In Australia *Macropus* and *Wallabia* species are very important intermediate hosts. The significance of the sylvatic cycle in the epidemiology of hydatid disease in animals has been studied, but its significance for humans has not yet been fully elucidated (Thompson and Lymberry, 1990).

An epidemiological survey in northern Queensland (Banks, 1985) indicated that sylvatic and domestic cycles of *E. granulosus* operate in the area. The first cycle being sylvatic between dingoes and wallabies and the second involving the propagation of the mainland domestic strain between dingoes and feral pigs (Banks, 1985). The cycle between dingoes and wallabies in Australia and the cycle between wild carnivores and wild ungulates in different countries would serve as a potential source of infection for livestock and man.

The economic loss to the meat industry from hydatid disease is considerable (Gemmel and Brydon, 1960; Arundel, 1979). According to some studies, the adverse effect of hydatid infection in food animals could contribute to the decrease of their growth rates and other parameters of production (Abuladze and Sadykov, 1971; Ramazanov, 1978). Losses occur mainly from the condemnation of livers, lungs and sometimes-whole carcasses. In Australia alone, the loss to the export beef industry was estimated at 0.5 million dollars per year (Banks, 1985). In general, hydatidosis is a globally distributed disease; it threatens rural and urban public health; it exerts constraints to the economics of the animal production systems; and the existence of sylvatic cycles perpetuate the disease as one of the major parasite zoonotic diseases and creates obstacles for control and eradication programs. The objective of this study was to further study and determine the prevalence of hydatid disease in feral pigs in North Queensland.

Feral pigs (*Sus domestica*) are free living pigs originating from domesticated stock. The present domestic pig breeds are the product of cross-breeding of the various subspecies of the wild boar (*Sus scrofa*). (reviewed by Kanameda, 1990). Feral pigs are distributed in temperate and tropical regions of the world. They are found widely in Australia and New Zealand (Epstein and Bichard, 1984). In Australia the total number of feral pigs is estimated at 8 – 11 million.
Two extreme types of feral pigs are present. These are the early types of red Tamworth and black Berkshire breeds and the recent types of the progeny of white breeds. The appearance of feral pigs varies considerably. Predominantly their color is black or black and white (reviewed by Kanameda, 1990).

Feral pigs are important because of their ability to transmit diseases and parasites of economic importance to livestock, and to human health. The involvement of wild animals in cycles of *E. granulosus* is frequently important in the epidemiology of the disease. The presence of *E. granulosus* in cattle, sheep, pigs and other animals has been confirmed in all states of Australia (Queensland, New South Wales, Victoria, Western Australia, South Australia, Northern Territory and Tasmania). The highest prevalence seen in Queensland in cattle was 46% (Kumaratilake and Thompson, 1982) to 51% (Banks, 1985). Based on morphological, developmental and biochemical criteria, Thompson and Kumaratilake (1985), Thompson (1987), and Lymbery and Thompson (1989) classified *E. granulosus* in Australia into three intraspecific variants namely the Tasmanian sheep strain, the Australian mainland strain, and the Australian sylvatic strain.

Banks, (1985) studied the epidemiology of hydatid disease in North Queensland and found that the sylvatic cycle existed between dingoes and macropods. Cattle were also infected (21% prevalence) but all cysts were sterile. He also examined 32 feral pigs and found only 3 infected (9.4%). However, the two isolates of fertile cysts from these feral pigs were identified as “not sylvatic strain” of *E. granulosus*. But Banks (1985) Hutchinson and Copeman (1988) and Sakamoto et al., (1989, 1990) still suggested that feral pigs in northern Queensland could play an important role in the sylvatic cycle of the parasite. More recently, Thompson (1987) reported that 12 out of 25 feral pigs trapped in Western Australia were infected with the parasite. This study was therefore carried out to further investigate the prevalence, organ predilection and cyst fertility levels of hydatid disease in feral pigs in northern Queensland.

2. **Materials and Methods**

2.2 **Location of Study Area**

This study was conducted in the Charters Towers region of Dalrymple Shire in sub coastal North Queensland approximately 120 km inland from Townsville. Data and specimen collection was primarily conducted at a chiller depot (Figure A) which has been assigned permanently to the outskirts of the town. The total area was estimated as up to 30,000 square kilometers. The area is in the seasonally dry tropics and has one annual wet season which is nominally...
between December and April. The wet season may vary depending on the monsoon. The mean annual rainfall during 1989, 1991 and 1992 in Charters Towers was 570mm. The temperature also varies according to the season. The annual average daily maximum temperature was $27.4^\circ C$ while the average minimum temperature was $12.7^\circ C$.

### 2.2. Animals

Feral pigs are hunted for sport and for export as game meat to Europe especially to Germany. Field shot animals were deposited the same day in the chiller depot after their intestinal tracts were removed. Data such as weight, sex, age and physical conditions of the pig carcasses were easily collected. For subsequent meat inspection prior to export certification hearts, lungs, livers, kidneys and spleens were still attached within the carcasses (Figure B).

### 2.3. Data Collection

A total of 238 pigs were examined, with the collection of data starting in September 1989 and continued until November 1990. In 1991 data were collected from April to October. Sex identification was conducted before collection of specimens. Age was estimated based on dentition. The animals were assigned to either of the two broad age groups i.e. young and adult. Pigs that were estimated up to one year old were categorized as young; while pigs estimated above one year were categorized as adults. Data on sucklings or weaner pigs were not available.

### 2.4. Hydatid Cyst Lesions

Organs of the abdominal, thoracic, and pelvic cavities were examined for the presence of hydatid cysts by observation and palpation; with special emphasis and critical examination of livers and lungs. The hydatid lesions were differentiated from other cystic parasitic diseases based on FAO/UNEP/WHO guidelines (1981), and removed intact from the infected organs, of small lesions $< 5$mm diameter or those which could not be confidently differentiated as hydatids were excluded. Cysts were recorded according to organ distribution.

The contents of each cyst were then aspirated with a hypodermic syringe and transferred into vials or petri- dishes were examined under a stereoscopic binocular microscope for the presence of brood capsules. Drops of hydatid cyst fluid (HCF) were also mounted on slides with cover slips and observed under a compound microscope for the presence (fertile cysts) or absence (sterile cysts)
of protoscoleces. A fertile cyst was recorded as viable if it contained protoscoleces showing flame-cell activity.

Cysts were then incised with a scalpel to determine the stages of degeneration. All lesions were examined for the presence of an identifiable laminated membrane indicating that the cyst was of \textit{Echinococcus} origin. This structure could be detected in hydatid cysts which were either live or partially necrotised and appeared to persist some time after death of the parasite (Banks, 1985). The collected cysts were then preserved in 10\% buffered neutral formalin (BNF) for histopathological examination.

\textbf{2.5. Data Analysis}

Age and sex were the main factors considered to determine the prevalence of the disease. Other factors such as breed, environment, nutrition, etc. were not considered. Chi-square method of analysis was employed to determine statistical differences in the fertility of cysts in both sexes and age groups. Numbers and size of cysts were calculated and differences tested for statistical significance using a one-way analysis of variance (one-way ANOVA) using Statistix version 3.5 (Analytical Software, St. Paul, MN, USA).

\textbf{3. Results}

All pigs were of the same black type (Figure B). A total of 238 feral pigs were examined, 137 male and 101 females. Of these 103 were classified as “young” and 135 as “adult”.

\textbf{3.1. Age and Sex Specific Prevalence}

The overall prevalence of \textit{E. granulosus} was 31.1\% (74/238) with the age group specific prevalence of the disease 31.1\% in both young and adult feral pigs alike. The sex specific prevalence rate was 32.1\% and 29.7\% in male and female feral pigs respectively (Tables 1 and 2).

\textbf{3.2. Organ specific prevalence}

In all 74 infected feral pigs 46 lungs, 17 livers and one kidney were found harboring one or more cysts. The prevalence of \textit{E. granulosus} metacestode cysts in the principal sites of predilection: lung 46/74 (62.16\%), liver 17/74 (22.97\%) were calculated (Table 3).
Mean numbers of cysts per organ were 2.8 in liver and 5.5 in lungs (Table 3). A single sterile cyst was found in kidney. No cysts were found in the heart or other organs.

3.3. Fertility

A total of 301 confirmed hydatid cysts were found in the livers and lungs of all infected feral pigs (Table 4). The percentage of fertile cysts in livers and lungs was 79.2% and 68.7% respectively (Table 3). The overall fertility rate of cysts in livers and lungs was 70.3%. Live protoscoleces were found 19/38 (50%) of all fertile liver cysts and 109/173 (63.2%) fertile cysts from lungs. The ratio of livers to lungs infected with fertile cysts was about 1:4 compared with 1:8 for sterile cysts. The diameter of fertile cysts ranged from 15mm to over 60mm (Tables 5 & 6). Of all cysts in either organ only few showed necrosis and calcification.

The mean size of sterile cysts from livers (33.7mm) was significantly larger than fertile cysts (21.0mm) (Table 5) but in lungs there was no difference between the two types (mean 31mm). There was no significant difference in fertility of cysts in pigs of either sex (P = 0.803).

Table 1. Frequency distribution of infected feral pigs by sex

<table>
<thead>
<tr>
<th>Sex</th>
<th>Number of feral pigs</th>
<th>% Infected</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Examined</td>
<td>Infected</td>
</tr>
<tr>
<td>Male</td>
<td>137</td>
<td>44</td>
</tr>
<tr>
<td>Female</td>
<td>101</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>238</td>
<td>74</td>
</tr>
</tbody>
</table>

Chi-square = 0.2662
Degree of freedom = 1
Significance = 0.606

Thus sex and infection are independent.
Table 2. Frequency distribution of infected feral pigs by age

<table>
<thead>
<tr>
<th>Age</th>
<th>Number of pigs</th>
<th>Infected</th>
<th>Not infected</th>
<th>% Infected</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Examined</td>
<td>Infected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>135</td>
<td>42</td>
<td>93</td>
<td>31.1</td>
</tr>
<tr>
<td>Young</td>
<td>103</td>
<td>32</td>
<td>71</td>
<td>31.1</td>
</tr>
<tr>
<td>Total</td>
<td>238</td>
<td>74</td>
<td>164</td>
<td>31.1</td>
</tr>
</tbody>
</table>

Chi-square = 2.587
Degree of freedom = 1
Significance = 0.108

Thus age and infection are independent

Table 3. Distribution of cysts in the organs of feral pigs collected from Charters Towers district, and the percentage of cysts from each organ that were fertile

<table>
<thead>
<tr>
<th>Organ</th>
<th>No. Infected</th>
<th>Fertile</th>
<th>Sterile</th>
<th>Total</th>
<th>% Fertile</th>
<th>Mean No. Cysts per Organ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livers</td>
<td>17</td>
<td>38</td>
<td>10</td>
<td>48</td>
<td>79.2</td>
<td>2.8</td>
</tr>
<tr>
<td>Lungs</td>
<td>46</td>
<td>173</td>
<td>79</td>
<td>252</td>
<td>68.7</td>
<td>5.5</td>
</tr>
<tr>
<td>Kidney</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>211</td>
<td>90</td>
<td>301</td>
<td>70.1</td>
<td></td>
</tr>
</tbody>
</table>

Degree of freedom = 1
Significance P = 0.1980
Table 4. Distribution of cysts by size in lungs and livers of feral pigs

<table>
<thead>
<tr>
<th>Number of Cysts</th>
<th>Organs</th>
<th>1-20</th>
<th>21-30</th>
<th>31-40</th>
<th>41-50</th>
<th>&gt;51</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver</td>
<td>Fertile</td>
<td>19</td>
<td>18</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Sterile</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Necrotic</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Sub Total</td>
<td>23</td>
<td>21</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Lungs</td>
<td>Fertile</td>
<td>48</td>
<td>85</td>
<td>23</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Sterile</td>
<td>1</td>
<td>39</td>
<td>5</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Necrotic</td>
<td>5</td>
<td>21</td>
<td>5</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Sub total</td>
<td>54</td>
<td>145</td>
<td>33</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>77</td>
<td>166</td>
<td>36</td>
<td>17</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 5. Differences in the mean size (± standard error) of fertile and sterile liver cysts in feral pigs

<table>
<thead>
<tr>
<th>Cyst type</th>
<th>Mean size (mm) ± S.E</th>
<th>No. pigs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertile</td>
<td>21.6 ± 2.02</td>
<td>22</td>
</tr>
<tr>
<td>Sterile</td>
<td>33.7 ± 3.66</td>
<td>6</td>
</tr>
</tbody>
</table>

For cysts in the liver there was significant difference in size in accordance to fertility/sterility; $F_{(1,26)} = 7.84$, $P = 0.0095$

Table 6. Differences in the mean size (± standard error) of fertile and sterile lung cysts in feral pigs

<table>
<thead>
<tr>
<th>Type of Cyst</th>
<th>Mean size (mm) ± S.E</th>
<th>No. pigs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertile</td>
<td>31.2 ± 0.58</td>
<td>40</td>
</tr>
<tr>
<td>Sterile</td>
<td>31.1 ± 2.87</td>
<td>15</td>
</tr>
</tbody>
</table>

For cysts in the lung there was no significant differences in size due to fertility sterility; $F_{(1,53)} = 0.0$, $P = 0.9680$
Figure 3a: Refrigerated game chiller collection depot for storage of feral pig carcases at Charters Towers.
Figure 3b: Eviscerated feral pig carcases in chiller depot showing attached organs (heart, lungs, liver, kidneys, spleen)
4. Discussion

This study showed an overall prevalence of 31.1 percent of *E. granulosus* hydatid cysts in mature feral pigs in the Charters Towers region in Dalrymple shire of North Queensland. The prevalence is a little higher than the preliminary reported prevalence 8/29 (27%) in the same area, but the samples were small (Hutchinson and Copeman, 1988). There was no statistical difference due to age or sex (Tables 1 & 2). Gemmel and Brydon (1960) found no differences in sex-specific prevalence in beef and dairy cattle in New South Wales, but showed an increase in prevalence with age. Similarly, Baldock, Arthur and Lawrence (1985b) found no differences in sex-specific prevalence in Queensland cattle, but the prevalence increased linearly with age from 17 months to 4 years. Several factors may affect the variation in prevalence with origin of hosts. These include climate, stocking rate, and the abundance of infected definitive and other intermediate hosts. Similar factors may be responsible for the variation in prevalence in feral pigs between Queensland and Western Australia. Weaner or suckling pigs were not sampled therefore; the true age prevalence could not be determined, but would be expected a priori to be similar to cattle.

The lungs and livers were favored sites for hydatid cyst development in feral pigs as has been shown to be the case with other studies in pigs or other host species. In this study five times more cysts were found in lungs than in livers. About 13.5 percent of the total feral pigs sampled had cysts in both organs, but no cysts were found in any other organ except a single cyst in a kidney. Whereas Banks (1985) found three infected feral pigs of which two harbored single hepatic cysts, one of which was fertile, and the third had disseminated infection with some fertile cysts in the liver, lungs, spleen and kidneys. Sakamoto et al., (1989) also found cysts mainly in lungs from feral pigs around Charters Towers.

In other susceptible host species such as ungulates, hydatid cysts also occur predominantly in the lungs and livers. In cervids cysts are rarely found other than in the lungs (Raush, 1975), while in macropods cysts are often found in the thoracic cavity, mainly in the lungs, although occasional cysts were found in the pleural cavity attached to the lungs by a thin peduncle (Banks, 1985).

In swine the liver is often involved alone or in combination with the spleen and kidneys. Unicystic (infection with one cyst) forms of infection seem to be more common than multicystic forms. Only few multicystic forms of infection were found in this study. As reviewed by Rausch (1975), in sheep slaughtered in Southern France the percentage involvement was; liver 67.8 and lungs 38.2, whereas in Spain it was; lungs 35.7%, liver 32.8%, and both organs 31.4%.
Multiple organ infections are also frequent in cattle, with unilocular cysts predominating. Again the lungs and livers are most commonly affected with occasional involvement of the spleen, heart or other organs. Further in his review, Rausch (1975) cited a report of 2074 infected cattle in Victoria, Australia, where the distribution of cysts was; liver 88.4%, lungs 72.2% and spleen 7.2%. In equids (horses) about 95 percent of the hydatid cysts occur in the liver and lungs. In humans cysts occur most often in the liver and lungs. For example, organs involved in cases infected by the European strain were; liver 60 to 70%, lungs 25 to 35% and other organs 10 to 15 percent (Rausch, 1975).

At present there are no means by which to estimate the ages of hydatid cysts in feral pigs without an experimental infection study to determine growth rates. In the absence of this information it would be difficult to extrapolate backwards to determine when pigs became infected. While the majority of cysts observed in this study were between 21 and 30mm in diameter there was no significant difference (P > 0.05) between the mean size of cysts in livers and lungs.

Banks (1985) found that the diameter of metacestodes of the sylvatic strain of *E. granulosus* in experimentally infected cattle increased linearly with time. Hepatic cysts increased at a rate of 0.3mm per month, so that after one year the predicted mean diameter was only 3.9mm. Thus, according to his estimate a cyst with a diameter of 5mm could be between one and two years of age. Growth rates in sheep are believed to be similar (Sweatman and Williams, 1973a), while early studies by Dew (1925) on hydatid cysts in domestic pigs claimed cysts reached 40mm in only 3 months. Unfortunately no information has been found of similar studies in feral animals. As there are host species differences and other factors such as the immune response, environmental and climatic factors etc. it is not clear if the natural growth rate of hydatid cysts in feral pigs would be similar to this, or closer to that in herbivores.

The high percentage (69 – 80%) of fertile hydatid cysts in feral pigs was surprising in view of earlier limited information on fertility, and the very low (< 1%) rate in cattle cysts in the same region. Although a high proportion of cysts were fertile the number of protoscolecies observed in each cyst were relatively low (usually less than 50, which precluded having the protoscolices typed to strain), these were frequently non-viable. In contrast, from a single fertile cyst of sheep origin one can often find several thousand protoscolecies. In the present study, there was no statistically significant difference in the fertility of cysts in pigs of either sex (P = 0.843).
Fertile liver cysts were, with one exception, smaller than 30mm diameter, whereas some lung cysts up to 60mm contained protoscoleces. The reasons for the high fertility level of *E. granulosus* in feral pigs and whether feral pigs harbour the sylvatic strain of the parasite are not yet known.

The low proportion of fertile cysts in cattle (Baldock, et al., 1985b, Banks, 1985) suggests that cattle play little part in continuing the life cycle of the parasite. Our results support the view that feral pigs might play an important role in maintaining the sylvatic life cycle of *E. granulosus*.

Banks, (1985) noted that in those parts of northern Queensland hundreds of kilometers from the nearest sheep, no evidence was found for the existence of domestic animal cycle spill-over into wild and feral animals which share the same habitat. Since, in northern Queensland the mainland domestic strain has been identified (Ballock et al., 1985a) and propagation of the mainland domestic strain between dingoes and feral pigs has been suggested (Banks, 1985) further study is clearly necessary to better understand the relationships between strains and their host assemblages. Banks also worked in our study area, and described the two most significant intermediate hosts as the black-striped wallaby (*Macropus dorsalis*) and the feral pig (*Sus domesticus*) with a prevalence of 21.8% and 9.4% respectively. In the present study the 31% prevalence of the disease in feral pigs was higher than the obtained previously by other workers. And it has now become clear that feral pigs have a role in the epidemiology of the disease in this region, even if there is no direct evidence from Banks’ study that feral pigs are a substantial part of the diet of dingoes, in distinction to wallabies which have been identified in stomach contents (Banks 1985). Whether feral pigs are infected from dingo faeces, and if dingoes are capable of being infected from pig-derived cysts is yet to be clarified. The public health significance of this observation is potentially very important. Hunters’ dogs which may be fed with offal from killed feral pigs or scavenged from dead feral pigs could possibly be infected, and if patent infections develop these dogs may shed *E. granulosus* eggs within and around urban centers. Since after being voided in the faeces of a dog, eggs can contaminate extensive areas, through transmission by blowflies and this cause real potential for human infection. Thompson (1987) has suggested such a cycle already exists in Perth and a public education campaign to warn hunters of this danger has recently been initiated (Thompson 1991, personal communication). Baldock et al., (1985) in determining the origin of human infections suggested the domestic strain was most commonly encountered in human cases. From this study, we speculate that the sylvatic pig form may be a potential source of human cases of hydatidosis.
Acknowledgement

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