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ECONOMIC DEVELOPMENT OF THE LIVESTOCK INDUSTRY IN THE SUBSISTENCE AGRICULTURAL ENVIRONMENTS OF SOUTHERN AND EASTERN AFRICA: DROUGHT, LIVESTOCK NUMBERS, HUMAN POPULATION GROWTH AND ANIMAL DISEASES*#

B McCULLOCH**

Introduction

The subsistance agricultural environments of southern and eastern Africa are largely tribal in nature and in many instances cover vast tracts of land. The populations of many of these environments virtually constitute nations within nations. With regard to the economic development of the livestock industry in such areas or regions, most attention is directed towards cattle[1,2,3,4,5,6,7,8,9]. Although all classes of livestock are of importance in African subsistance agriculture, cattle in general form the most significant holdings and therefore are integral to this subsistance system. It is therefore essential to understand the functions of cattle within the system.

Cattle provide milk, meat, blood, hides, labour, fuel and capital gain in terms of herd replenishments. These are all important commodities in any subsistance environment. However, in addition and most important, in the African subsistance agricultural environment, cattle are a primary source of food in years of drought when maize, sorghum and other agricultural crops fail. Under these circumstances cattle provide an immediate source of fresh meat when they die of starvation or thirst. Thus in broad terms, it is the function of cattle in African subsistance agriculture, to produce milk and to grow fat in the summer when grass is plentiful, and on death, preferably in the winter or under drought conditions, to be absorbed into the food chain as meat.

It is well-known that most of the tribal communities of southern and eastern Africa are reluctant to sell cattle, and schemes which involve a planned reduction in numbers, are generally unacceptable to them. It is the purpose of this paper to show that in the African subsistance agricultural environment there are a number of factors which support these viewpoints and appear to justify related animal husbandry practices.

Any factor which influences the subsistance agricultural system in any part of southern and eastern Africa, warrants thorough investigation. Factors requiring special consideration are drought, cattle numbers, human population growth, and animal diseases, especially cattle diseases of a death-related and epizootic nature. The land tenure factor which is also important to the economic development of the cattle industry, and the livestock industry as a whole, is however largely hypothetical to most parts of southern and eastern Africa and thus receives only limited mention, namely in relation to the long-term outlook. Tribal laws and social customs, which are complex matters, are not discussed, as to a large extent, these have been determined over countless generations with due regard to the conditions of the environment.

Drought and African subsistance agriculture

In African rural communities, cattle are often referred to as the wealth of the individual or the family. The term "wealth" however, in its normal context, is inclined to draw the perception away from the basic function of cattle, which is, in the long-term, to provide a source of food during years of drought, although food of any kind, in times of drought and starvation, is indeed "wealth".

Drought is greatly feared in all African subsistance agricultural environments. Drought causes failure of agricultural crops and at the end of summer, prospects for family survival during the coming winter or dry season look grim. Prospects for those with moderate to large cattle and other livestock holdings look better, as the death of livestock which inevitably occurs in the winter or dry season, supplies a ready source of fresh meat, and as long as water is available, family survival is assured. Indeed in the African subsistance agricultural environment, cattle and other livestock can be regarded as walking refrigerator systems, which provide a ready source of fresh food as local conditions deteriorate.

At this point it should be appreciated that in the African subsistance agricultural environment, drought often means family uprootment and translocation to a viable water source. Livestock, in their walking refrigerator capacity, greatly facilitate this translocation, as they provide food during the journey and of course at the ultimate destination. Man can survive a drought as long as he has livestock, but man and his livestock die side by side when there is no water.

The physical and psychological effects of drought on African subsistance agricultural populations are often overlooked by people, such as town dwellers, who are sheltered from the rigours of the environment, themselves being accustomed to an infra-structure of roads, electricity, water, food supplies, shops and other ammenities, which make them relatively independent of local weather conditions. To aggravate the overall position, drought is not an uncommon circumstance in many parts of southern and eastern Africa.

Losses of livestock in years of drought should not be regarded as a loss of "individual wealth", or for that matter as a waste, but rather as the utilisation of a food crop, when no other food crops are available for consumption. Even in normal years, a certain number of livestock die of starvation in the winter

*Paper delivered at the Biennial Congress of the South African Veterinary Association, Pietermaritzburg, 11-15 July 1988

#The views expressed in this paper are the author's alone and do not necessarily reflect those of the government of KwaZulu

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or dry season, but again as in drought, such animals are absorbed into the food chain.

Livestock numbers and African subsistance agriculture

Grass is the most freely available crop in the African subsistance agricultural environment. Grass is converted by cattle and other livestock, into milk, meat and other items for human use. This conversion requires only limited effort on the part of the livestock owner. Agricultural crops, on the other hand, require a high labour input in terms of ploughing, planting, weeding and harvesting. With grass widely available in the summer months, it is understandable that African subsistance agricultural populations seek to keep large numbers of livestock, even although a percentage are lost due to starvation in normal years. Even in a drought year, losses are seldom above one third, and in a 2-year drought period, about half of the survivors from the first year die, to give an overall loss of two thirds of the original holding. On return to normal conditions, the herds and flocks are replenished by means of increased fertility: there being less competition for grass and edible shrubs.

By and large, African subsistance agricultural population fears for family survival in drought are not unreal and in this regard, large numbers of livestock help to procure a fully justified sense of security and are a sound backup to possible agricultural crop failure. Large numbers of livestock also provide a buffer to the effects of untoward illness within the individual family itself and, protection against the ravages of epizootic disease in livestock holdings.

The effect of human population growth on livestock numbers in African subsistance agriculture

Customary, social and economic considerations have led to the development of large families in most parts of the African subsistance agricultural environment. A lowering of childhood mortality in southern and eastern Africa over the last 3 decades has given rise to unrestricted human population growth in the areas under consideration. This human population growth is in itself a spur to the desire and need to keep large numbers of cattle and other livestock. The primary objective of keeping large numbers of livestock, is of course, to prevent family starvation in the event of drought and agricultural crop failure.

Veterinary science and African subsistance agriculture

The veterinary departments of the various countries of southern and eastern Africa have no control over drought, but they can to a large extent control animal diseases. Given the support of the local populations, they can keep untoward outbreaks of epizootic diseases to a minimum. Failure to control animal diseases, especially death-related epizootic diseases such as East Coast fever, blackquarter, pleuropneumonia, rinderpest, pasteurellosis and anthrax for example, aggravates the instability of drought-prone subsistance agricultural environments. The reason is that animal diseases affect the ultimate human food resources in times of drought. Thus fears of animal diseases and drought, as a combined set of circumstances, further increase the psychological stress associated with African subsistance agriculture and its particular demands on family survival. It follows therefore, that animal disease control is essential to the economic development of the livestock industry in African subsistance agriculture, especially in parts which are drought-prone. A breakdown in animal disease control can result in a loss of confidence in the various departments. This confidence would be hard to regain, the position being very different from that in western countries where animal disease stability is regarded as a normal state of affairs.

Economic development of the livestock industry in African subsistance agriculture

Once the place of animals in the African subsistance agricultural environment is understood, attention may be given to economic development of the livestock industry.

Tribal communities with the largest livestock holdings are generally those who live in the arid and semi-arid areas. The ravages of drought over countless generations have led to this situation. Programmes to destock in these areas, either by voluntary or compulsory marketing are unlikely to succeed in the long-term. In general, planned schemes of reducing livestock numbers have shown limited success in these environments of southern and eastern Africa. Despite the fact that the arid and semi-arid areas are usually the most disease-stable parts of a country, fears of the consequences of drought are an overriding factor: large livestock holdings placate fears of family starvation.

If solutions are to be found to the problems of economic development of the livestock and particularly the cattle industry, they should be looked for in the high rainfall areas. In these areas drought is rare, grass cover is good, milk is normally plentiful and, tick-borne disease is largely enzootic, and therefore, in a relatively stable form. Furthermore, the communities of these areas often enjoy cash crop benefits, as derived for example, from the sale of cotton and sugar. As a consequence, fears of family starvation are not so prevalent in these high rainfall areas and it may be possible to seek methods of planned marketing and development in such parts.

In these high rainfall areas of potential development, the veterinary departments concerned need to practice a standard of tick-borne and other disease control adequate to maintain disease stability. In the longer term, and depending on geographical location, it is desireable that supplies of animal disease medicines be readily available in the high potential areas. Coupled to this would be the need for the employment of adequate numbers of veterinary and animal health personnel to advise on the use of such medicines. The advent of land tenure or equivalent concept may demand a much higher clinical input from veterinary and animal health personnel. Should land tenure be accompanied by a reduction in livestock numbers, then individual animals would assume more importance on both monetary and emotional bases. This will almost certainly require re-appraisal of livestock and, veterinary and animal health personnel ratios.

If economic development of the livestock industry is to take place in the African subsistance agricultural environment, it is essential that agricultural, veterinary and animal health personnel develop a less westernised approach to the problem, have an understanding of the subsistance environment and have, at the least, a sympathetic appreciation of the rigours of life in the drought-prone subsistance agricultural environments of southern and eastern Africa. Furthermore, efforts to stimulate economic development of the livestock industry require direction, and in this connection anthropological contributions are pertinent.

African sayings and African subsistance agriculture

There is an east African saying that "the cow's grave is man's belly". Taken together, these sayings emphasise the importance of milk and meat in African subsistance agriculture and, the very close relationship, which exists throughout southern and eastern Africa, between man and his cattle. If economic development of the livestock industry, and the cattle industry in particular, is to take place in a sustainable manner in the African subsistance agricultural environment, these concepts should not be ignored.

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Book review/Boekresensie

MICROBIOLOGY FOR VETERINARY TECHNICIANS

M IKRAM and E HILL. 1st Edition, American Veterinary Publications, Inc. 1991. pp 213. Price $24.50 (ISBN 0-939674-30-0)

In the preface the authors state that the book was written as an inexpensive reference for veterinary technicians, practising veterinarians, agriculture students, workers in the biological field and other allied health professionals. To achieve this objective, the book is divided into 3 main sections, namely Bacteriology, Mycology and Virology. These sections are divided into a considerable number of short chapters dealing with classification, morphology, pathogenesis, treatment, control and laboratory procedures. In this respect the book is well set out. It is also pleasing to find chapters introducing the concepts of host resistance and pathogenesis. However, the authors have in a few instances neglected to distinguish clearly between bacterial and viral pathogenesis. In the section on bacteriology, viruses are cited as examples to explain concepts such as tissue affinity, chemical barriers and biological barriers. In terms of host resistance the statement that: "the skin is free of micro-organisms" is incorrect and does not consider the important role that the normal flora play.

The correctness of certain statements was not sufficiently checked. In a description of *Cl. botulinum,* it is stated that: "Only types A and B are of major veterinary importance", whereas types C and D are the toxigenic types most commonly involved in bird and animal disease all over the world. Further examples of incorrect information include New Castle disease described under the heading of Togaviruses, equine influenzavirus included with the paramyxoviruses and herpesviruses described as single-stranded DNA viruses.

The section on laboratory procedures in bacteriology is practical and includes for the most part up-to-date information. However, some information may be misleading to the laboratory technician. In this regard one may refer to the statements that most *Actinomyces* species are aerobic and that *Borrelia* is an aerobic organism.

The inclusion of therapy and control in a book on microbiology for veterinary technicians is debateable. To state that: "Tetanus toxoid and antitoxin should be given after castration, tail docking and traumatic wounds", will be confusing to persons not familiar with the prin-ciples of vaccination.

This book covers the subject of veterinary microbiology satisfactorily from the viewpoint of the veterinary technician, and may serve to provide basic information as envisaged by the authors.

M J van Vuuren

ERRATUM

Perinatal lamb mortality - its investigations, causes and control - K G Haughey. Journal of the South African Veterinary Association 62: 78-91

1. Table 2, page 81 - prevalence of meningeal haemorrhage in the death after birth column should read "20-75%" instead of "35-55%.

2. Table 4, page 83 - "Mean (± SD)" should read "Mean (± SEM)".

3. Column 2, page 84 - insert the heading "Aids to controlling perinatal mortality" immediately above the subheading "Genetic aids".

THE EFFECT OF ENDOGENOUSLY PRODUCED CARBON MONOXIDE ON THE OXYGEN STATUS OF DOGS INFECTED WITH *BABESIA CANIS*

J H TAYLOR*, A J GUTHRIE** and A LEISEWITZ***

ABSTRACT

Carboxyhaemoglobin fractions were found to be significantly higher ($P<0,05$) in dogs (n=5) with severe babesiosis than in control subjects (n=5). The enzymatic conversion of haem to biliverdin by haem oxygenase is the only known source of endogenous carbon monoxide. We propose that the increased production of endogenous carbon monoxide following the haemolysis associated with babesiosis, results in the carboxyhaemoglobinaemia observed in this study. The superimposition of carboxyhaemoglobinaemia on severe anaemia results in further compromise of the oxygen status of dogs with severe babesiosis, and probably plays a role in the pathogenesis of the hypoxic tissue damage associated with this condition.

Key words: Canine, babesiosis, *Babesia canis*, carbon monoxide, carboxyhaemoglobin

Taylor J.H.; Guthrie A.J.; Leisewitz A. **The effect of endogenously produced carbon monoxide on the oxygen status of dogs infected with *Babesia canis*.** *Journal of the South African Veterinary Association* (1991) 62 No. 4, 153-155 (En.) Department of Physiology, Faculty of Veterinary Science, University of Pretoria, Private Bag X04, 0110 Onderstepoort, Republic of South Africa.

INTRODUCTION

Babesia canis infection of dogs often results in tissue hypoxia which increases anaerobic tissue metabolism, production of metabolic acids, shock and death[1]. The transport of oxygen from the lungs to the tissues depends on haemoglobin function. Maegraith et al. observed a left shift of the oxygen dissociation curve (ODC), and hypoxic effects that were similimar to those associated with canine babesiosis, in normal dogs following subcutaneous injection of sodium nitrate[2]. These authors were, however, unable to detect methaemoglobin in the blood of dogs infected with *B. canis*. They therefore speculated that the hypoxic tissue damage that occurs with canine babesiosis was due to local factors within the tissues themselves[2].

Following haemolysis, haem is metabolised, iron is salvaged and biliverdin formed. This reaction is catalysed by haem oxygenase. The enzyme specifically catalyses the cleavage of the α-methene bridge. This pathway requires molecular oxygen and produces carbon monoxide (CO) as a metabolite[7]. The α-methene carbon is the only known endogenous source of CO[7]. The affinity of CO for the iron of haem is 218 times greater than that of oxygen[6]. It competes with O_2 for binding sites on the haem, thus lowering the effective haemoglobin concentration of the blood. Binding of CO also influences the haemoglobin molecule to such an extent that the remaining binding sites have an increased affinity for oxygen. This, however, decreases the ability of haemoglobin to off-load oxygen at the tissues[5].

The advent of accurate multiwavelength oximeters for in vitro measurement of oxygen saturation, haemoglobin concentration, and carboxy- and methaemoglobin fractions has resulted in the development of a number of new parameters to describe the oxygen status of patients[5,6]. The oxygen extraction tension (P_x) is one such parameter[5]. P_x is defined as the oxygen tension required to extract 2,3 mmol of oxygen per litre of blood (at constant pH and pCO_2). This parameter integrates the effects of changes in arterial pO_2, oxygen capacity, and oxyhaemoglobin affinity on the delivery of O_2 to the tissues[5]. At present, P_x appears to be the most relevant parameter for evaluating the overall arterial oxygen status[3].

The purpose of the present investigation was to compare the carboxy- and methaemoglobin concentrations of blood from dogs with *B. canis* infections with that of clinically healthy dogs. Furthermore, the theoretical effects of increased carboxyhaemoglobin concentrations on the oxygen status of dogs with clinical babesiosis were investigated.

MATERIALS AND METHODS

Anaerobic, heparinised blood samples were collected aseptically from the cephalic veins of control dogs (n=5) and dogs with natural *B. canis* infections (n=5). The control group comprised 5 clinically healthy dogs. The 5 principal subjects were all presented at the Outpatients Clinic of the Faculty of Veterinary Science, University of Pretoria. Clinical examination revealed that all subjects were pyrexic and examination of a stained blood smear (CAMS Quick stain, C.A. Milsch (Pty) Ltd) showed the presence of *B. canis* parasites. Four of the 5 subjects were also severely anaemic. Due to the severity of the condition in all of the subjects, they were admitted for further investigation. Blood samples were collected prior to the administration of any therapeutic agents.

The total haemoglobin concentration

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(ctHb), carboxyhaemoglobin fraction (FCOHb) and methaemoglobin fraction (FMetHb) of the blood samples were measured using a semi-automated haemoximeter (OSM3, Radiometer A/S, Copenhagen). The instrument was calibrated using the standard calibration procedures and standard solutions (Hemoximetry-Qualicheck, Radiometer A/S, Copenhagen) were processed prior to, and following analysis of samples.

The oxygen status algorithm[6] was used to calculate estimates of the oxygen extraction tension (P_x) for a healthy dog, an anaemic dog and a dog with anaemic and concurrent carboxyhaemoglobinaemia. The means of the FCOHb and FMetHb of blood from control and principal subjects were compared using an analysis of variance procedure in SAS[4]. Significance was set at $P<0,05$.

Table1: **Total haemoglobin concentration, carboxyhaemoglobin and met-haemoglobin fractions of blood from healthy dogs and dogs with severe clinical babesiosis**

	Control (n=5)			*Babesia canis* infected (n=5)		
	Mean	SD	Range	Mean	SD	Range
ctHb (g ℓ^{-1})	159,4	18,5	133,0-185,0	70,8	54,7	39,0-168,0
FCOHb (%)	1,1*	0,2	0,8-1,4	3,0*	1,3	1,6-5,2
FMetHb (%)	0,0	0,0	0,0-0,0	0,8	0,4	0,5-1,0

SD - Standard deviation
ctHb - total haemoglobin concentration
FCOHb - Carboxyhaemoglobin fraction
FMetHb - Methaemoglobin fraction
*- Signifies that the means are significantly different ($P<0,05$)

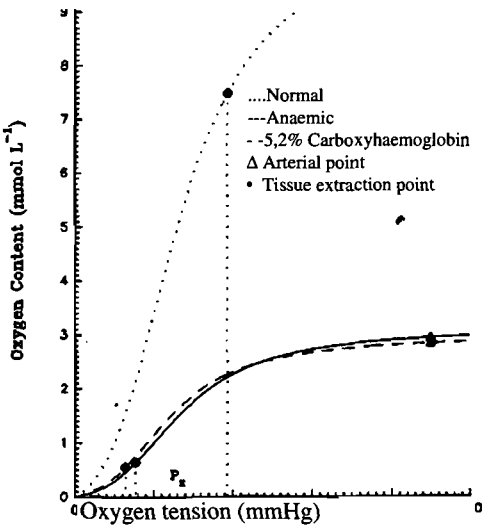

Fig. 1: **Derived blood oxygen binding curves of blood from a normal dog, from an anaemic dog and from a dog with anaemia and concurrent carboxyhaemoglobinaemia. The arterial blood oxygen tension was taken to be 90,0 mmHg in all cases.**

RESULTS

The haemoximetry data are summarised in Table 1. The mean of the FCOHb of blood from the dogs with clinical babesiosis was significantly greater than that of the control group of dogs. The means of FMetHb did not differ significantly between the 2 groups. The oxygen binding curves of blood derived for a dog with a ctHb of 160 g ℓ^{-1} and a FCOHb of 1,1%, for a dog with a ctHb of 47 g ℓ^{-1} and a FCOHb of 1,1% and for a dog with a ctHb of 47 g ℓ^{-1} and a FCOHb of 5,2% are depicted in Fig. 1. The estimated oxygen extraction tensions (P_x) of the blood from the normal dog, the anaemic dog and the dog with anaemia and concurrent carboxyhaemoglobinaemia were 38,6, 15,4 and 12,7 mm Hg, respectively.

DISCUSSION

This study revealed that there was a significant increase in the carboxyhaemoglobin fraction of blood obtained from dogs with severe babesiosis. This increased FCOHb was associated with a marked anaemia in 4 of the 5 principal subjects (mean ctHb of 47 g ℓ^{-1}). The mean methaemoglobin fractions of blood from control dogs and babesiosis cases were not significantly different. This finding supports that of a previous study in dogs[2]. In man, a P_x of less than 33,75 mmHg is considered to be indicative of tissue hypoxia[5]. The P_x value calculated for a dog with a ctHb of 47 g ℓ^{-1} was 15,4 mmHg. This value was approximately 40% that of a normal dog with a ctHb of 160 g ℓ^{-1}. The superimposition of a FCOHb of 5,2% upon a ctHb of 47 g ℓ^{-1} resulted in a P_x of 12,7 mmHg. This implied that the oxygen status of the dog with concurrent carboxyhaemoglobinaemia and anaemia was approximately 20% worse than that of a dog with anaemia alone. The metabolic salvaging of iron from haem is viewed as an essential homeostatic mechanism[7]. This pathway uses O_2 and produces endogenous CO as a metabolite. Normally the CO produced by this reaction is slowly excreted via the respiratory tract and is of little physiological consequence. Following severe haemolysis, however, the amount of CO produced by haem oxygenase may have physiologically significant effects. These effects include a marked shift to the left of the ODC and a reduced effective haemoglobin concentration, resulting in further compromise of the oxygen status of the already anaemic animal. The increased FCOHb with concurrent reduced haemoglobin concentration, is analogous to a superimposition of CO toxicity upon severe anaemia.

We conclude that the increased FCOHb observed in severe cases of canine babesiosis may be important in the pathogenesis of the severe tissue hypoxia often associated with this condition. In the light of these findings, further study of the oxygen status of the blood in less severe cases of canine babesiosis, and in babesiosis of other domestic animal species should be undertaken. Our findings also suggest that therapy of severe babesiosis should be aimed at radical improvement of the oxygen status of the patient. This could include blood transfusion with cross-matched blood, thus limiting further potentially disastrous oxidation of haem, oxygen therapy and measures to shift the ODC to the right. The effect of such threapeutic measures could be quantitated using the recently developed parameters describing the oxygen status of blood.

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Medical Distributors (Pty) Ltd are thanked for kindly supplying the haemoximeter used in this study.

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Book review/Boekresensie

DISEASES AND MANAGEMENT OF BREEDING STALLIONS

D D VARNER, J SCHUMACHER, T L BLANCHARD and L JOHNSON

American Veterinary Publications, Inc., 5782 Thornwood Drive, Goleta, CA 93117 1991, pp 349, 215 figures and 5 tables. Price $44.50 (ISBN 0-939674-33-5)

The contents of this very informative text is divided into 16 chapters each with its own reference list. The first 4 chapters deal with normal processes and procedures including reproductive anatomy and physiology, breeding soundness evaluation, management of breeding stallions and semen collection and preservation. Spermatogenesis and sperm morphology feature strongly in the first 2 chapters with excellent additional information being provided in the many figures included in these 2 chapters. There is, however, in my opinion, the unfortunate use of terms such as "predicting stallion fertility" (p 63) and "fertility examination" (with breeding soundness as an alternative, p 94) in the chapter on breeding soundness evaluation.

The chapter on management of breeding stallions includes detailed sections on estimation of a stud book as well as artificial insemination programmes. In support of the latter, Chapter 4 then deals with a detailed exposition of semen collection, handling and preservation techniques.

Chapter 5 contains a concise explanation of castration techniques and postoperative complications while Chapter 6 deals with sexual behaviour dysfunctions including lack of libido, erection failure, mounting/intromission abnormalities, ejaculatory dysfunction and aggressive behaviour.

Chapters 7-15 deal with diseases and conditions of the genital organs and tract in ascending order from scrotum to prepuce. Where applicable, the contents of each chapter is divided into diagnostic and therapeutic considerations, congenital and familial diseases, physical conditions, toxic diseases, infectious/inflammatory/immune diseases, idiopathic diseases, neoplasia and multifactorial diseases/conditions.

Intersexual conditions are dealt with in the chapter on scrotal diseases; cryptorchidism in the chapter on testicular diseases; epididymal diseases and diseases of the tunica vaginalis in separate chapters, the latter also including hydrocoele and inguinal/scrotal herniation. A separate chapter is devoted to diseases of the spermatic cord including torsion. Subsequent chapters (12-15) deal with the accessory sex organs, uethra, penis (including paraphimosis, paralysis, priapism, phallopexy, amputation and infectious conditions) and prepuce (including phimosis and sarcoid).

The last chapter contains a discussion of diseases/conditions affecting semen including haemospermia, urospermia, abnormal morphology, abnormal sperm motility and oligo-/azoospermia.

I believe this to be a useful book for equine practitioners and students of diseases and amangement of breeding stallions and recommend it as such. Of particular value is the fact that each chapter contains references to all possible conditions/diseases with cross references to the chapters of specific importance relevant to the condition/disease.

H M Terblanche

Disinfestation of irrigated sheep pastures by alternating grazing with cattle

0038Southcott & Barger[1] grazed cattle on sheep pastures for 6, 12 and 24 weeks. After only 6 weeks there were significant reductions in the number of *Haemonchus* and *Trichostrongylus* acquired by tracer sheep, when compared with tracers placed on pastures that were continuously grazed by sheep. Tygerhoek Experimental Station (34°10'S, 19°55'E), Riviersonderend, is a paradise for free-living stages of nematode parasites of sheep. Mixed rye-grass, fescue and lucerne pastures are intensively grazed (26-36 sheep per ha) and in dry periods during summer and autumn, are spray-irrigated (8mm per h for 3h, 3 times per week).

In the summer of 1988, 6 sheep were slaughtered every 6 weeks to carry out total and differential worm counts post mortem. *Teladorsagia* (syn. *Ostertagia)* reached a peak in January, *Haemonchus* in March or April and *Trichostrongylus,* the dominant genus, in August. Despite oral treatment with albendazole (ABZ) (Valbazen, Smithkline Beecham) at a dosage of 3,8 mg kg^{-1} in January, and rafoxanide (RFX) (Ranide, Logos Agvet) at a dosage of 7,5 mg kg^{-1} in February, sheep started dying 26-42 d later, in March and April, with massive mixed infections ranging from 26 819 to 132 973 nematodes.

In 1989 (9 January - 18 July) 2 parallel pastures (± 1 ha each), separated by a barbed wire fence and spray-irrigated as mentioned earlier, were subdivided into strips with electric fences and each strip grazed to depletion before animals were moved to an adjacent, ungrazed strip. South African mutton Merino hoggets (n=84) were divided into 2 groups and allocated to Paddocks A and B. Paddock A was strip-grazed throughout by 39 sheep. Paddock B was strip-grazed as follows: 3 heifers strip-grazed half Paddock B from 11 January to 5 March and 45 hoggets strip-grazed the other half. From 6 March to 14 May the surviving hoggets were transferred to the pasture previously grazed by cattle. Two heifers were discharged and the other grazed the area previously grazed by sheep. On 15 May the remaining heifer was discharged and the surviving hoggets strip-grazed the entire Paddock B.

Anthelmintics were dosed to all sheep (excluding 6 per group to be killed within 4 to 16 d of treatment) as follows: 9 January 1989: ivermectin (IVM) (Ivomec, Logos) (0,2 mg kg^{-1}) per os; 6 March: ABZ per os plus di-iodonitrophenol (DNP) (Mintic, Fisher) (10 mg kg^{-1}) subcutaneously; 1 May: levamisole (LVZ) (Ripercol, Janssen) (7,5 mg kg^{-1}) per os; 26 June: IVM per os.

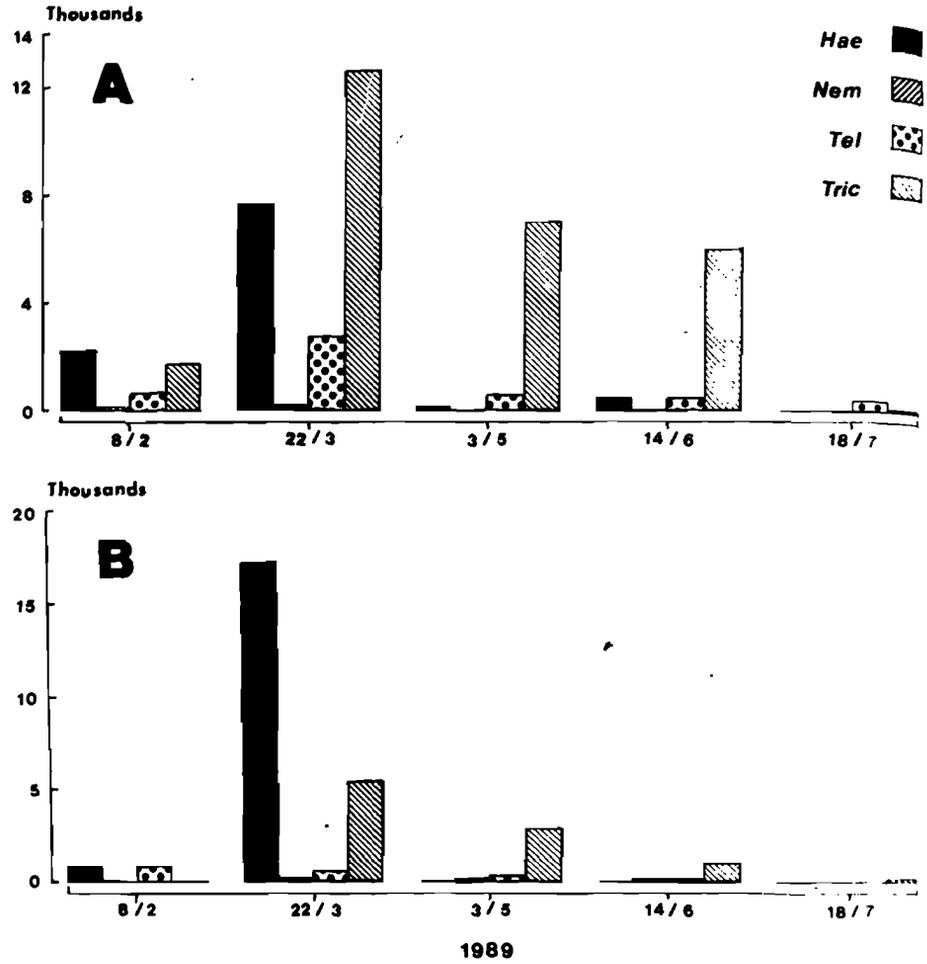

Fig. 1: **Variations in the geometric means of *Haemonchus (Hae), Nematodirus (Nem), Trichostrongylus (Tric)* and *Teladorsagia (Tel)* in Group A (Controls) and Group B (cattle before sheep)**

Six sheep per group were killed for worm counts on 8 February, 22 March, 5 May, 14 June and 18 July respectively. The variations in geometric mean worm burdens of 4 genera are illustrated in Fig. 1.

In March the geometric mean and range of the total worm burdens reached a peak for Group A, namely 28 536 (17 100 - 41 169) and Group B, 27 237 (15 637 - 45 134) but the difference was not significant. In May the reduction for *Haemonchus* was significant at 92,0% (P<0,05). By 14 June, however, Group B [1 939 (493 - 10 912)] had 76,4% fewer nematodes than Group A [8 230 (727 - 42 280)] which was significant (P<0,05). This was due to the combined reduction of *Haemonchus* by 93,5% and *Trichostrongylus* by 83,3% (P<0,05). In July the reduction of 88,2% for *Teladorsagia* was also significant (P<0,05).

These preliminary findings suggest that worm control in sheep grazing on irrigated pastures in the winter rainfall region should involve the following:

1. Test the efficacy of the anthelmintics by the first stage larval reduction test. Narrow spectrum chemoprophylactic drugs effective against *Haemonchus* for 3 months DNP, 7 weeks closantel CSL (Flukiver, Janssen) or 2 weeks RFX should be included, as well as broad-spectrum compounds, e.g. IVM, LVZ and morantel (MRL) (Banminth, Pfizer). No compounds should be prescribed before testing their efficacy in the flock grazing on the farm concerned.
2. Strip-graze with cattle for 3 months from December to February for autumn lambing and June to August for spring lambing before placing pregnant ewes on these pastures. Cattle can become infected with *H. contortus* and sheep with *Haemonchus placei.* Faecal samples

must be collected every 3-4 weeks from calves, first stage larvae harvested and examined microscopically to determine the nature and level of infection.

3. Anthelmintics should be dosed as follows: January: DNP or CSL and any effective broad-spectrum drug; March: DNP or CSL and any effective broad-spectrum drug plus RFX or CSL; May: any effective broad-spectrum drug; September: any effective broad-spectrum drug, plus RFX or CSL.

The inclusion of CSL or RFX in May and September is aimed at the larval stages of *Oestrus ovis* which overwinter in the nasal cavities and sinuses of sheep.

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Book review/Boekresensie

EQUINE MEDICINE AND SURGERY - VOLUME 1 & 2

Patric T Colahan, Ian G Mayhew, Alfred M Merritt, James N Moore (Editors)

4th Edn. American Veterinary Publications, Inc., 5782 Thronwood Drive, Foleta, California 93117. 1991 pp 1850, numerous tables, figures and colour plates (ISBN 939674-27-0).

The fourth edition of *Equine Medicine and Surgery,* published as 2 hard-back volumes, is a multi-author text which endeavours to present the practising veterinarian with information that may improve his service to clients. According to the editors, the book has been "organized ... to follow closely ... steps that the veterinarian follows in making a diagnosis".

The first section of the book deals with "logical approaches to the most common problems as perceived ... by the veterinarian's office", the second section describes the diagnostic and therapeutic approach by the veterinarian and the last section (the major portion of the book) is devoted to individual organ systems. Diseases of multiple body systems and of the cardiovascular, respiratory, alimentary, nervous, reproductive, ocular, musculoskeletal, urinary, endocrine and haemolymphatic systems as well as of the skin are included. The discussion of each of these systems is started with a presentation of specialised diagnostic aids, particular ancillary aids, principles of pathophysiology and methods of therapy of relevance to the particular organ system. The diseases that affect the organ system are then presented and some are discussed under one or more of the following subheadings: epizootiology, lesions and aetiology, clinical signs, diagnosis and treatment. Each chapter is concluded with an extensive list of references, for example, 778 on *Diseases of the alimentary system.*

If it was the intention of the editors to publish a book which would focus on problem-solving, I doubt whether they have succeeded. To start off with, the title of the first chapter *Diagnostic approaches to common presenting complaints* is misleading insofar as this chapter merely lists some 35 complaints/problems/syndromes and then elaborates on these without a genuine attempt to introduce a diagnostic approach. The introductory paragraphs to this chapter, however, state that this chapter presents "a series of short discussions to assist the veterinarian in the planning process". In my opinion the editors have lost a golden opportunity to introduce a problem-solving approach. The list of "common presenting problems" should be expanded to include more clinical signs/syndromes such as jaundice, pale mucous membranes, polydypsia, polyphagia, chronic diarrhoea etc. This section should then also include basic guidelines to a practical approach to the listed problems.

The title of the second chapter, *Principles of patient evaluation and diagnosis,* I find equally misleading - especially with the inclusion of sections such as "the pathophysiology of anaesthesia", a detailed discussion of the different anaesthetic agents and the necropsy procedure. South Africans may find it odd that peripheral blood smear examination is not even mentioned as a diagnostic aid.

As with most multi-author texts, the book has its strengths and its weaknesses. The text on endocrine system disorders is incomplete. Hyperparathyroidism, for example, is not even mentioned. Conditions of local importance, like equine piroplasmosis, are often treated very superficially. Orbi-virus infections like Encephalosis are not even mentioned in the text. In my opinion a book of this nature would have international appeal and an inclusion of detailed discussions on diseases exotic to the countries of the authors would certainly be appropriate.

In any book, indexing is of vital importance. I battled to find information on "osteodystrophia fibrosa/nutritional secondary hyperparathyroidism/calcium-phosphorous imbalance - only to eventually find something on the subject under the listing: "nutrition - bone disorders". The words "calcium", "parathyroid hormone" and "phosphorus" also do not appear in the index. This is but one example. A more extensive and complete index list is something that should be seriously considered in future revisions of the book.

Equine Medicine and Surgery, however remains a valuable source of information for equine practitioners, general practitioners and students. If it does not contain what you were hoping to find in it, it is likely to provide you with one or more references. I have no hesitation in strongly recommending it to everybody with an interest in the health and handling of horses.

J van Heerden

A DESCRIPTIVE STUDY OF THE CANINE POPULATION IN A RURAL TOWN IN SOUTHERN AFRICA

G H RAUTENBACH*, J BOOMKER** and I L DE VILLIERS**

ABSTRACT

The health status of a population of dogs (n=220) from a rural southern African town is described. A cross sectional survey was done to collect the necessary information. All animals examined were mongrels with a mean condition score of 1,93. The oldest dog found in the population was 8 years old. *Rhipicephalus sanguineus* was the dominant tick species encountered on the dogs, *Echidnophaga gallinacea* the dominant flea species, while *Cordylobia anthropophaga* and *Demodex canis* also affected the health status of the population. Fourty five per cent of the population were found to have nematode eggs in the faeces. On clinical examination, 5% of the population were judged to be acutely ill and 27% to be chronically ill. Based on the clinical examination, bloodsmears and laboratory results, 51% of the population had one or more serious clinical conditions at the time of examination. The conditions with the highest point prevalence rate in the community were canine ehrlichiosis (17,2%), transmissible veneral tumour (6,8%), canine distemper (5%), *Cordylobia* infestation (5,5%), trauma (4,1%), and severe malnutrition (4,1%). It was concluded that a significant section of this population was in a chronic state of starvation and malnutrition. There was also a heavy infestation of internal and external parasites and the prevalence of serious diseases in this population was high.

Key words: Canine, disease prevalence, black rural area.

Rautenbach G.H.; Boomker J.; De Villiers I.L. **A descriptive study of the canine population in a rural town in southern Africa.** *Journal of the South African Veterinary Association* (1991) 62 No. 4, 158-162 (En.) Department of Production Animal Medicine, Faculty of Veterinary Science, Medical University of Southern Africa, 0204 Medunsa, Republic of South Africa.

INTRODUCTION

The Faculty of Veterinary Science of the Medical University of Southern Africa established a clinic in the rural village of Maboloka in the district of Odi, Bophuthatswana. The housing in the town is of a moderate to low standard with tin shanty houses predominating. There are no formal sanitary services available in the town. Subjective observations suggest that the occurrence or pattern of diseases in dogs in this area is different from that found in more affluent societies. No previous data on mortality, morbidity or disease occurrence in dogs existed for the area. This paper reports on the results of a cross-sectional survey undertaken in Maboloka.

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MATERIALS AND METHODS

The town Maboloka (25°26'S; 27°51'E) in the district of Odi, Bophuthatswana was divided into 11 sections of more or less equal size. Every fourth house within each section was visited. If the owner consented, one of the dogs of the household was included in the study. Dogs under 3 months of age or with a mass of less than 2,5 kg were excluded from the study, as it was considered deleterious to their general health to collect the amount of blood required for the various diagnostic tests. A total of 220 dogs were sampled, 20 from each section. The size of the dog population was estimated on the results of a mini census which was carried out by counting the dogs of a randomly selected sample of families. The size of the human population was based on the 1985 census results of the Republic of Bophuthatswana.

An attempt was made to obtain a complete history on the dogs included in the survey. The dogs were weighed and their condition was established by a condition scoring procedure[22]. With this procedure a score of 0 indicates extreme emaciation, while 5 indicates obesity. The age of the dogs were obtained by taking the history or alternately by dental examination.

A full physical examination was performed on each animal and animals were graded as either healthy, acutely ill, chronically ill or weak and disabled.

Blood was collected from all cases and a number of haematological and chemical pathology tests were performed. The methodology used and results obtained have been described[12,13].

The final diagnosis was based on the results of clinical findings and laboratory results. The disease rate was calculated within the following parameters:

a. Where cases had more than one distinct clinical condition, all were counted - for example a dog with babesiosis that suffered from a concurrent genital neoplasia would add 2 conditions to the disease rate.
b. In a case where one condition was judged to be a sequel to the primary disease, only the primary disease would be counted - for example in a case with ehrlichiosis with secondary emaciation, only the ehrlichiosis would be added to the disease rate list.

External parasites were collected from 6 body areas for later identification. These body areas were the eylids and one cm of skin area around the eyes; the ears, including the base of the ear, the external and internal pinnae and the ear canal; a rectangular area of 10 x 10 cm on the lateral thoracic wall; the 4 feet of the animal from the carpus and tarsus down to the toes; a rectangular area of 10 x 10 cm on the tail-root of the dog, extending from the tail root cranially; and an area of 2 cm on either side of each groin. All the parasites present in these areas were collected except for fleas, of which only a representative sample was taken.

Faecal samples were collected during rectal examination and nematode egg counts were done using the modified

McMaster technique[5,14]. The faecal examination also included a macroscopic examination for cestode proglottids.

The mean and standard deviations were determined for the recorded parameters and where applicable, the data were tested for normal distribution.

RESULTS

At the time of the study, the human population of Maboloka was 25 800, the number of houses were 3 583 and there were an estimated 2 329 dogs present in the town. The human to dog ratio was 11,1 to 1 and there were 0,68 dogs per dwelling.

All the animals were mongrels of a mixed genetic background. The sex distribution was 56,4% male, 43,6% female, giving a sex ratio of 1,29 to 1. None of the bitches sampled had been sterilised and only 4 males had been castrated. The mean estimated age of the dogs was 30,8 months with a range of 3 to 96 months. The mean mass of the dogs sampled was 13,2 kg with a range of 2,5 to 45 kg and a standard deviation of 7,19 kg. These data were tested for normal distribution and the test values conformed to a Gaussian distribution by 93,2%. Of the 220 dogs sampled 57,7% were unrestrained, 15,5% were chained for certain periods of time, 25,5% were permanently chained and 1,4% were kept permanently in cages.

It was extremely difficult to obtain any history from the owners or relatives present. Elementary questions about age, appetite and habitus were often answered in vague and inaccurate terms and persistent cross examination would elicit completely different answers to the same question. Even with the unreliable history, it became apparent that only a small proportion of the population had been vaccinated for rabies or distemper.

The mean condition score was 1,93 with a range of 0,5 to 3,5 and a standard deviation of 0,82. Eighteen dogs attained a score of 3,5 which was the highest score awarded, and 16 attained a score of 0,5 which was the lowest score awarded.

On clinical examination alone, 148 dogs (67,3%) were judged to be relatively healthy, 11 (5%) were acutely ill, 60 (27,5%) were chronically ill and one dog was judged to be weak and debilitated due to starvation.

On analysis of the final diagnoses, based on the clinical examination, bloodsmear and laboratory results, 51% (113) of the animals were found to suffer from one or more clinical conditions that were deemed serious enough to require veterinary intervention. A list of the 146 conditions that were diagnosed are presented in Table 1. Parasitic conditions were only included in this list if it was obviously the cause of a state of disease. The total number of ticks collected over the period was 7 398. Of these, 7 337 (99%) were *Rhipicephalus sanguineus* while *Rhipicephalus appendiculatus* (0,08%), *Amblyomma* species (0,54%) and *Rhipicephalus simus* (0,2%) were also present.

Fleas collected consisted of mixed infestations of *Ctenocephalides felis* (28,4%), *Ctenocephalides canis* (1,9%) and *Echidnophaga gallinacea* (70,2%). A total of 299 fleas were collected. It must be stressed that no attempt was made to collect all fleas seen and only representive samples were taken. *E. gallinacea* was especially plentiful and some animals had massive infestations on the ears and around the eyes.

Other external parasites identified were the lice *Heterodoxus spiniger* (4 dogs) and *Trichodectes canis* (one dog), and the larvae of *Cordylobia anthropophaga* on 12 dogs. Three dogs were infested with *Demodex canis*.

Samples of faeces were successfully collected from 209 of the 220 dogs examined. Of these, 95 or 45,5% were positive for nematode ova with the heaviest infestation being 7 500 eggs per gram. Proglottids of *Taenia* species were found in 4 faecal samples, while egg capsules or segments of *Dipylidium caninum* were present in 7 samples. Coccidia oocysts were found in one faecal sample with a count of 900 oocysts per gram.

DISCUSSION

The human/dog ratio is often used as an indicator of canine over-population. The Maboloka human/dog ratio suggests a relatively low population density when compared to ratios in developed countries which vary between 6,3/1 in France, 9,4/1 in the United Kingdom and 7,3/1 in the USA[17,18]. In communities with a higher socio-economic level, canine overpopulation is usually due to an oversupply of pups[17]. The relative

Table 1: **Clinical conditions observed in a canine population in a rural town in southern Africa expressed as the number affected and the point prevalence rate(PPR) per 100 of the population**

Conditions	No	PPR
Canine ehrlichiosis	38	17,2
Genital neoplasia	15	6,8
Cordylobia infestation	12	5,5
Distemper	12	5,5
Trauma	9	4,1
Emaciation through malnutrition	9	4,1
Canine babesiosis	6	2,7
Infectious cyclic thrombocytopaenia	5	2,3
Demodectic mange	3	1,4
Lameness	3	1,4
Pyoderma	3	1,4
Abscessations	2	0,9
Keratitis and blindness	2	0,9
Cryptorchidism	2	0,9
Flea-bite dermatitis	2	0,9
Acute moist dermatitis	2	0,9
Canine hepatozoonosis	2	0,9
Phymosis and paraphymosis	2	0,9
Chronic renal disease	2	0,9
Valvular insufficiency	2	0,9
Tick toxicosis	1	0,45
Stomoxys wounds (extensive)	1	0,45
Sinusitis	1	0,45
Solar dermatitis	1	0,45
Seborrhea sicca	1	0,45
Interdigital granuloma	1	0,45
Femur fracture	1	0,45
Conjunctivitis (primary)	1	0,45
Cellulitis	1	0,45
Anal gland impaction	1	0,45
Other	2	0,9
Total	146	

Table 2: **Internal parasites identified in a canine population in a rural town in southern Africa**

Species	Stools examined	Stools positive	%	Mean eggs per gram
Ancylostoma spp.	209	84	40,2	296,6
Toxocara leonina	209	10	4,8	28,7
Toxocara canis	209	4	1,9	13,4
Taenia spp.	209	4	1,9	-
Dipylidium caninum	209	7	3,3	-

underpopulation that seemed to exist in Maboloka, may be due to the high death rate of especially young puppies in the area. It is obvious, in the light of the freedom of movement and the low sterilisation rate, that it is not due to breeding control.

The fact that 100% of the sample population were of mixed genetic background is probably a reflection of the socio-economic background of the owners. Robinson[16] reported that the proportion of purebred dogs in 4 American states varied from a high 71,4% to a low 36,8%. In a southern African study, 70% of the dogs were found to be purebred[10]. Breed predisposition may well be disregarded as a variant in epidemiological research in this study as this is an exclusive mongrel population.

The sex distribution found in this population is not unlike the findings of other surveys. Robinson[16] surveyed populations with a male to female distribution of 51,8 to 48,2%, 51,1 to 48,9%, 52,7% to 47,3% and 63,6 to 36,4% with the male population more numerous in all the groups. Odendaal[10] reported a ratio of 52% males to 48% females in a survey of 600 dogs in South Africa.

The assessment of age in this survey is in most cases an estimate. Robinson[16] reported a mean age of 56,4 months in the populations he surveyed, with 10,1% of the population over 10 years old. In a southern African survey it was found that 13% of the canine population was over 10 years of age[10]. In Maboloka, no dogs were found to be over 8 years of age and the estimated mean age of 30,8 months compares poorly with the 56,4 months of dogs in North America. The apparent lack of longevity in this dog population may be due to the poor health status and high disease rate.

Dogs under 2,5 kg were excluded from the study, therefore the average mass of 13,2 kg cannot be regarded as representative of the population.

The difficulty in obtaining a history, is mainly ascribed to language difficulties, but disinterest of the owners in the animals as individual pets probably played a role.

The method of condition scoring proved to be an effective way of eliminating frame size and mass as variables and is reputed to be highly repeatable in production animals[22]. The generally poor body condition of the sample population was clearly caused by a number of factors. An insufficient and imbalanced diet, heavy infestations of internal and external parasites and chronic wasting disease probably all played a role.

The observed disease prevalence was high, even when compared to that of a population of caged, intensively kept dogs[12,13]. Canine ehrlichiosis was the disease with the highest suspected prevalence, but not one diagnosis could be substantiated by the demonstration of morulae in a bloodsmear. The diagnosis of ehrlichiosis in this study was based on the clinical signs of the disease and the presence of leukopaenia, anaemia and hypergammaglobulinaemia.

The prevalence of genital neoplasia was very high. The tumours seen varied from ulcerating masses of 100 mm in diameter to smaller cauliflower-like growths of 20 mm or more. Most of the tumours resembled the clinical appearance of transmissible venereal tumours (TVT) as described elsewhere[7]. As 5 of the 7 biopsy samples were diagnosed histologically as TVT, it is probable that most of the others that were not biopsied were indeed also TVT lesions. In a survey to establish the incidence of neoplasms, it was found that TVT was the eighteenth most frequent type of tumour encountered and its morbidity in the female genital tract was 15 of a total of 322 neoplasms examined[3]. These observations contrast with those in the present study. Factors that may have played a role in the high prevalence of TVT in Maboloka, could include the relatively closed population and a high population turnover rate, the transmissible nature of TVT and its potential of becoming endemic in an area, the strong demand for puppies and the fact that mating is therefore encouraged, the fact that hardly any dogs in this population are sterilised, and lastly, immunodeficiency caused by endemic parasitism, malnutrition and ehrlichiosis. It has been reported that a possible familial immunodeficiency to TVT may play a role in the incidence of this condition[20].

The dogs that were diagnosed as suffering from extreme emaciation were free from clinically detectable diseases and it is therefore presumed that malnutrition and verminosis were the main reasons for their debilitated condition. The high prevalence of clinical distemper is to be expected in the Maboloka population because of a rapid turnover of population, unrestrained movement, concomitant diseases and because dogs are rarely vaccinated.

Of the 6 cases with *Babesia* positive blood smears, 2 had low parasitaemias with a relatively normal haematocrit and red cell count. These cases were assessed to be in a premune carrier state. The other 4 cases had low to moderate parasitaemias with low haematocrits and red cell counts and were regarded as acutely ill. In chronic conditions, surveys of this nature detect not only cases of diseases acquired fairly recently, but also those of relatively long duration. Conversely, acute diseases such as babesiosis have less chance of detection and therefore a prevalence rate of 4 cases out of a population of 220 is high. The fact that acute babesiosis is usually fatal if not treated, is an indication that this population probably has a high mortality rate overall. This high mortality rate may have practical implications for animal health officers working in the area. If 220 dogs were to be vaccinated for rabies, for instance, and 4 dogs were to die during the following few days, it is clear that the programme would be discredited. In this respect, vaccinating large numbers of dogs at a central vaccination point would also need to be re-evaluated in view of the high prevalence of contagious diseases within the dog population.

Harvey described a thrombocyte-specific rickettsial micro-organism isolated from a dog which was readily transmitted experimentally to adult dogs by intravenous inoculation of infected blood[8]. He could not establish the natural mode of transmission, but did establish that the dog from which the organism had been isolated, had a heavy tick infestation. A cyclic parasitaemia with a concomitant thrombocytopaenia was seen in infected dogs which gave rise to the name infectious cyclic thrombocytopaenia. The micro-organisms were ultrastructurally very similar to *Ehrlichia canis*. In the present survey, the blood smears of 4 animals had similar organisms in their thrombocytes, while a further one case was suspicious. All these cases had ticks collected from them, but none could be described as heavily infested if compared to the mean number of ticks (33,4 per animal) collected. Clinically, one of these cases was diagnosed as suffering from chronic

ehrlichiosis while another had a concomitant infection of *Babesia canis*. The other positive cases did not show appreciable signs of ill-health.

The high prevalence of *R. sanguineus* corresponds well with results obtained by Horak[9]. The absence of *Haemaphysalis leachi* in this survey corresponds with a previous finding that this species may be considered to be rare in the central and north-western Transvaal[19].

The frequency distribution of the flea species identified in the present study differs appreciably from that of other surveys. In an extensive survey in Egypt, *Ctenocephalides felis felis* was the most frequently encountered flea species on dogs, followed by *Pulex irritans* and *Ctenocephalides canis* with only a few *Echidnophaga gallinacea* being encountered[1]. In an Irish study no *E. gallinacea* were found on dogs in the Dublin area and *C. canis* was the dominant species encountered[2]. Guzman[6] also found *C. canis* to be the most frequently encountered flea on dogs in New Zealand, followed by *C. felis felis* and *P. irritans*.

Although only token samples of fleas were collected, it was clear that *E. gallinacea* presented a major problem in the area, clustering together in large groups around the eyes and on the ears of dogs. The preponderance of this species is probably due to the close contact between free-ranging poultry and dogs. Although the burdens of *E. gallinacea* were very large, they did not seem to cause much damage other than superficial wounds. It is known that young chicks are easily killed by these fleas and that even adult birds may succumb to heavy infestations. It is thus probably that these fleas have a deleterious effect on their canine hosts as well, especially in the case of young and weak animals.

Infestation with *Cordylobia anthropophaga* had a high prevalence for a parasite that usually remains on a host for only 8 - 15 d. Some of the dogs had heavy infestations in excess of 50 larvae. Severe infestation seemed to have a deleterious effect on the health of young and small dogs in particular. It is possible that the cause for the high prevalence of this parasite is a combination of the hot climate, coupled with the unhygienic surroundings in which a large percentage of the animals were kept. *Stomoxys calcitrans* bites caused extensive superficial wounds in only one case, but a great number of the dogs had minor wounds that corresponded in appearance to those caused by *Stomoxys*.

There was a high prevalence of ova of *Ancylostoma* spp. when compared with the reported prevalence of 16,5% in the Pretoria area and 24,3% found in a national survey[21]. Female *Ancylostoma* spp. lay large numbers of eggs and in this survey egg burdens of up to 7 500 eggs per gram were found. Due to a number of factors, however, this study may underestimate the real thread of ancylostomiasis. It has been proven that as high as 65% of the *Ancylostoma* worm burden may be retarded as L 3, and faecal examination fails to reveal their presence in a host[15]. This may have an appreciable influence on the detectable prevalence. This survey was also undertaken during an exceptionally dry year. Hookworm larvae are highly susceptible to dessiccation and therefore it is possible that the prevalence of *Ancylostoma* spp. may be even higher after a good rainy season.

It is probable that *Ancylostoma* infestation has a significant influence on the general health and well-being of the canine population of Maboloka and that it seriously affects the survival rate of puppies. Collins[4] stressed the possible effect of nematodes on human health. It is probable that *Ancylostoma* larvae would have an adverse effect on the health of the human inhabitants of Maboloka in view of the unsanitary living conditions prevailing there.

Verster[21] reported a prevalence of 5,5% for *Toxascaris leonina* in dogs examined by her and a prevalence of 3,7% where only stool samples were examined. These results compare well with the findings in this study. The prevalence of *Toxocara canis* was appreciably lower in the present study than the 12,5% prevalence previously reported[21]. It is possible that the prevalence of *Toxocara* spp. was underestimated in the present study, because dogs under 3 months of age were excluded.

Centrifugal flotation with a sugar solution is an effective method of determining the presence of most nematodes. *Spirocerca lupi* is the exception, with poor egg recovery in a sugar solution[15]. Flotation is also unsatisfactory for the detection of cestode infestation. The use of arecoline hydrobromide has been advocated for the collection of faecal samples to identify cestodes[11]. This method is, however, not without risk to the patient and in a survey where the co-operation of the owners of the animals was essential, it was deemed unwise to use this drug. Although no sign of *Echinococcus granulosus* infestation was found in this survey, the presence of this parasite has been firmly established in the general area[21]. It is also probably that the prevalence of *D. caninum* is much higher than may be surmised from the results of this survey.

It is evident that the population described is afflicted by a heavy infestation of external and internal parasites, a high prevalence of infectious diseases, starvation, malnutrition and a high mortality rate. If the situation in this town is typical of many southern African rural towns, the findings of this survey are a cause for concern. There appears to be a lack of veterinary involvement in the less priviledged communities in southern Africa which certainly affects the health status of the canine population, but may also have an impact on the health status of the human population.

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MITRAL VALVE E POINT TO VENTRICULAR SEPTAL SEPARATION IN THE DOG

R M KIRBERGER*

ABSTRACT

Mitral valve E point to septal separation (EPSS) was measured ($\bar{x}$=3,27 ± 1,29mm) in healthy non-anaesthetised Beagle and German Shepherd dogs (n=50). The minimum and maximum values recorded were 1 and 6mm respectively. Breed, age, sex, mass and heart-rate had no significant effect on the EPSS value.

Key words: Mitral E point septal separation, dog, M-mode echocardiography

Kirberger R.M. **Mitral valve E point to ventricular septal separation in the dog.** *Journal of the South African Veterinary Association* (1991) 62 No. 4, 163-166 (En.) Department of Surgery, Onderstepoort Veterinary Academic Hospital, University of Pretoria, Private Bag X04, 0110 Onderstepoort, Republic of South Africa.

INTRODUCTION

Originally M-mode echocardiography was the only echocardiographic technique available for studying cardiac pathology. During the last decade, however, two-dimensional (2-D) and Doppler echocardiography have been developed. These are now used routinely together with M-mode echocardiography. The latter still remains the most accurate method of anatomical cardiac mensuration as well as determining subtle changes of valvular or wall motion[7]. The mitral apparatus and interventricular septum can readily be displayed by means of 2-D echocardiography using described techniques[1,7]. By using M-mode echocardiography the phasic motions of these structures can be displayed over time at a specific anatomical location within the heart (Fig. 1). The various openings and closings of the anterior mitral leaflet are labelled (Fig. 2). The end of systole, immediately prior to the opening of the valve, is point D. Initial rapid diastolic inflow through the mitral valve results in peak opening of the anterior leaflet at point E. The nadir of mid-diastolic closing is F. This is followed by atrial contraction with a second peak flow at A. The valve begins to close with atrial relaxation and complete closure occurs at the start of ventricular systole at C[7]. Echocardiographic measurement of the minimum separation between the anterior mitral leaflet E point and the left ventricular septal surface is known as the E point to septal separation (EPSS). This is a useful, practical and easily reproducible clinical index of left ventricular inflow of blood and consequently left ventricular function[4]. The major virtue of EPSS as a clinical measurement is its simplicity[10].

This study was designed to determine EPSS values in the normal dog. Factors which influence EPSS during cardiac disease will be discussed briefly.

MATERIALS AND METHODS

Beagles (n=21) and German Shepherd dogs (GSD) (n=29) of both sexes were used (Table 1). They were divided into 10 groups according to age and breed. The dogs were housed under similar conditions and were routinely vaccinated and dewormed. Dogs were allocated into 5 age groups according to availability, attempting to have equal numbers of sexes, breeds and dogs of different litters in each group. No dog was evaluated more than once. All dogs underwent a clinical examination, lead II electrocardiogram, clinical-pathological evaluation[14] [red blood cell count, haematrocrit, haemoglobin, white blood cell count, thrombocyte count, total plasma proteins (measured by refractometer)] and a 2-D echocardiographic examination[2]. The results of these examinations were all found to be within normal range.

The dogs were manually restrained in right lateral recumbency and scanned from below using a specially constructed table[15]. The right parasternal long axis view was used to take all measurements. A real time, multipurpose, linear and sector scanning, diagnostic ultrasound unit was used (Aloka SSD 630, Aloka Co., Japan). A 7,5 MHz electronic convex sector probe with dynamic frequency scanning or a 3 MHz cardiac mechanical sector probe was used. The choice of probe depended on the size of

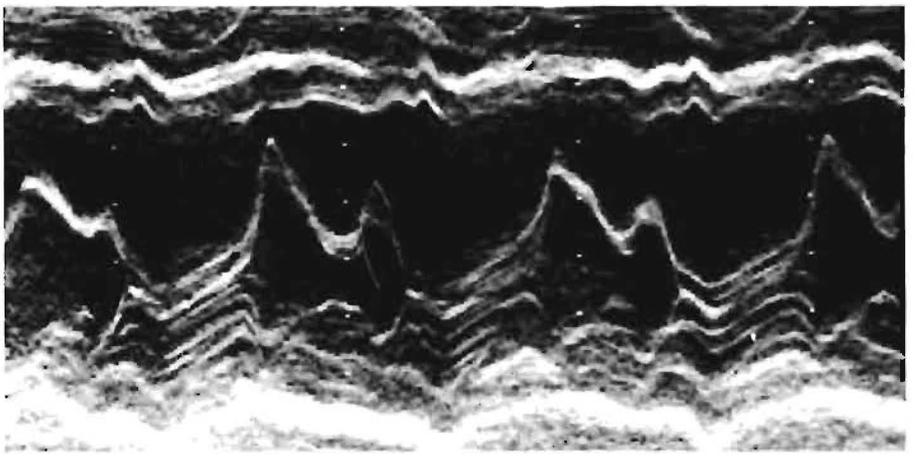

Fig 1: **M-mode echocardiogram of normal motion of the anterior mitral valve leaflet**

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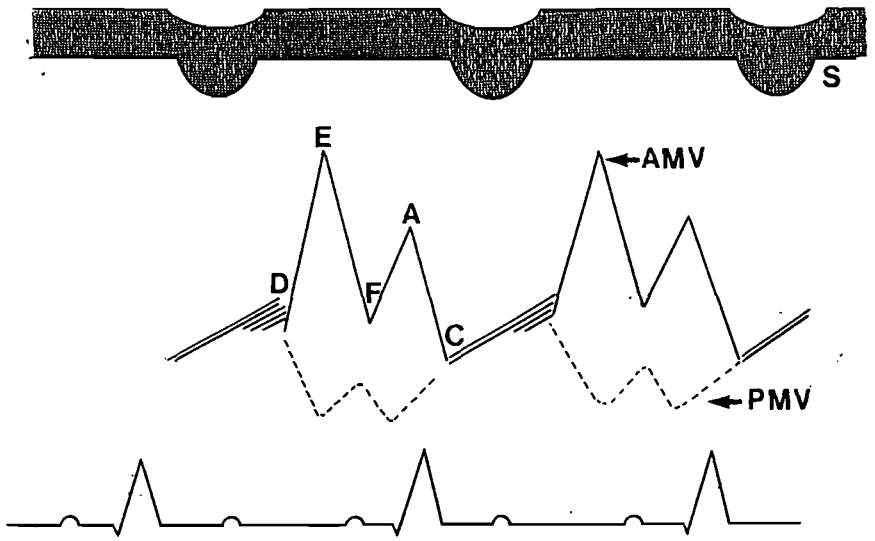

Fig. 2: **Schematic representation of mitral valve motion as visualised by M-mode echocardiography from the right parasternal long axis view. AMV and PMV are anterior and posterior mitral valve respectively. D is the end of ventricular systole, E is the peak opening of the mitral valve during early diastolic flow, F is the nadir of initial diastolic closing, A is the peak mitral valve opening during atrial contraction and C is the complete closure of the valve at the start of ventricular systole**

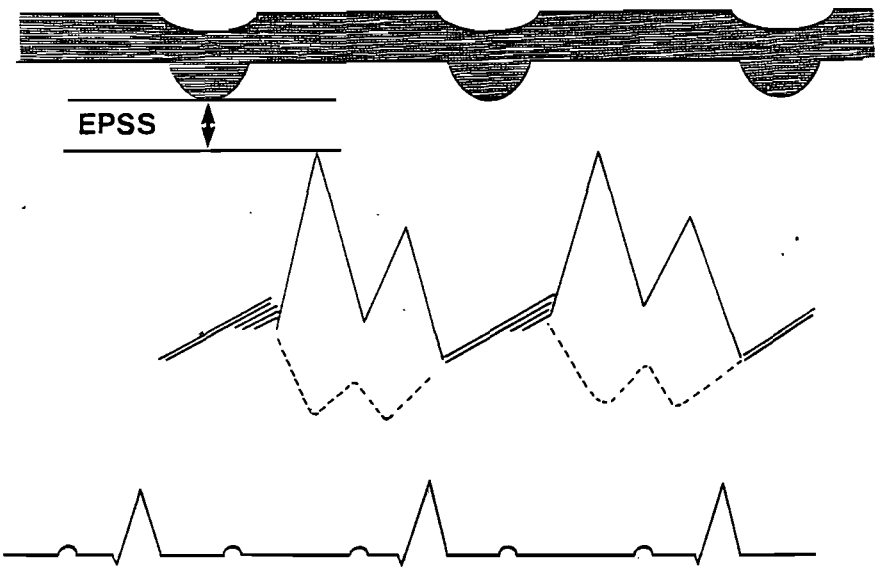

Fig. 3 **Schematic representation of the measurement of EPSS**

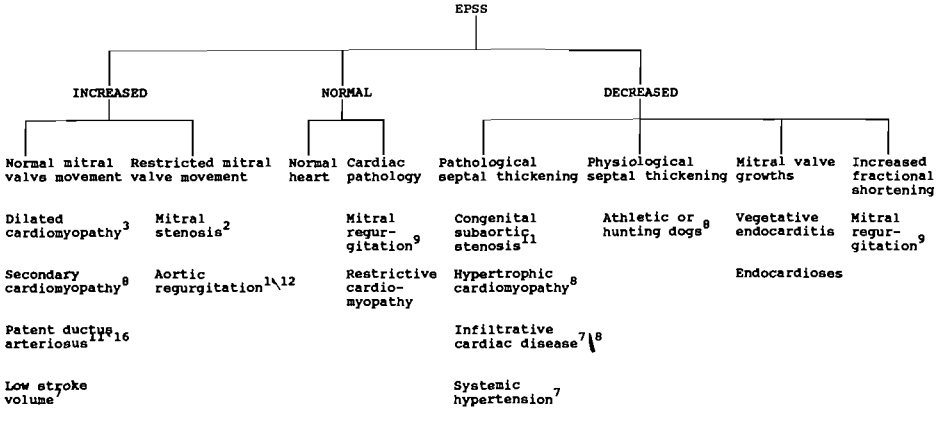

Fig. 4: **Flow diagram of some possible conditions that may alter EPSS in dogs**

the patient. Paper speed was set at 150 cm per min.

EPSS was measured by taking the perpendicular distance between the E point and a tangent drawn to the most posterior point reached by the interventricular septum within the same cycle[10] (Fig. 3). Heart rate was determined simultaneously from a lead II electrocardiogram. An alternative method, which measures the distance from the E point to the septum directly opposite to it, has been described but was not evaluated[5].

The influence of the following was investigated by undertaking an analysis of variance (ANOVA)[13]:

- Breed, age, and sex as main factors. The ages were grouped into dogs ≤22 weeks, dogs 32-43 weeks and dogs ≥97 weeks old.
- Heart-rate and individual body mass as co-variants.
- Interactions of breed with sex, breed with age, sex with age and mass with age. Age was grouped as above. Mass was taken as 3 groups; dogs <10 kg, dogs 10-25 kg and dogs>25 kg.

This study was approved by the ethical committee of the Veterinary Faculty of the University of Pretoria

RESULTS

Measurements were obtained in 49 dogs. One measurement could not be obtained due to the presence of particularly thick chordae tendinae. The mean EPSS value was 3,27 mm with a standard deviation of 1,29. The minimum and maximum values recorded were 1 and 6 mm respectively. The EPSS values for the various subgroupings are given in Table 2.

Breed, age, sex, mass, heart-rate and interactions of breed with sex, breed with age, sex with age as well as mass with age had no significant effect on the EPSS value ($P<0,05$). P values are recorded in Table 3.

DISCUSSION

Increasing age and increasing mass as indicated by mass groupings, males versus females or the larger breed tended to result in increasing EPSS values (Table 2). There was however, no statistical significant difference between the various groupings, although mass did have the lowest P value (0,3102).

In patients with cardiac pathology, EPSS may be increased, normal or decreased. The latter may be a negative value as the E point and the most posterior movement of the septum do not necessarily occur at the same time[7]. In man, normal EPSS values are thought to be less than 5 mm and it has been found to be a reliable indicator of left ventricular function[7]. EPSS has a strong negative correlation to ejection fraction, providing aortic regurgitation and mitral

Table 1: **Subgroupings of experimental dogs from which E point to septal separation was determined**

Group	Breed	Age weeks	Sex	Mass kg
1	Beagle	8-9	2m;3f	3,6-3,95
2	GSD*	10	2m;3f	7,0-10,0
3	Beagle	22	2m;2f	7,5-9,80
4	GSD	22	3m;3f	12,5-18,1
5	Beagle	32-34	2m;3f	6,3-11,8
6	GSD	34	2m;3f	21,5-26,0
7	Beagle	43	2m;0f	15,4-15,7
8	GSD	43	5m;3f	20,4-32,0
9	Beagle	116-121	1m;4f	10,2-14,2
10	GSD	97-112	2m;3f	20,9-29,3

*German Shepherd dog

Table 2: **Mean EPSS values of Beagle and German Shepherd dogs of different sexes, ages and body masses**

Subgroup	Mean EPSS value	Number of dogs
Females	3,19	26
Males	3,35	23
Beagle	2,86	21
German Shepherd dogs	3,57	28
Mass		
<10 kg	2,50	16
10-25 kg	3,42	26
>25 kg	4,57	7
Age group		
≤22 weeks	2,55	20
32-43	3,74	19
≥97 weeks	3,80	10

Table 3: **P values of main factors, co-variants and interactions influencing EPSS values in normal dogs**

Breed	0,8425
Sex	0,6978
Mass	0,3102
Age group	0,9818
Heart-rate	0,9411
Breed * sex	0,8578
Breed * age group	0,7798
Sex * age group	0,9005

stenosis are absent[5,10]. This valid predictor of ejection fraction was found to be independent of left ventricular size[4]. EPSS is, however, only a qualitative and not a quantitative indicator of left ventricular function[4]. The above findings also apply to children and EPSS is used in pediatric echocardiography to assess left ventricular function[6].

In dogs, a variety of conditions may influence EPSS and ventricular function (Fig. 4). An increased EPSS value can occur with a dilated left ventricular chamber due to volume overload, or as result of a reduced fractional shortening. A decreased mitral valve excursion will also result in an increased EPSS value. Decreased EPSS values may occur as result of a thickening of the septum or of the anterior mitral valve leaflet. It must be emphasised that a normal EPSS value may also occur in the presence of severe cardiac disease.

EPSS is a simply determined cardiac measurement, which, if altered, should alert the examiner to the possibility of a cardiac problem. This is particularly the case where the examiner does not routinely do echocardiography and is not familiar with other signs of cardiac disease that can be visualised by echocardiography. EPSS can guide the clinician in the right direction and, with the use of the other echocardiographic means available, a definite diagnosis can be made.

ACKNOWLEDGEMENT

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Book review/Boekresensie

TOWARDS THE CONTROL OF EMERGING BLUETONGUE DISEASE

P Roy

Oxford Virology Publications, London 1991 pp xii and 71, 44 figures (8 colour plates) No price indicated (ISBN 1 873530 00 5)

This volume is not strictly a monograph, but rather a glossy summary of Prof. Roy's work on the bluetongue virus, published by the company Oxford Virology, which sponsored much of her research. It consists of a brief review of the disease and the virus (Chapter 1), which was obviously written as an introduction and not meant to be exhaustive, either in a historical sense or in scientific detail. This is followed by an outline of previous genetic studies on the virus, again very brief and rather superficial. The main part of the text is contained in Chapters 3 and 4, on the structure of the bluetongue virus genome and on the structural-functional analysis of the viral proteins, respectively.

After a brief discussion of the molecular cloning strategies that were followed, the results of sequence studies on the 10 RNA segments of mainly BTV type 10 are presented. A very useful attribute of the book is the way in which this data is presented in tables, e.g. Table 3 summarising the non-coding end sequences, lengths and coding assignments of the BTV-10 RNA species. The complete nucleotide sequence of all 10 segments as well as restriction maps of each is given in an addendum. A short discussion of each segment and its function in terms of the protein it codes for, follows. There is some unnecessary duplication in this discussion with that of the various proteins in the following chapter.

The author's most important contribution to bluetongue virus research is the development and application of baculovirus recombinants to study the function of BTV proteins. The efficient production in relatively large quantities, of the individual proteins in the baculovirus system, enabled her to confirm conclusively many of the functions previously determined by others, and to extend previous results. The most elegant application of the technology, however, lies in the production of virus-like particles in insect cells infected with 2 double recombinants containing 2 inner capsid and 2 outer capsid genes respectively. These viral-like particles, which closely resemble natural varions lacking RNA, have been shown to possess considerable potential as safe second generation vaccines in collaborative studies with researchers at Onderstepoort and in Australia. These ongoing studies could lead to vastly improved vaccines and diagnostic tests.

A confusing aspect of the text is the fact that it was necessary to include the results obtained by many other workers in order to give a logical summary of the author's research. Although references are given, it is often impossible to determine the original source of much of the information. On the whole, however, the book presents a very readable and well illustrated overview of the present state of bluetongue virus research.

DW Verwoerd

'N ANALISE VAN INFORMELE VEEARTSKONSULTASIES TYDENS RADIOPROGRAMME

J S J ODENDAAL* EN H VAN ARK**

ABSTRACT

A sample of informal consultations based on letters which were sent to a radio programme in which the theme was informal veterinary consultations were analysed. The animal-owner profile, the identification of animals involved and the need which motivated owners to seek such consultations were investigated. The results indicated that the most typical animal owner to participate in programmes of this nature was an adult woman living in the country and the most common animal involved was an intact male dog. The most common area of concern was ethological of nature. Behavioural problems were the most common ethological problem, followed by management and care. The significance of this study for the veterinarian is probably that it recognises the role and importance of informal consultations, that deficiencies in formal consultations are indicated and that it emphasises the need of readily available knowledge of ethology, that informal consultations are unsuitable for serious cases, and that informal consultations give further insight into human-animal interaction from a veterinary perspective.

Key words: Informal veterinary consultation, analysis

Odendaal J.S.J.; Van Ark H. **An analysis of informal veterinary consultations during radio programmes.** *Journal of the South African Veterinary Association* (1991) 62 No. 4, 167-170 (Afr) Department of Veterinary Ethology, Faculty of Veterinary Science, University of Pretoria, Private Bag X04, 0110 Onderstepoort, Republic of South Africa.

INLEIDING

Alhoewel informele veeartskonsultasies 'n bekende verskynsel is, is dit nog nooit bestudeer nie. Die rede daarvoor is hoofsaaklik omdat dit sporadies en in 'n ongestruktueerde situasie plaasvind. Formele veeartskonsultasies daarenteen vind meesal plaas terwyl daar 'n verstandhouding tussen veearts en kliënt is dat professionele fooie vir so 'n konsultasie gehef sal word. Informele veeartskonsultasies kan dus gedefinieer word as raad en verduidelikings wat veeartse aan diere-eienaars, wat nie noodwendige kliënte is nie, verskaf sonder dat 'n kliniese of enige ander ondersoek plaasvind, behandeling toegepas word of vergoeding geëis word. Die veearts se mening berus dus uitsluitlik op die geskiedenis en 'n beskrywing van die probleem of geval. Die veearts trek geen direkte voordeel uit informele konsultasies nie, maar kan moontlik indirek daarby baat deur die bekendstelling van die professie of praktyk.

Ten spyte van die feit dat informele konsultasies 'n moeilike area van ondersoek is, behoort dit nie geïgnoreer te word nie, omdat dit deel van die veearts se professionele beeld en diens uitmaak. Die doel van hierdie ondersoek is dus om 'n analise te maak van die diere-eienaar en die soort diere in so 'n situasie, asook die redes vir die aanvraag van informele veeartskonsultasies.

METODE

Hierdie ondersoek is deur middel van 'n geleentheidsteekproef uitgevoer. Die inligting is versamel uit informele konsultasies wat oor Radio Suid-Afrika uitgesaai is. Die steekproef was landswyd en het oor 2 jaar (1987-1988) gestrek. Die meeste programme se teikengehoor was huisvroue, terwyl 8 programme ook vir die jeug aangebied is. Die formaat van al die programme het behels dat luisteraars per brief probleme met hul diere aan 'n veearts kon voorlê vir informele konsultasie. Navrae oor enige spesie is aanvaar. Agt veeartse is uitgenooi om konsultasies te behartig met betrekking tot gevalle wat spesifiek in hul veld van besondere ondervinding en kennis geval het. Een was in privaat praktyk, terwyl die ander verbonde was aan die Fakulteit Veeartsenykunde, Universiteit van Pretoria.

Aan die einde van die tydperk is die briewe wat ontvang is, geanaliseer ten opsigte van die eienaarprofiel (geslag, ouderdom, woonplek), diereprofiel (spesie, ras, geslag, vrugbaarheid, ouderdom) en die redes waarom die eienaars informele konsultasies aangevra het. Slegs briewe wat al die voorgenoemde inligting bevat het, is vir die steekproef gebruik. Die data is met behulp van 'n rekenaar verwerk. Chi-kwadraat-toetse is gebruik om frekwensies in verskillende groeperings te vergelyk. Waar meervoudige vergelykings van groeperings uitgevoer is, is die toetspeil ($\alpha = 0,05$) deur die aantal vergelykings gedeel, terwille van Fouttipe I-beskerming. In die teks word die waarskynlikhede waarteen getoets is, aangegee. Die program FREQ.EXE is vir die analises gebruik.

RESULTATE

'n Totaal van 352 briewe is in die streekproef gebruik. Die frekwensies ten opsigte van geslag, woonplek en ouderdom van korrespondente, asook die diersoorte betrokke word in Tabel 1 weergegee.

Daar was geen betekenisvolle verskille ($P>0,05$) in die verhouding van jonk tot volwasse tot oud tussen vroulike korrespondente woonagtig op die platteland en in die stad nie. Die ouderdomsverhoudings vir die manlike korrespondente het ook nie tussen die platteland en die stad verskil nie ($P>0,05$). Die ouderdomsverhouding tussen alle vroulike en alle manlike korrespondente was egter hoogs betekenisvol verskillend ($P<0,001$). Hierdie ouderdomsverhoudings word in Fig. 1 uitgebeeld.

Daar is bevind dat die voorkeur ten opsigte van alle diersoorte nie betekenisvol verskil het ($P>0,01$) van die ouderdomsvoorkoms van die vroulike korrespondente nie, vir sowel dié wat op die platteland as dié wat in die stad woonagtig was. Die enigste betekenisvolle verskil ($P<0,01$) was die verhou-

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Ontvang: Maart 1991 Aanvaar: Julie 1991

Tabel 1: **Frekwensie van geslag, woonplek en ouderdom van korrespondente en diersoorte wat betrokke was by informele konsultasies tydens deelname aan 'n radioprogram (n=352)**

Geslag		Jonk	Volwasse	Oud	Spesies	Totaal
		18	98	10	Honde	126
	Platteland	10	19	0	Katte	29
		12	13	1	Voëls	26
		6	6	0	Ander	12
	Totaal	46	136	11		193
Vroulik						
		9	55	2	Honde	66
	Stad	8	14	3	Katte	25
		11	11	2	Voëls	24
		3	1	0	Ander	4
	Totaal	31	81	7		119
		4	6	4	Honde	14
	Platteland	2	1	0	Katte	3
		1	0	0	Voëls	1
		1	1	0	Ander	2
	Totaal	8	8	4		20
Manlik						
		5	4	0	Honde	9
	Stad	2	0	2	Katte	4
		5	0	2	Voëls	7
		0	0	0	Ander	0
	Totaal	12	4	4		20
	Groottotaal	97	229	26		352

ding van jong tot volwasse vroue vir honde teenoor voëls vir beide woonplekke. Geen voorkeur in diersoorte was dus in die verskillende ouderdomsgroepe van die korrespondente aanwesig nie, behalwe dat ongeveer eweveel jong as volwasse vroue navraag oor voëls gedoen het. Die verhouding van die diersoorte wat by die korrespondensie betrokke was, word in Fig. 2 uitgebeeld. Die ouderdomsverdeling van die diere word in Fig. 2 weergegee. Daar was egter geen betekenisvolle verskille (P>0,0167) tussen die 3 dieresoorte ten opsigte van die verhoudings van die ouderdoms-groepe nie.

Die besonderhede ten opsigte van die geslag en vrugbaarheid van diere word in Tabel 2 weergegee. Onvrugbaarheid verteenwoordig gekastreerde en gesteriliseerde diere. Die verhouding van manlik tot vroulik het geen betekenisvolle verskille (P>0,0167) tussen die 3 diersoorte getoon nie. Die verhouding van vrugbaar tot onvrugbaar vir manlike honde het nie betekenisvol

Fig. 1: **Ouderdom van manlike en vroulike korrespondente tydens radioprogramme oor informele veeartskonsultasies**

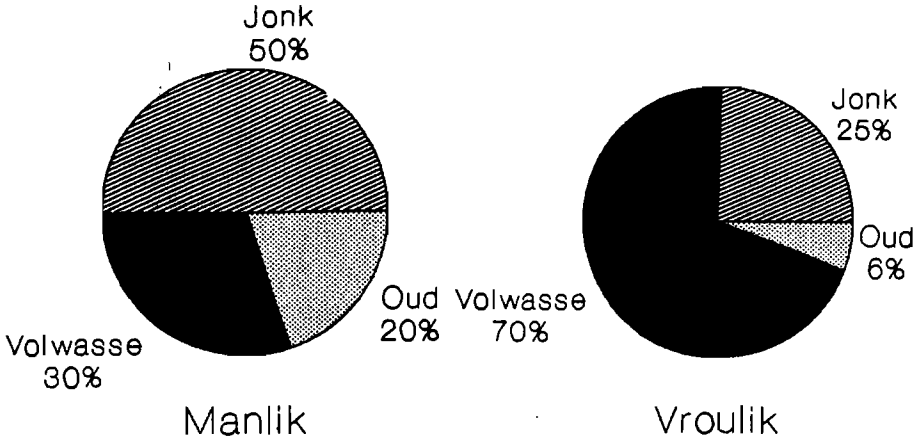
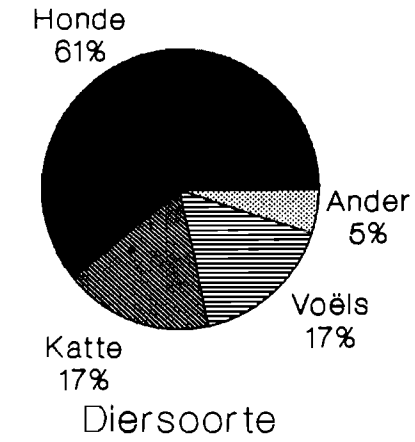
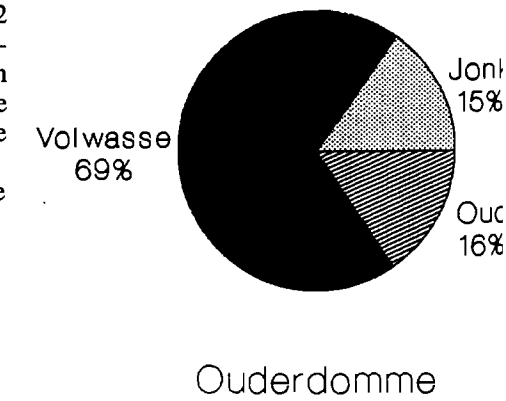


Fig. 2: **Diersoorte en ouderdom van diere soos gereflekteer in radioprogramme oor informele veeartskonsultasies**





verskil (P>0,0125) van dié vir manlike katte nie. Dieselfde tendens was vir vroulike honde en katte waar (P>0,0125). Daar was egter relatief meer manlike as vroulike honde vrugbaar (P<0,001). Alhoewel die frekwensies 'n moontlike voorkeur vir sterilisasie van vroulike katte bo kastrasie van manlike katte aandui, het die frekwensies nie betekenisvol verskil nie (P>0,0125).

Die konsultasiebehoeftes van die korrespondente word in Fig. 3 uitgebeeld.

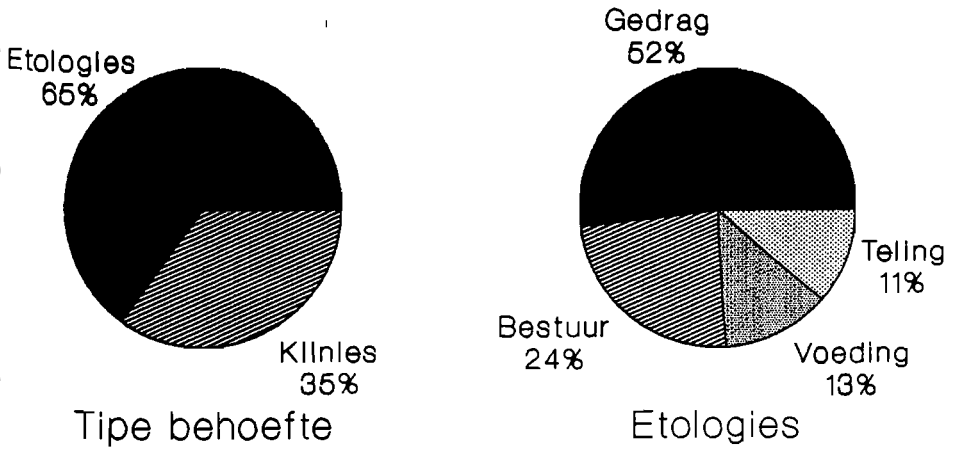
Tabel 2: **Geslag en vrugbaarheid van diere soos gereflekteer in radioprogramme oor informele veeartskonsultasies (n=334)**

Spesie	Geslag	Vrugbaar	Onvrugbaar	Totaal
Honde	Manlik	126	6	132
	Vroulik	58	25	83
	Totaal	184	31	215
Katte	Manlik	30	4	34
	Vroulik	19	8	27
	Totaal	49	12	61
Voëls	Manlik	30	-	30
	Vroulik	19	-	19
	Albei	9	-	9
	Totaal	58	-	58

Daar was 'n hoogs betekenisvolle verskil (P<0,001) in die verhouding tussen diersoorte ten opsigte van kliniese en etologiese behoeftes. As voëls uit hierdie groep gelaat word, is die verskil tussen die diereverhoudings nie betekenisvol nie. Die diereverhoudings vir die 4 onderafdelings van etologiese inligting is ook vergelyk en geen betekenisvolle verskille (P>0,0125) kon gevind word nie (Fig. 3). Besonderhede van die mees algemene diagnoses word in Tabel 3 weergegee.

Altesaam 29 herkenbare honderasse was verteenwoordig, terwyl kruisrasse ongeveer 21% van die rasse uitgemaak het. Van die mees algemeen herkenbare honderasse was Malteestipes, Duitse Herdershonde, Fox Terriërs en Bull Terriërs. Die plaaslike huiskat as ongeïdentifiseerde ras, het nagenoeg 67% van die katrasse uitgemaak, gevolg deur Persiese en Siamese katte. Kouvoëls het 86% van alle voëls uitgemaak, met kokketiele en grasparakiete die mees algemene voëls.

Fig. 3: **Konsultasiebehoeftes van korrespondente van radioprogramme oor informele veeartskonsultasies**



BESPREKING

Informele konsultasie kan handel oor minder ernstige probleme, chroniese probleme, opvolging van formele konsultasies en algemene inligting oor diere. Dit kan aangevra word om 'n tweede mening in te win en sommige diereeienaars verwag selfs kitsoplossings vir ingewikkelde probleme. Ernstige gevalle moet egter deurgaans verwys word vir formele konsultasies.

Alhoewel radioprogramme vir die steekproef gebruik is, word informele konsultasies ook per telefoon en tydens formele konsultasie oor ander diere nie teenwoordig nie, of direk met die veearts buite die formele konsultasie, gevoer.

Die feit dat daar 'n groot behoefte is aan informele konsultasies onder volwasse vroue wat op die platteland woon, is te verwagte as die geleentheid vir die steekproef in ag geneem word. Sulke vroue is minder afhanklik van werk buite die huis en is dalk ook meer aangewese op die radio as kommunikasiemiddel. Verder is veterinêre inligting nie so geredelik beskikbaar as in die stad nie. Die feit dat 91% van alle navrae vanaf vroue gekom het, het waarskynlik niks te maak met die behoefte wat daar in die algemeen bestaan om van veeartskonsultasies, formeel óf informeel, gebruik te maak nie. Ander studies het aangetoon dat vroue in elk geval die meeste betrokke is by huisdiere se versorging[1,2,3,4].

Die volwasse hond, soos ook in ander studies aangetoon, was in hierdie ondersoek ook die mees algemeen betrokke spesie[1,3]. Dit is opvallend dat die behoefte aan konsultasies oor katte en voëls byna ewe groot is. Daar is 'n goeie aanduiding dat die aanhou van kouvoëls aan die toeneem is en dat veeartskonsultasies oor hierdie spesie sal toeneem[2]. Die mees negatiewe tendens uit 'n veearts se oogpunt was die groot aantal vrugbare honde en katte wat in huishoudings aangehou word. Hierdie groep diere het dan ook 84% van die betrokke behoefte aan konsultasie verteenwoordig. Manlike vrugbare honde het meer as 'n derde van al die gevalle uitgemaak en dit lyk of the "weerstand teen kastrasie" nog steeds 'n rol kan speel in die oorsaak van veral gedragsprobleme[2]. Vrugbare tewe en veral mannetjieskatte, het verder tot probleme bygedra.

'n Belangrike bevinding van hierdie studie was die groot behoefte aan etologiese konsultasies, 2 keer soveel as kliniese konsultasies. By die voëls was die verskil besonder groot. Vir elke spesie was gedragsprobleme die grootste komponent van die etologiese probleme. 'n Rede vir hierdie verskynsel kan wees dat eienaars voel dat hulle net bereid is om vir 'n konsultasie te betaal as dit behandeling insluit.

Tabel 3: **Besonderhede van die mees algemene diagnoses onder honde, katte en voëls tydens 'n radioprogramme oor informele veeartskonsultasies (n=150)**

	Honde		Katte		Voëls	
Klinies	Velallergieë	33	Blaasstene	3	Respirasiesiektes	4
			Plaveiselkarsinoom	3		
Etologies verdeel in:						
Gedrag	Fobie en vrees	15	Sproei	4	Uittrek van vere	9
	Aggressie	9	Gebruik van membrana nictitans	3	Leer praat of makmaak	7
	Onaanvaarbare urinering	6				
Bestuur	Vlooibeheer	8	Vlooibeheer	4	Algemene versorging	8
	Uitval van hare	6	Uitval van hare	3		
Voeding		10		6		9
Totaal		87		26		37

Informele konsultasies moet as 'n wesenlike aspek van veeartsenykunde erken word. Dit kan waarskynlik bydra tot die beeldbou van die professie en veeartspraktyk en ook leemtes wat in formele konsultasies mag voorkom, aantoon. Informele konsultasies is nie geskik om ernstige gevalle te hanteer nie. Dit het dus beperkinge en dra ook 'n sekere risiko. Dit kan voorts waarskynlik bydra tot verdere begrip van die mens-dier-interaksie in veterinêre perspektief, omdat dit 'n aanduiding kan gee van óf bykomende belangstelling in die dier se welsyn, óf om professionele advies te bekom sonder om daarvoor te betaal.

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Book review/Boekresensie

STUDENTS' GUIDE TO VETERINARY MEDICAL TERMINOLOGY

P E COCHRAN

American Veterinary Publications, Inc., 5782 Thornwood Drive, Goleta, CA 93117, USA 1991 pp 274 Price not mentioned (ISBN 0-939674-31-9)

This guide was written to help veterinary students understand the construction, meaning and pronunciation of terms used in the veterinary medicine. Instead of presenting long lists of words for memorisation, the proper rules of word construction and word analysis are elucidated, enabling the student to construct or define words based on an understanding of their component parts.

The book was designed in the form of a programmed guide so as to provide information in a sequential learning order and can be used for self study. The guide is divided into 11 lessons, each of which ends with word drills. Crossword puzzles are often used in these drills. Answers to all word drills are given in an appendix. A comprehensive glossary, exceeding 100 pages in length, is also given.

Non-American students should be wary of Americanised spelling such as "diarrhea" and typical American phonetic rendering of pronunciation:
anabolic (AN-uh-BAH-lik), antibiotic (AN-ti-by-AH-tik), pox (pahks), lockjaw (lahk-jah), farrow (FAIR-oh)< etc.

All in all this is a fun way to come to grips with veterinary terminology.

B L Penzhorn

DIE GEVAAR VAN WYE VERSPREIDING VAN WEERSTANDBIEDENDHEID TEEN WURMMIDDELS DEUR VELDRAMPRESTASIETOETSSENTRA

J A VAN WYK*, P C VAN SCHALKWYK**, G F BATH***, H M GERBER# en REGINA M R ALVES*

ABSTRACT

A veld ram performance testing unit consists of an association of stud or commercial ram breeders, who compare the performance of selected rams under field conditions on common pastures. The best performers are subsequently auctioned at public sales. To date, at least 10 Merino veld ram clubs have been established in various centres in South Africa. A strain of *Haemonchus contortus,* which was isolated from the pastures of one of these performance testing units, was found to be resistant to ivermectin, oxfendazole and rafoxanide. Closantel, levamisole and disophenol were more than 99% effective. The wide dispersal of the rams after testing, constitutes a potential danger for dissemination of helminths with resistant genes. Precautionary methods should include careful routine monitoring of drug susceptibility on the communal pastures, on the farms of individual members and thorough deworming of rams before they leave the testing unit. The prevention and control of resistance in such testing units are discussed, but it is emphasised that this is difficult, particularly if the worm strains on the communal grazing have become resistant to some of the anthelmintic groups.

Van Wyk J.A.; Van Schalkwyk P.C.; Bath G.F.; Gerber H.M.; Alves R.M.R. **The threat of wide dissemination of anthelmintic resistance by veld ram performance testing units.** *Journal of the South African Veterinary Association,* (1991) 62, No. 4, 171-175 (Afr.) Section of Helminthology, Veterinary Research Institute, 0110 Onderstepoort. Republic of South Africa.

INLEIDING

Die afgelope tyd het veral telers van Merino skaap in die Republiek van Suid-Afrika sogenaamde veldramklubs, wat daarop gemik is om stoetramme onder veldtoestande vir prestasie te toets, gestig[1]. Ramme van 'n groot aantal telers word tesame op veld, wat naastenby met die heersende toestande op die meerderheid van die plase in die streek ooreenstem, met mekaar vergelyk.

Die voordeel van die stelsel is dat die ramme op veldweiding grootgemaak word en dat direkte vergelyking van die diere van verskillende stoetboere moontlik is[4]. By die 10 klubs wat sedert 1984 gestig is, word jaarliks ongeveer 2 000 ramme onder natuurlike voedingstoestande getoets[1]. Weerstandbiedendheid van wurms teen wurmmiddels het sodanig toegeneem dat weerstand teen al 5 groepe wurmmiddels reeds in Suid-Afrika waargeneem is[13]. 'n Wye verskeidenheid van wurmsoorte is betrokke, en 'n stam van *Haemonchus contortus* wat weerstandbiedend teen 4 van die 5 beskikbare groepe wurmmiddels is, is reeds beskryf[7,14,15].

In Februarie 1988 het die bestuur van 'n veldramtoetseenheid na dosering met ivermektien, vermoed dat daar probleme met die doeltreffendheid van die middel teen haarwurm mag wees. Daaropvolgende dosering met bensimidasool middels kon blykbaar ook nie die probleem oplos nie.

Die skape op die toetseenheid word blykbaar 3-weekliks in die somer gedoseer, en 5-weekliks in die winter. Die dosis van elke middel wat toegedien is, is beraam deur tydens elke dosering die massas van die diere te bepaal, en die dosis te baseer op die gemiddeld van die gemiddelde massa en die swaarste diere in die groep.

By die toetseenheid is die ramme by opname ongeveer 3-6 maande oud, en hulle bly vir 11 maande op die weiding. Die gesamentlike weiding van ramme is ook deur 'n kudde van ongeveer 200 teelooie gedeel.

Nadat voorlopige ondersoeke (gebaseer op vermindering van wurmeiertellings na dosering) getoon het dat daar wel 'n moontlikheid van weerstandbiedendheid was, is 'n stam van haarwurm vanuit skape op die weiding geïsoleer. Hierdie artikel is 'n verslag oor die evaluering van die haarwurmstam vir weerstandbiedendheid teen wurmmiddels.

MATERIAAL EN METODES

Merinoskape (n=37) is vir 7 maande voor die aanvang van die proef op betonvloere wat tweemaal per week gevee is, aangehou. Die diere is aanvanklik met levamisool (Ripercol-l, Janssen) teen 'n dosis van 7,5 mg kg^{-1} ontwurm. Twee weke voordat die proefneming begin het, is ontwurming met levamisool teen 15 mg kg^{-1} herhaal. Misondersoeke van die skape 7 dae later deur middel van totale flottasie[18], het negatiewe resultate opgelewer.

Die isolaat (stam van *H. contortus)* waarmee die skape besmet is (Tabel 1), is verkry deur kulture van mis van verskeie skape op die prestasietoetssentrum, wat naby Pietermaritzburg geleë is, te maak.

Op die dag van dosering (Dag 0) is alle skape se massas bepaal voordat hulle volgens die gemiddelde eiertelling gerangskik, en met behulp van tabelle van lotstoevallige getalle aan proefgroepe toegedeel is. Aangesien die groepe ongelyke getalle skape bevat het, is die metode wat deur Van Wyk & Gerber[12] beskryf is, gebruik om die skape aan die verskillende groepe toe te ken. Die skape is besmet en vervolgens op Dag 0 met verskillende wurmmiddels behandel (Tabel 1).

Op Dag 7 is al die skape geslag. Die abomasuminhoud van die skape is gekonsentreer deur dit deur siwwe met openinge van 150 µm op ander siwwe met openinge van 37 µm te was, waarna die residue op beide siwwe geformaliseer en vir wurmherwinning behou is.

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#Oorlede

Ontvang: Maart 1990 Aanvaar: September 1991

Tabel 1: **Besmetting van skape met *Haemonchus contortus* en daaropvolgende behandeling met verskillende middels**

DAG	BEHANDELING
-31	Besmet skape elk met ongeveer 1 020 L3 *H. contortus*
-30	Besmet skape elk met ongeveer 1 020 L3 *H. contortus*
-29	Besmet skape elk met ongeveer 680 L3 *H. contortus*
0	Doseer 6 skape met ivermektien* (0,2 mg kg^{-1})
	Doseer 4 skape met oksfendasool** (5,0 mg kg^{-1})
	Doseer 5 skape met rafoksanied*** (7,5 mg kg^{-1})
	Doseer 6 skape met klosantel# (5,0 mg kg^{-1})
	Doseer 4 skape met levamisool## ((7,5 mg kg^{-1})
	Spuit 4 skape met disofenol### (10,0 mg kg^{-1})
	Doseer 6 skape met water, as kontroles
+7	Slag 37 skape vir wurmherwinning

* Ivomec, Logos
** Synanthic, Logos
*** Ranide, Logos
\# Flukiver/Seponver, Janssen. Die aktiewe bestanddeel van beide Flukiver en Seponver is klosantel respektiewelik 5% en 2,5% konsentrasie), wat teen dosisse van 10 mg kg^{-1} en 5 mg kg^{-1} respektiewelik aanbeveel word.
Flukiver is teen 'n dosis van 5 mg kg^{-1} gebruik.
Ripercol-l, Janssen
Trimintic LA, Cyanamid (onderhuids toegedien)

Wurmladings van die verskillende skape is vanaf makroskopiese ondersoek van 'n 20% gelykdelende monster (alikwot) van elk se gesifte abomasuminhoud en die totale mikroskopiese ondersoek van die verteerde abomasumslymvlies beraam. Ongeveer 2% van elke skaap se abomasuminhoud is ook mikroskopies ondersoek.

Tensy anders gestel, stem die metodes vir wurmeiertellings, vir die maak van miskulture vir differensiële larwetellings, en vir besmetting van die diere ooreen met dié van Reinecke[9]. Vir berekening van die meetkundige gemiddelde wurmlading per proefgroep, is 'n waarde van een toegeken by die skape waaruit geen wurms herwin is nie.

Die doeltreffendheid van die verskillende middels is aan die hand van die volgende formule beraam:

$$\% \text{ doeltreffendheid} = 100 - \frac{B\ 100}{K}$$

waar B en K die meetkundige of rekenkundige gemiddelde wurmladings van onderskeidelik behandelde en onbehandelde kontrole diere is. Beide die meetkundige en die rekenkundige gemiddelde doeltreffendheid van die verskillende wurmmiddels wat gebruik is, word in Tabel 3 gelys, ten einde te toon dat beide metodes tot groot mate ooreenstem, wat betref die indeling van die doeltreffendheidsvlak van elke middel.

Die wurmladings van die verskillende behandelingsgroepe is deur middel van variansieanalise vir 'n bloklose proefontwerp [na $\log_{10}$ (x + 1) transformasie] en die Bonferroni metode vir meervoudige vergelykings met mekaar vergelyk[10].

RESULTATE

Die gemiddelde wurmladings van kontrole en behandelde skape, en doeltreffendheidsgegewens word in Tabel 2 weergegee.

Die meetkundige gemiddelde wurmladings van die groepe skape wat met ivermektien, oksfendasool en rafoksanied behandel is, het nie betekenisvol van dié groep onbehandelde kontrole skape verskil nie ($p>0,05$). In teenstelling daarmee, was die verskille tussen die meetkundige gemiddelde wurmladings van die groepe skape wat met klosantel, levamisool en disofenol ontwurm is, en die kontrole-groep wel betekenisvol ($p<0,05$).

BESPREKING

Die 3 middels waarteen die veldram stam van *H. contortus* weerstand ontwikkel het, sorteer volgens die klassifikasie van Arundel[3] almal onder verskillende groepe.

Hierdie stam van haarwurm is dus waarskynlik weerstandig teen middels uit 3 van die 5 moderne chemies onverwante groepe verbindings wat vir die beheer van haarwurm beskikbaar is.

By veldramklubs soos hierdie, waar die getoetste stam van *H. contortus* geïsoleer is, is die kanse goed dat by minstens sommige van die lede weerstandbiedende stamme sal voorkom. Stoetboere is oor die algemeen geneig om hulle diere meer dikwels te ontwurm as ander, en daar bestaan 'n omgekeerde korrelasie tussen die doseringsinterval en die mate waartoe weerstandbiedendheid ontstaan[6,8]. Verder, omdat die boere onafhanklik besluit oor hulle doseerprogramme, is daar teoreties gesproke ook 'n goeie kans dat weerstand teen verskeie wurmmiddelgroepe by die verskillende lede van die klub sal bestaan.

Gegewe die strawwe doseerprogram op die gesamentlike weiding van 'n veldramklub, en die verskeidenheid van wurm genetiese materiaal wat daarop byeengebring word, is dit waarskynlik dat weerstandige helmintstamme wat ingevoer word, deur seleksie "uitgesif" sal raak, en mettertyd tot stamme met veelvuldige weerstand aanleiding sal kan gee. Dit is ook te verstane dat daar by sulke klubs 'n neiging sal wees om ramme wat vergelyk word, baie doeltreffend teen die nadelige effek van wurms te beskerm sodat wurms nie 'n rol in die ramme se produksie kan speel nie. Trouens, indien die ramme nie teen wurms beskerm word nie, sal haarwurm in groot gedeeltes van die somerreënstreke sinvolle vergelyking van ramme bykans onmoontlik maak, aangesien selfs vrektes in die afwesigheid van gereelde dosering moontlik is. Onder sulke toestande van strawwe dosering (soos elke 3 weke in die haarwurmseisoen by die betrokke toetseenheid waar ons ondersoek ingestel het) kan vatbare wurmstamme hul nie teen weerstandige stamme

0038-2809 Jl S.Afr.vet.Ass. (1991) 62(4):171-175

Tabel 2: ***H. contortus*** **stam van die veldramtoetseenheid: wurmladings van onbehandelde kontroles en van skape wat met ivermektien, oksfendasool, rafoksanied, klosantel, levamisool of disofenol behandel is**

Behandeling	Wurmlading				
		Gemiddeld*		Vermindering (%)	
(mg kg^{-1})	Totale wurmlading per skaap	Meet-kundig	Reken-kundig	Meet-kundig	Reken-kundig
Kontroles*	1 048				
	1 147				
	1 393				
	1 733				
	1 743				
	2 152	1 489,4	1 536,0	-	-
Ivermektien	171				
(0,2)	896				
	915				
	928				
	1 317				
	1 555	803,5	963,7	46,1%	37,3%
Oksfendasool	300				
(5,0)	809				
	1 520				
	1 564				
	1 909	1 020,9	1 220,4	31,5%	20,5%
Rafoksanied	306				
(7,5)	321				
	429				
	503				
	1 051				
	1 273	553,4	647,2	62,8%	57,9%
Klosantel	0				
(5,0)	3				
	5				
	6				
	9				
	20	5,7	7,2	99,6%	99,5%
Levamisool	1				
(7,5)	1				
	10				
	15	5,2	6,8	99,7%	99,6%
Disofenol	0				
(10,0)	0				
	5				
	6	2,6	2,8	99,8%	99,8%

*Elk met 10 ml water gedoseer

handhaaf nie, en slegs die weerstandiges bly oor. Die probleem raak des te groter as in aanmerking geneem word dat die ramme wat die toets slaag, ná die veiling, wyd oor die land versprei word.

Voorkoming van weerstandbiedendheid

Vir die voorkoming van weerstand moet onderskei word tussen die veldramklub en sy lede. By laasgemelde is die beheer soortgelyk aan dié op plase van nie-lede, maar moontlik meer belangrik; die situasie op die individuele plase vanwaar die toetsramme oorspronklik kom, gaan bepaal of weerstandige gene in wurmstamme by die sentrale toetsperseel ingebring gaan word, of nie. Die gevare van weerstandbiedendheid wat dié stelsel inhou, behoort by elke lid van die veldramklub ingeskerp te word, ten einde elkeen te oorreed om voorkomings- en beheermaatreëls toe te pas. Gereelde miseiertellings is

noodsaaklik om die doeltreffende beheer van wurms (veral van weerstandige wurmstamme) onder veldtoestande soos dié van die veldramstelsels te monitor. Dit dien om die besoedelingstempo van die weiding deur die skape, en hierdeur dus ook die doeltreffendheid van die wurmbeheerprogram wat gevolg word, aan te dui. Terselfdertyd kan dit 'n vroeë aanduiding gee van weerstandbiedendheid indien eiertellings onmiddellik voor, en ongeveer 14 dae ná ontwurming uitgevoer word.

Vir roetine gebruik kan die gewysigde McMaster eiertelling metode[9] aangewend word, maar in gevalle waar diere na 'n gegewe plaas ingevoer word, of wanneer getoetste ramme verkoop gaan word, is dit verkieslik om die flottasiemetode van Whitlock[18] te gebruik. Met hierdie metode word 5g mis met 40% sukrose-oplossing gemeng, en in 'n plat bottel gelaat sodat die eiers na bo dryf, en aan die glas kleef.

Geïntegreerde beheerstelsels

Die gebruik van geïntegreerde stelsels van beheer (soos die afwisseling van diersoorte en/of kontantgewasse op weiding[17]) skep ongunstige toestande vir vermeerdering van wurms en die gebruik van wurmmiddels kan verminder word.

Geslote kudde

Deur die invoer van diere van elders na 'n geslote kudde te beperk, word voorkom dat weerstandige gene ingevoer word. Wanneer skape (soos teelramme) egter noodwendig na 'n plaas met 'n geslote kudde ingebring moet word, is kwarantyn en deeglike ontwurming noodsaaklik alvorens die nuwelinge op die weiding losgelaat word. Dit is raadsaam om die betrokke diere met rondewurmmiddels uit minstens 2 verskillende groepe met 'n breër werking en een met 'n smaller werking te ontwurm. Indien die skape met lintwurms of slakwurms besmet is, moet hulle ook dáárteen behandel word.

Indien moontlik, moet die wurmmiddels wat gebruik word, meer as 99% doeltreffend wees om die generiese variasie van die wurmpopulasie te beperk[5]. Die dosisse moet liefs volgens die swaarste diere in 'n groep (nie die gemiddelde massa nie) bepaal word[2], sodat geen dier onderdoseer word nie. Sonder om die dosis na potensieël gevaarlike peile te verhoog, sal dit raadsaam wees om dosisse hoër as wat gewoonweg aanbeveel word, te gebruik, ten einde weerstandige wurms uit so 'n kudde te hou.

Veldramklub

Die belangrikste verskil tussen wurmbeheer by die klublede en die klub toetsperseel is dat die kudde by die klub nie geslote kan wees nie, en gereeld nuwe innames vanaf die verskillende lede moet ontvang. By die klub moet uiterste metodes toegepas word, veral wat wurmeiertellings en dosering betref. Sonder uitsondering sal gesorg moet word dat die mis van elke ram wat ingebring word, met die flottasiemetode negatief vir wurmeiers is, alvorens hy op die weiding losgelaat word. Indien strawwe dosering met 'n reeks middels nie daarin slaag om enige ram van wurmeiers te bevry nie, moet hy liefs nie vir toetsing aanvaar, en op die weidings geplaas word nie. Die eiertellings kan ook dien as aanduiding van die persele van lede waar weerstand aan die ontwikkel is.

Wat doserings betref, moet oorweeg word om gereeld dubbeld die aanbevole dosisse van die wurmmiddels aan die toetsramme toe te dien, tensy dit (afhangende van die middel) 'n gevaar sou inhou. Dit is ook raadsaam om 10-14 dae na elke dosering deur middel van 'n misondersoek te verseker dat die dosering doeltreffend was. Op hierdie wyse behoort probleme met weerstandbiedendheid onmiddellik opgespoor te word, en behoort dit moontlik te wees om betyds op te tree alvorens veelvoudige weerstand ontstaan.

Beheer van bestaande weerstand

Sodra weerstand vasgestel word, sal die sensitiwiteit van die betrokke wurmstam vir wurmmiddels met behulp van die wurmeierreduksietoets (of ander geskikte metode) bepaal moet word.

Indien die wurmpopulasie groot is wanneer die weerstand ontdek word, sal dit drasties verminder moet word, bv. deur onttrekking van vee, deur beweiding met alternatiewe diersoorte (bv. beeste of perde), of deur doeltreffende, hoëfrekwensiedoserings met middels waarteen die betrokke wurmstam nie weerstandbiedend is nie[11]. Indien dit wel nodig is om so straf te doseer, sal die sukses daarvan baie noukeurig deur middel van wurmeiertellings gemonitor moet word om die frekwensie so gou doenlik, na mate die besmetting verminder, te verlaag.

Alternatiewe beheermetodes soos beweiding met beeste en kontantgewasverbouing moet voortaan op die betrokke perseel tot die maksimum gebruik word om te verseker dat daar nie oor die langer termyn gepoog word om wurms oormatig met wurmmiddels alleen te beheer nie.

Een moontlikheid vir beheer by die veldramklub is om vir minstens 2 jaar alternatiewe weiding wat nie met weerstandige wurmstamme besoedel is nie vir die toetsramme te bekom. Intussen sal die weiding van die klub vir bv. beeste of perde, aangewend kan word, sonder om die uitroeiing van die weerstandige wurmstam te benadeel. In die geval van wurmsoorte soos *Nematodirus* spp., waarvan die vrylewende stadia lank op die weiding kan oorleef, sal daar moontlik na 'n tydperk van selfs 2 jaar, van merkerlammers gebruik gemaak moet word om te verseker dat die weerstandige stam wel uitgevrek het, alvorens toetsing van ramme hervat kan word.

Indien ander metodes nie blyk doeltreffend te wees nie, kan gepoog word om die weerstandige wurmstam op die weiding deur 'n vatbare stam te vervang[16], hoewel daar moontlik ook praktiese probleme aan verbonde sal wees.

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Book review/Boekresensie

VETERINARY APPLIED PHARMACOLOGY AND THERAPEUTICS

G C BRANDER, D M PUGH, R J BYWATER en W L JENKINS

Die 5de uitgawe gepubliseer in 1991 deur Bailliere Tindall, London, pp 624 (ISBN 0-7020-1366-8) (prys nie gemeld).

Die basiese uitset van hierdie nuwe uitgawe is dieselfde as in die vorige uitgawe. Deel I handel kortliks oor die geskiedenis en ontwikkeling van medisyne. Die orige deel van hierdie hoofstuk handel oor farmakodinamika, farmakokinetika, middeltoksisiteit en statistiese metodes wat van toepassing is.

Middels wat selfunksie, weefsel en organosisteme beïnvloed word in die volgende hoofstuk bespreek. Dit word op 'n sisteembasis gedoen, maar onderwerpe soos vitamines, die hantering van metaboliese toestande in herkouers en groeistimulante word apart bespreek.

Hoofstuk III handel oor chemoterapie waarby antimikrobiese middels, anthelmintika en pestisiede ingesluit word.

Die laaste hoofstuk handel oor wette en medisynebeheer wat nie van toepassing in hierdie land is nie. In 'n bylaag aan die einde is daar notas aangaande die behandeling van vergiftigings. Dit is in breë terme gestel en bevat net 'n paar riglyne.

In die geheel, is die teks goed uiteengesit en verskaf dit baie inligting oor die werking van middels, dosisse en newe-effekte. Van die ouer middels is tereg weggelaat en vervang met die meer moderne middels wat nou beskikbaar is. Daar word baie gebruik gemaak van sketse om die werking van middels te verduidelik en die chemiese struktuur aan te toon. Tabelle word gebruik om inligting oor en vergelykings tussen middels uiteen te sit. Aan die einde van elke groep middels, word daar 'n aantal publikasies vir verdere studie aangegee. Die inhoudsopgawe is volledig en toon duidelik waar inligting in die teks gevind kan word.

Hierdie boek sal van belang wees vir elke praktiserende veearts en student in farmakologie. Die inligting is byderwets, die inhoud lees maklik en die boek kan met vrymoedigheid as naslaanwerk gebruik word.

A Immelman

THE ROLE OF THE VETERINARIAN IN THE EDUCATION AND HEALTH OF PRE-SCHOOL CHILDREN

CHERYL M E McCRINDLE*

ABSTRACT

Two surveys conducted in pre-schools (n=156) located in advantaged areas and disadvantaged areas in Pretoria, indicated that animals had social and psychological as well as educational value for pre-school children. All schools (n=156) utilised animals in some way for the education of pre-school children. Nineteen of the pre-schools in advantaged areas kept animals permanently at the school. All of these schools utilised the zoo. Only 3 of the schools in disadvantaged areas (n=106) were able to keep animals permanently on the premises although 69 would have liked to keep animals and 77 of the schools visited the zoo at least once a year. Limiting factors included lack of finances and facilities, lack of knowledge on animal management and anxiety about zoonoses. No cases of zoonotic disease in children were recorded. The species of animals utilised at the pre-schools differed from those found most commonly as household pets. Pre-schools favoured rodents, fish and birds rather than carnivores.

The role of the veterinarian may include clinical treatment of the animals from the pre-school, advice on management and zoonosis prevention, pet-care counselling, communication with children and their parents in the consulting room, public health aspects and promotion of environmental education.

Key words: Pre-school, education, veterinarian, communication, zoonoses, pet-care counselling, human-education.

McCrindle C.M.E. **The role of the veterinarian in the education and health of pre-school children.** *Journal of the South African Veterinary Association* (1991) 62 No. 4, 176-181 (En.) Department of Production Animal Medicine, Faculty of Veterinary Science, Medical University of Southern Africa, 0204 Medunsa, Republic of South Africa.

INTRODUCTION

Animal-related topics are not confined to those disciplines dealing only with zoology, agriculture and veterinary science, but probably to all fields of academia. Much of the educational and recreational material presented to pre-school children, is in some way related to animals[4 16]. The stresses of today's society have resulted in alienation, isolation and loneliness for both children and adults[2]. Although socio-economic aspects may play a role in disadvantaged children, this phenomenon is probably as common in affluent households. This may in part be remedied if the young child can inter-react with animals under structured and controlled supervision inthe pre-school[16] where the social and emotional advantages attached to human-animal contact may be experienced[11 12 13].

A high percentage of veterinary clients have been found to be parents with young children[1 3 10 14 15]. It is therefore to the advantage of the private practitioner to become involved in matters pertaining to young children. According to the American Veterinary Association's booklet on marketing strategies[1], 30% to 80% of new clients are estimated to be the result of word-of-mouth referrals. It suggests 2 key sources for referrals, namely clients and personal social structures[1]. As many clients are parents, showing an interest in and being able to communicate with their children therefore has obvious benefits for a veterinary practice. This has been recognised in South Africa by the introduction of Pet-Care Week by the South African Veterinary Association. However most of the information disseminated, is aimed at the school-going child who is already literate, without due consideration being given to the pre-school child where the type of communication is entirely different and more analogous to communication with an illiterate of any age[7].

Limiting factors preventing animals being kept permanently at schools, are lack of knowledge regarding the management, housing and diseases of these animals as well as considerable anxiety about zoonoses and allergies[5 6]. For the purposes of this publication, a disadvantaged child is defined as one being brought up under conditions where poverty is a limiting factor in the education of that child[9]. In many cases the pre-school, with its informal methods of teaching and involvement of parents, is an excellent way of disseminating knowledge to the community[9].

The aim of this investigation was to elucidate the scope of involvement with animals in the pre-school. Such involvement was then considered with reference to the value animal contact has for the pre-school child in terms of physical and mental health as well as risks to the child as a result of zoonotic diseases, allergies and injuries.

METHOD

Pre-schools in advantaged areas:

A questionnaire (Table 1) was compiled in 1987 and an alphabetical list of all the pre-schools within the municipal boundaries of Pretoria (n=65) was obtained from the South African Association for Early Childhood Educare (SAAECE). The list was arranged alphabetically and the first 50 that answered the telephone were selected as a representative sample. The most senior teacher on the staff was asked to answer

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the questionnaire on behalf of each school and time was permitted for consultation with other staff-members in order to obtain consensus of the opinions at each particular school.

Pre-schools in disadvantaged areas:
A slightly simplified, but similar questionnaire, was handed out to the teachers from disadvantaged schools prior to a lecture on the use of animals in the pre-school. The questions were read out and time given for answers to be written in (English was a second language for many of the participants). The questionnaires were then collected immediately before the lecture. As there were in some cases more than one teacher present from a school, the questionnaires were first grouped according to schools. Of the 125 questionnaires, 19 were discarded as they were incorrectly filled in. The 106 pre-schools and créches were located in Mamelodi, Soshanguve, Atteridgeville, Mabopane, Hammanskraal, Ga-Rankuwa, Temba, Pankop, Daspoort, De Wildt, Laudium and Eersterust.

Clinical cases needing veterinary treatment:
Data on all the clinical cases from 2 pre-schools in the advantaged group which kept animals permanently on the premises, were recorded over a period of 10 years.

RESULTS

The total number of respondents was 156, the numbers of teachers and pupils are reflected in Table 2.

According to the results of the questionnaire, whether animals were kept permanently on the premises or not could not be correlated to the location, language spoken or type of pre-school (Table 1, Questions 1,2,3 and 6). All schools (n=156) in both the advantaged and disadvantaged groups used animals and/or insects for themes or projects (Table 1). The number of schools that kept or did not keep animals on the premises, as well as the number of schools that visited the zoo are reflected in Table 3. Teachers' opinions on the educational, psychological and social value of contact with animals for the pre-school child are presented in Table 4.

The reasons for not keeping animals are listed in Table 5. Two schools in the ad-vantaged group cited an additional reason for not keeping animals. They had kept animals in the past, but older children and tramps had broken into the schools after hours and killed them. In the case of the tramps, rabbits were killed, presumably for food. Older children had stolen and killed guinea-pigs, hamsters and budgerigars. In the disadvantaged group, a few examples are cited of the reasons given in addition to those listed above. These are quoted in the original English used, as this reflects the emotions and grammatical limitations of teachers from the disadvantaged schools.

"We don't have money to cater for pets".
"Children should not eat while animals".
"There is no security at our school like yards".
"There are no other objects in our school. There are no pets".
"Unhygenic if we don't look after them".
"Objections by the Inspector".
"Pets are of important value as long as you care for them and treat them with disinfectant".

The types of animals kept permanently on the premises at pre-schools are listed in Table 6. Parties responsible for the care, feeding and health of these animals are reflected in Table 7. The number and types of clinical cases requiring veterinary examination are noted in Table 8.

Within the last 5 years, no schools in the advantaged group (n=50) reported disease in children as a result of animal contact. Only 3 cases of allergy were reported. These were allergies to rabbit fur, cat hair and to feathers. The affected children were subsequently kept away from the animals concerned. The rabbit was moved outside, the cat given away and the budgerigar moved to a different classroom. No children had needed the attention of a doctor as a result of injuries sustained from handling animals, although 4 schools mentioned that children had been nipped by hamsters. Three schools described injuries to animals. These were: a child who had poured blue paint into the fish tank, a child who had broken open hatching eggs and pulled out the ducklings and children who had pulled the wings and legs off grasshoppers.

DISCUSSION

The responsibility for feeding and caring for animals at a pre-school, falls mainly on the teaching staff. They are also in close daily contact with the children and animals and are therefore in a position to judge the value of interaction between these children and the animals. For this and ethical reasons, the questions were therefore structured to gain the opinions of teachers rather than children.

The pre-schools in disadvantaged areas were devoid of fences, grass, trees, climbing apparatus, books, toys - even paper and crayons. For amusement the teachers sat the children in circles and they sang and clapped their hands. Under such circumstances the keeping of animals must have seemed unattainable. Several (n=69) of these schools would, however, have liked to keep animals. Trips to the zoo are subsidised and therefore within the reach of even the most disadvantaged.

It might have been expected that teachers with larger classes would have had less time to cope with animals at school. This, however, was not the case. In pre-schools in advantaged areas, the number of children per class did not play a significant role in whether or not the schools kept animals permanently. Pre-schools with a higher percentage of qualified teachers were statistically more likely to keep animals permanently on the premises. This is possibly because qualified teachers, as a result of their training, are in a better position to evaluate the needs of the pre-school child[4 16]. The large number (n=205) of pre-schools in the disadvantaged group which did not answer one or more subsections of Question 16, is probably the result of a lack of understanding of the concepts. For most of the teachers at these schools English is a second language.

During a survey of primary and pre-schools in France, Goden et al[4 5] found no evidence of children having suffered from zoonoses as a result of animals kept at school. The survey done in advantaged pre-schools supported this finding. Despite the fears of teachers at schools that did not keep animals, there was also a very low incidence of allergy and no cases of serious injury to children caused by animals kept permanently at pre-schools.

It cannot be assumed from these findings that there is no possibility of zoonotic diseases occurring in pre-schools. Disease prevention and animal management are within the sphere of the veterinarian[17 18] and veterinary advice on the prevention of zoonoses should be valuable to pre-school teachers. This should also extend to the choice of animals. Psittacines, for example, should be regarded with circumspection because of the risk of psittacosis[5 6 18]. Pre-school education should be pleasant and meaningful[4 16]. This will not be so if children are exposed to animal suffering. The veterinarian should be consulted by the pre-school on management and disease prevention for the well-being of the animals as well as the prevention of zoonoses. The pre-schools in this survey kept rodents fish and birds, rather than carnivores (Table 6). This distribution is different to that in households, where dogs and cats are kept as pets[5 6]. The probable reason for this is that rodents, birds and fish are easier and cheaper to keep at school. Faecal disposal is simpler and the animals are more gregarious than dogs and cats[17]. There is also less danger attached to bites by

these animals.

The veterinarian in private practice is possibly more used to treating companion animals than rabbits, guinea-pigs, bantams, pigeons and fish. The requirements of the pre-school are also slightly different to those of the pet-owner. The number of cases seen is relatively low and cost is a limiting factor in considering the treatment regimen. Animals not easily cured or found to be suffering from zoonotic diseases, cannot be returned to the pre-school. The former because animals that appear to be suffering, lay the school open to complaints by parents concerning animal welfare, and the latter because of the danger to the children.

It has been established from the above that animal topics and animal contact are used in the pre-school curriculum. A majority of pre-school teachers appreciate that animals have social and psychological value as well as educational value for their pupils. There is also a perception among teachers that animals may affect the health of the pre-school child.

The veterinarian has the knowledge to advise parents and educational authorities on the management of animals to promote their well-being and minimise the risk of disease. In turn, the advantage for the veterinarian is that many of his clients are parents of young children and interest in this field will promote the image of the veterinary profession as a whole, as well as the veterinarian's own practice. A further possible advantage is in the field of health education, where, through the pre-school, the state veterinarian may have access to the community and be able to educate them in disease prevention to promote public health. A total of 127 of the schools, both advantaged and disadvantaged, visited the zoo. This opens up the possibility of research into animal contact in the pre-school being used to promote conservation and environmental education, particularly with regard to disadvantaged areas.

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Table 1: **Questionnaire put to pre-schools within the Pretoria Municipal area**

1. Name and address of school
2. Name and position of contact
3. Number of pupils, language spoken
4. Total number of teachers
5. Number of qualified teachers [HED (preprim) or similar]
6. Type of school: private/subsidised/provincial
7. Do you use animals/insects for themes or projects? Y/N
8. Does the school visit the zoo? Y/N
9. Do you keep animals permanently on the premises at school? Yes/No/Sometimes
10. Would you like to keep animals but are unable to? Y/N
11. What are the reasons for not keeping animals?
12. What type of animals do you keep at your school?
13. Who looks after the animals at school?
    a) During the term: staff member/labourer/parents/children/other
    b) During the holidays: staff member/labourer/parents/children/other
14. Do you use a duty roster for this? Y/N
15. Who pays for the animal's food and veterinary attention: school/staff member/parents/other
16. In your opinion, contact with animals has a:
    a) social value for pupils Y/N
    b) educational value for pupils Y/N
    c) psychological value for pupils Y/N
17. How many times, within the last 5 years, according to school records, has an animal:
    a.- caused allergy in a pupil? Give details
    b.- caused disease in a pupil? Give details
    c.- been injured or killed by a pupil? Give details

Table 2: **Child-teacher ratios and percentage of qualified* teachers at pre-schools in Pretoria where animals were kept on the premises permanently, occasionally, or not at all**

Category	Animals kept permanently	Animals kept occasionally	No animals at school
Total number of children	1493	497	2147
Average number of children	78,6	62,1	102,2
Total number of teachers	85	32	120
% qualified* teachers (significant** at p<0,05)	82,35	56,25	60

* Higher education diploma (preprimary) or similar. HED (preprim)

** The percentage of qualified teachers at schools where animals were kept permanently was significantly higher than those that did not or only occasionally kept animals. The Chi-squared test was used to determine this significance at a level of probability exceeding 0,05

Table 3: **Number of pre-schools that kept animals temporarily, permanently or not at all on the premises of the pre-school, or that visited the zoo**

Type of school	Total (n=)	Permanently	Ocassionally	Not at all	Visited the zoo
Advantaged*	50	19	9	22	50
Disadvantaged*	106	3	7	96	77

*Twenty three of the pre-schools in advantaged areas and 69 of those in disadvantaged areas would have liked to keep animals

Table 4: **Teachers' opinions on the educational, psychological and social value of contact with animals for the pre-school child**

	Educational	Psychological	Social
Advantaged (n=50)			
Yes	46	42	43
No	3	7	6
Not answered	1	1	1
Disadvantaged (n=106)			
Yes	36	30	32
No	4	7	7
Not answered	67	70	68

Table 5: **Reasons for not keeping animals permanently on the premises at the pre-school**

Reason	Advantaged (n=31)	Disadvantaged (n=106)
Too much extra work	13	52
Animals carry diseases	14	55
Animals are unhygienic	11	50
Too expensive to feed and care for	7	65
Animals cause allergies	17	60
Children may be bitten or scratched	10	61
Children may injure animals	12	56
Just as much can be learned from books and charts	7	51
The environment at the school is adequate without animal contact	9	45
Pets at home are enough, do not need them at school	14	34
Children should not keep pets at all as they are a health hazard	0	28
Lack of facilities	6	78
Pretoria Municipal Health Department or other health regulations	10	47
Parents object	1	31
Owners of land/nursery school object	3	50
Not answered	0	3

Table 6: **Types of animals kept permanently in pre-schools in the advantaged group**

Type of animal	Number of schools which kept these animals (n=19)
Rabbits	12
Budgerigars	10
Pigeons and doves	10
Fish	10
Tortoises	8
Chickens and bantams	6
Guinea pigs	5
Dogs	5
Canaries	4
Hamsters	4
Cats	2
Rats	2
Other	5

Table 7: **Parties responsible for care, feeding, health and costs involved in keeping animals at the pre-schools where they are kept permanently on the premises (advantaged and disadvantaged schools combined)**

Responsible party	Number of schools (n=22)
Care and feeding:	
a) During the term:	
Staff member	9
Labourer	2
Parents	0
Staff member and children	11
b) During the holdiays	
Staff member	10
Labourer	2
Parents and children	10
Number of schools using a duty roster:	12
Expenses involved paid by:	
School	20
Staff member	3

Table 8: **Number of cases seen between 01/07/79 and 01/07/89 by a private practice involved with 2 pre-schools in advantaged group**

Diagnosis	Number of cases seen					
	Rabbits	Guinea pigs	Rats	Hamsters	Pigeons	Fish
"Scaley ear" *(Psoroptes cuniculi)*	15	-	-	-	-	-
Malnutrition due to overcrowding	2	2	-	-	-	-
Drowned after rain	1	-	-	-	-	-
Fight wounds	1	-	-	1	-	-
Neuter	10	-	3	-	-	-
Fracture	-	-	-	-	1	-
Tumour	-	-	-	1	-	-
Overfeeding	-	-	-	-	-	2
Total cases seen	29	2	3	2	1	2

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Book review/Boekresensie

THE VETERINARY FORMULARY. HANDBOOK OF MEDICINES USED IN VETERINARY PRACTICE

EDITOR; YOLANDE DEBUF

The Pharmaceutical Press, London SE1 7JN, England. 1991 pp 448, price $37.50, (ISBN 0 85369 245 9)

This is the first comprehensive and impartial book on animal medicines published in the United Kingdom, and indeed the first work on veterinary drugs produced by the Royal Pharmaceutical Society. This book aims to promote rational and effective treatment by grouping together the similar preparations of each drug and describing them from a pharmacological and therapeutic point of view. The text for *The Veterinary Formulary* was compiled by veterinarians or veterinary pharmacologists; reviewed by an Advisory Committee and edited by the staff of the Royal Pharmaceutical Society.

The Veterinary Formulary contains information on more than 1600 preparations licensed for use in animals in the UK. In addition, this book includes information on some 280 preparations licensed only for use in humans but commonly used in veterinary medicine because no licensed veterinary product exists. The increasing cost of licensing and the review of older licenses is resulting in fewer medicines becoming available with veterinary licenses and this text is an important source of drug dosages for human licensed medicines.

The information in *The Veterinary Formulary* is presented in a clear and easily accessible manner. The main text consists of 18 chapters each covering a particular body system, condition, or drug category. For all drugs dealt with in the text and/or in one of the 550 monographs, there are details of mechanism of action, therapeutic indications, side-effects, and dosages suitable for use in a variety of species including horses, cattle, sheep, pigs, dogs, cats and poultry. Text on fish, rabbits, rodents and non-domestic species such as exotic birds and reptiles is also provided. Extensive tables of antimicrobial, parasiticidal, and anaesthetic dosages are included, together with methods of drug administration and notes on diseases and conditions commonly treated in these species.

The Veterinary Formulary is intended primarily as a text for easy and rapid reference for veterinarians but will also be valuable for pharmacists and others involved in animal health-care.

OVERBERG RESEARCH PROJECTS. XIII. A COMPARISON OF THE EFFICACY OF ALBENDAZOLE DRENCH AND AN ALBENDAZOLE SLOW-RELEASE CAPSULE AGAINST NEMATODE PARASITES IN SHEEP

J P LOUW* and R K REINECKE**

ABSTRACT

The anthelmintic efficacy of albendazole intra-ruminal slow-release capsules (SRC) and albendazole drench against field strains of 5 genera of nematode parasites of sheep, where compared. The SRC reduced the number of L_4 and adult *Nematodirus* by 64,1% and 58,3% and the albendazole drench by 98,1% and 99,1%, respectively. Neither formulation was more than 89,5% effective against either the L_4 or adult stage of *Teladorsagia.* The efficacy of both formulations against the adult stages of *Haemonchus, Trichostrongylus* and *Oesophagostomum* ranged from 95,9 to 99,9%

Key words: Efficacy, albendazole, intra-ruminal slow-release capsule, nematodes, sheep

Louw J.P.; Reinecke R.K. **Overberg Research Projects. XIII. A comparison of the efficacy of albendazole drench and an albendazole slow-release capsule against nematode parasites in sheep.** *Journal of the South African Veterinary Association* (1991) 62 No. 4, 182-183 (En.) Department of Parasitology, Faculty of Veterinary Science, University of Pretoria, Private Bag X03, 0110 Onderstepoort, Republic of South Africa.

Laby[4] developed an intra-ruminal slow-release capsule designed to deliver albendazole intra-ruminally at a continuous daily rate of approximately 0,5 mg kg^{-1} to sheep with a body mass of 65 kg. This albendazole intra-ruminal slow-release capsule (SRC) was >90% effective against the common parasites of sheep in Australia and effectively controlled these parasites for a period of approximately 90 d[2]. The SRC, therefore, has very promising protective potential under conditions where sheep are exposed to severe continuous parasitic challenge. A non-parametric evaluation of the efficacy[3,5] of the SRC as well as the commercial drench of albendazole against field strains of nematode parasites of sheep, will not only provide the opportunity to compare the efficacy ratings of these 2 formulations against field strains of nematodes with one another, but also to compare these efficacy ratings with those obtained by other workers who tested similar formulations of the same compound against field[2] and laboratory[8] strains of nematodes in sheep.

For this purpose, 28 crossbred Merino yearling whethers kept on the Tygerhoek Experimental Farm for the preceding 6 months and 8, 7 month-old sheep of a similar type and sex, purchased on a nearby farm, were selected. On 14 November 1989 these animals were eartagged, vaccinated against blue tongue and enterotoxaemia, treated with ivermectin at 0,2 mg kg^{-1} and placed on a 2 ha spray-irrigated grass/lucerne pasture on the Tygerhoek Experimental Farm (34° 10'S, 19° 55'E). The trial was conducted according to the experimental design (Table 1).

The processing of the gastro-intestinal organs for the recovery of nematode parasites and the counting and identification of these parasites were carried out according to procedures previously described in detail[6].

The median, mean and range of nematode parasites recovered from the sheep in the different groups and the efficacy ratings determined by both the conventional and the non-parametric[3] methods for the albendazole drench as well as the SRC, are presented in Table 2.

The SRC reduced the L_4 and adult populations of *Nematodirus* in the present trial by 64,1 and 58,3%, respectively. This is in sharp contrast with reductions of 98,1 and 99,1% respectively, obtained with the albendazole drench in the present trial. Van Schalkwyk et al[8] recorded a 100% removal of *Nematodirus* with the albendazole drench. The time of 22 d allowed between application of the SRC and necropsy of the animals in the present trial, might have been too short for the SRC to reach its full potential efficacy. However, Barton et al[2] recorded peaks of the metabolites of albendazole (albendazole sulphone and albendazole sulphoxide) in sheep within 10 d. Moreover, these workers recovered L_4 and adult *Nematodirus* from sheep 30 and 101 d after the application of the

Table 1: **Experimental design**

12 Dec 1989: Select 33 sheep with positive faecal worm egg counts and a live mass of 35 to 65 kg from a group of 36 animals. Divide animals randomly with the aid of random tables, in 3 groups of 9 (Group 1), 12 (Group 2) and 12 (Group 3) animals.

18 Dec 1989: Dose each sheep in Group 3 with an albendazole intra-ruminal slow-release capsule (Captec Proftril, SmithKline Beecham).

3 Jan 1990: Dose all sheep in Group 2 with albendazole (Valbazen, SmithKline Beecham) at 3,8 mg kg^{-1} live mass. Slaughter one sheep from Group 1. Remove all sheep from the pasture, place in concrete-floored pen and feed lucerne hay.

8 Jan 1990: Slaughter 8 sheep (Group 1) and process.

9 Jan 1990: Slaughter 12 sheep (Group 2) and process.

10 Jan 1990: Slaughter 12 sheep (Group 3) and process.

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Table 2: **Median, mean, range and reduction of the number of nematodes recovered from control sheep (Group 1), sheep dosed with albendazole (Group 2) and sheep dosed with an albendazole intra-ruminal slow-release capsule (Group 3)**

	H. contortus		*N. abnormalis* and *N. spathiger*		*Strongyloides papillosus*	*Teladorsagia*		*Trichostrongylus colubriformis*	*Oesophagostomum venulosum*
	L4	Ad	L4	Ad	Ad	L4	Ad	Ad	Ad
Group 1									
Median	0	1333	37	225	182	494	7022	2566	32
Mean	39	1827	273	508	288	1977	9257	6893	56
Range	0-188	0-4300	0-1433	0-2310	0-1112	0-12566	2293-19033	144-26688	0-206
Group 2									
Mean	0	75	5	4	3	355	1136	2	0
Range	0-0	0-849	0-20	0-45	0-15	0-1551	88-3655	0-24	0-1
% Reduction+	100	95,9	98,1	99,1	98,8	82,1	87,7	99,9	99,9
NPM3++	A	A	B	A	A	C	B	A	A
Group 3									
Mean	0	29	98	212	246	209	2466	0	6
Range	0-0	0-100	0-466	0-2147	0-840	0-984	340-5316	0-0	0-51
% Reduction+	100	98,4	64,1	58,3	14,7	89,5	73,4	100	89,1
NPM3++	A	A	X	B	X	C	C	A	A

++NPM Rating[3]: A = > 80% effective in > 80% of treated animals
B = > 60% effective in > 60% of treated animals
C = > 50% effective in > 50% of treated animals
X = Ineffective
+% Reduction = Pecentage reduction compared to Group 1
**Teladorsagia* = *Teladorsagia circumcincta*
= *Teladorsagia davtiani*
= *Teladorsagia trifurcata*

SRC. Evidently, the SRC is not as effective as the albendazole drench against *Nematodirus* in sheep.

The efficacy of albendazole drench against a laboratory strain of *Teladorsagia* in South Africa[8] as well as the efficacy of the SRC against a field strain of *Teladorsagia* in Australia[2] was superior to the efficacy of either formulation of albendazole against the field strain of *Teladorsagia* in the present trial. Anderson et al[1] found that the SRC, even at albendazole releasing rates of 0,9 mg kg^{-1} day^{-1}, did not reduce the numbers of a benzimidazole-resistant population of *Teladorsagia* in sheep significantly. The comparatively low efficacy ratings obtained against *Teladorsagia* with both formulations of albendazole in the present trial, may be an indication of a degree of benzimidazole resistance present in the strain.

Very high efficacy ratings were recorded with both formulations of albendazole against *H. contortus, Trichostrongylus* spp and *O. venulosum* in the present trial. Reinecke & Louw reported the severe pathogenicity of *H. contortus* and *Trichostrongylus* spp in sheep grazing on irrigated pastures in the southern Cape Province[7]. Sensibly incorporated in a helminth control programme, the SRC could provide continuous anthelmintic protection against nematodiasis, especially where either the known epidemiology of the nematodes present or conditions of severe parasitic challenge from the pasture, call for a protective approach in helminth control.

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DIAGNOSIS OF LIVER TAPEWORM, *STILESIA HEPATICA*, INFECTION IN SHEEP

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ABSTRACT

A practical method of diagnosing *Stilesia hepatica* in live sheep is described. Intestinal contents and faeces were sieved through a sieve with apertures of 1,0 mm onto a sieve with apertures of 100 µm to reduce volume and turbidity. The residue on the fine sieve was examined microscopically. Gravid proglottids passed through the intestine without being digested. Intact proglottids were recovered from the intestine and faeces of infected sheep. Used purely on faeces, the technique is simple and reliable as a diagnostic method. Its application could facilitate basic research into the biology and epidemiology of the parasite.

Key words: Diagnosis, oncosphere, paruterine organ, sheep, *Stilesia hepatica.*

Coetzee H.G.J.; Kok D.J.; Fourie H.J. **Diagnosis of liver tapeworm, *Stilesia hepatica*, infection in sheep.** *Journal of the South African Veterinary Association* (1991) 62 No. 4, 184-185 (En.) Department of Animal Science, Faculty of Agriculture, University of the Orange Free State, P.O. Box 339, 9300 Bloemfontein, Republic of South Africa.

The liver tapeworm, *Stilesia hepatica,* inhabits the bile ducts of sheep, cattle and wild ruminants in Africa and is widespread in South Africa[2,4]. The infection causes considerable economic losses because infected livers are condemned at abattoirs[3] for aesthetic reasons[4]. Little is known about the life cycle of the parasite[1]. Investigations regarding the identity of the intermediate host and other aspects of the life cycle, have been largely unsuccessful because of the difficulty of diagnosing *S. hepatica* infection in the live host. The only successful analytical technique to demonstrate the presence of the parasite in a live host, was carried out on a single sheep by Van Amelsfoort & Schröder[3]. They used a flotation technique to recover oncospheres from a faecal sample.

This paper reports on a simple technique which can be used to demonstrate the presence of *S. hepatica* in live sheep without the need of specialised equipment. The method can be applied in the field requiring only sieves and a field stereo microscope. This technique could facilitate research into the biology and epidemiology of the parasite.

Fresh intestines of 12 sheep heavily infected with *S. hepatica* were collected at the Bloemfontein abattoir over a period of 3 to 4 months. The contents of each intestine, from duodenum to rectum, was examined microscopically for the presence of any identifiable parts of the tapeworm. Following this, the intestinal contents was washed through a sieve with apertures of 1,0 mm onto a sieve with apertures of 100 µm. The residue on the second sieve was washed off and suspended in 100 to 150 ml of water. This was then transferred in 2 or 3 50 ml aliquots to a petri dish and examined under a stereo microscope. Faecal samples, usually about 40 to 50 g, were also collected at the abattoir from live sheep in which the presence of *Stilesia* was determined post mortem. Faecal samples were gently crushed and diluted in water before sieving and examining the residue as described above.

During the initial microscopical examination of intestinal contents, some gravid proglottids were recovered. However, the volume of material involved, together with its turbidity, made the finding of proglottids largely a matter of chance and precluded microscopic examination of untreated intestinal contents as a routine method to determine the presence of proglottids.

The sieving of intestinal contents and faecal samples considerably reduced the volume of material which had to be examined. Much of the very fine material which caused turbidity was also washed out through the sieve with apertures of 100 µm. Gravid proglottids, roughly 0,9 mm wide and 0,6 mm long, were easily recovered from the residue on the sieve with apertures of 100 µm. Two rounded paruterine organs (Fig. 1), characteristic of *S. hepatica,* were conspicious, even under low magnification. Proglottids mostly occurred singly and were recovered from all regions of the intestine, posterior to the opening of the bile duct into the duodenum. Those found in the posterior regions of the intestine were often stained yellow to brown, but were still easily detected due to their characteristic shape. In faecal samples we seldom found more than 2 or 3 proglottids, even in heavily infected animals.

Oncospheres appeared to be intact in all gravid proglottids recovered from the intestine and faeces (Fig. 2). Movement of hexacanth embrios was often observed during microscopic examination. Oncospheres had a characteristic oval shape (Fig. 3). A thick capsule surrounded each embryo, but the oncosphere nevertheless appeared to be a delicate structure (Fig. 2). Each paruterine organ of gravid proglottids contained from 20 to 25 oncospheres. Only when pressure was exerted on the paruterine organ, did its contents extrude as a gelatinous mass containing the oncospheres. Paruterine organs probably function to protect the delicate oncosphere against adverse conditions outside the host.

The most significant finding of this study was that mature proglottids shed by adult worms pass through the intestine without being digested. Oncospheres will therefore not normally be present in the intestinal contents and faeces. Flotation techniques, such as those used by Van Amelsfoort & Schröder[3], would give positive results

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ig. 1: **Photomicrograph of a gravid proglottid of *S. hepatica*, recovered from the intestine of a sheep. The pair of rounded paruterine organs are characteristic. Scale bar 200 μm**

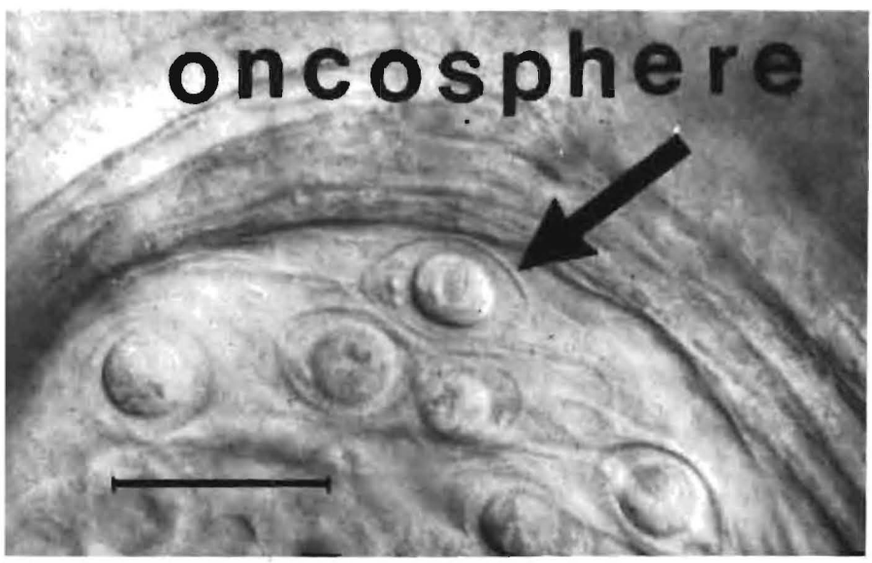

Fig. 2: **Photomicrograph of oncospheres inside the paruterine organ of a gravid proglottid of *S. hepatica*, recovered from the intestine of a sheep. Scale bar 50 μm**

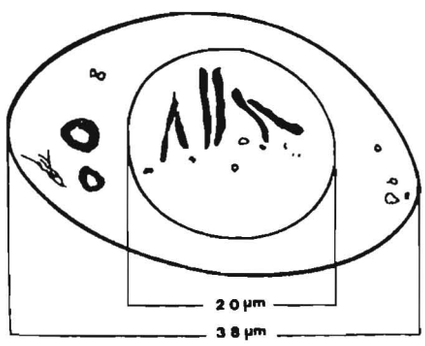

Fig. 3: **Drawing of an oncosphere of *S. hepatica*, indicating its approximate size and characteristic shape**

only in those cases where paruterine organs are damaged mechanically during the handling of samples, resulting in the extrusion of oncospheres. Even then the delicate oncospheres may be affected by osmotic stress, which would make it more difficult to identify them as those of *S. hepatica*. The sieving method described here, evidently overcame most of these problems, is easy to use and during application constantly gave reliable positive diagnoses.

In heavy infections with *Stilesia*, large numbers of worms crowded the bile ducts and it is difficult to explain why we never found large numbers of proglottids in any region of the intestines of infected hosts. This may be related to seasonality or the rate of maturation of proglottids, aspects on which no information is available. Most studies relating to the biology and epidemiology of *S. hepatica* are dependent upon the diagnosis of infection in the live host. The application of the technique described, should facilitate basic research into the biology of the parasite.

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SUSPECTED AVOCADO *(PERSEA AMERICANA)* POISONING IN GOATS

P STADLER*, I B J VAN RENSBURG** and T W NAUDÉ***

ABSTRACT

A herd of 15 Cameroon goats was suspected of having been poisoned by eating leaves of the Fuerte variety of avocado pear *(Persea americana)*. Two of the affected goats were examined clinically, while necropsies were carried out on 3 of the 4 that had died. The most significant clinical findings were tachycardia, hyperpnoea and evidence of lung oedema. At necropsy severe lung oedema, hydrothorax and hydropericardium were present. Severe myocardial degeneration, necrosis and fibrosis were the major histopathological findings.

Key words: Avocado poisoning, *Persea americana* (Fuerte strain), goats, cardiomyopathy

Stadler P.; Van Rensburg I.B.J.; Naudé T.W. **Suspected avocado *(Persea americana)* poisoning in goats.** *Journal of the South African Veterinary Association* (1991) 62 No. 4, 186-188 (En.) Department of Medicine, Faculty of Veterinary Science, University of Pretoria, Private Bag X04, 0110 Onder-stepoort, Republic of South Africa.

Although the avocado pear *(Persea americana)* is eaten with impunity by man, several outbreaks of toxicity in animals, ingesting particularly the leaves of various varieties, have been reported. Not all commercial varieties are toxic to animals[3,7]. Leaves of the Fuerte and Nabal strains killed rabbits within 24 h, whereas the Mexicola strain had no detrimental effect. Leaves, bark, seeds and fruit have been reported to be toxic to cattle, horses, goats, rabbits and canaries. In cattle, goats and horses, the primary clinical sign mentioned is a non-infective mastitis. More recently[4], sheep dosed with fresh avocado leaves of the Fuerte variety, developed cardiomyopathy. The ability of the Gautemalan variety to cause severe mastitis in goats has been reported[1,2]. The involvement of Gautemalan avocados *((P. americana* (Anaheim variety)) in a field outbreak, was confirmed through dosing experiments. Although the animals developed severe non-infective mastitis both in the field and experimentally, the condition was not lethal and all the animals recovered. Neck and brisket oedema and coughing, however, was noted in the field cases. Apart from severe mammary gland pathology and oedema, and haemorrhage in the supramammary lymphnodes of one goat, no lesions were found in the organs of goats experimentally intoxicated[2]. Unfortunately the hearts were not examined histologically. In this experiment, *P. americana* var. *Guatemala* proved to be toxic, but the Mexican variety was not.

The toxicity to cage birds of the fruit of both a common Guatemalan variety, Hass, and the very popular hybrid between the Mexican and Gautemalan varieties, Fuerte, was recently confirmed[6]. Budgerigars were highly susceptible to intoxication with both varieties. As little as 1,6 g given over a period of 4 h to budgerigars with an average mass of 36,25 g (dosage approximately 45 g kg^{-1}) was lethal within 36 h. Canaries were less susceptible and mortality was only with the Hass variety. Subcutaneous oedema, hydropericardium and generalised congestion were the most prominent findings and it was concluded that cardiac failure might have played a role in the death of the birds. Both these varieties are very popular in South Africa.

During August 1988, sudden deaths occurred in a herd of 15 Cameroon dwarf goats on a small-holding near Onderstepoort. They were kept with a few head of cattle in a camp of approximately 0,5 ha. The goats were fed dry lucerne hay, commercial sheep pellets, yellow maize and had access to a commercial lick. They were in a fair condition. The camp in which they were kept was severely overgrazed and the animals craved green feed. Apart from bluegum trees *(Eucalyptus* spp.), which had been depleted of leaves as high as the animals could reach, no plants of toxicological significance could be found in this camp. Periodically the animals were fed green garden refuse. Amongst others, avocado tree cuttings from the owner's own garden had been fed, without any deleterious effects. However, 6 d before the first animal died (Day 0), the owner started feeding them the foliage of one specific avocado tree that was being cut down in a garden in the vicinity. This was fed for approximately 10 d. On Day 6 the first goat died and over the next 2 d, 2 more died. The carcasses of these latter goats, (Goats 1 and 2), were submitted for autopsies on Day 9.

The same day, 2 animals, Goat 3 (a young ewe approximately 9 months old) and Goat 4 (a heavily pregnant ewe, approximately 14 months old) were admitted to the Department of Medicine, Faculty of Veterinary Science, University of Pretoria for examination and treatment. The owner had observed that the animals tended to lie down, were slightly bloated and showed open-mouthed breathing.

The remaining avocado branches *Persea americana* Mill. cf. var. *drymifolia* (Schechtend. & Cham.) S.F.Blake i.e. the Fuerte strain of avocado pear, were removed from the camp 15 d after their introduction. The leaves of this particular strain are anise-scented when crushed and this characteristic has been retained by the dry specimen for over a year.

A total of 4 animals out of 15 were lost, the last one being Goat 4 which succumbed 16 d after the first deaths occurred.

On admission, both goats were clinically examined. Goat 3 had a temperature of 39,2°C, a heart rate of 140 min^{-1} and a respiratory rate of 30 min^{-1}. The intensity of the respiratory

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Fig. **Myocardial necrosis and granular degeneration showing contraction bands and myolysis in goats with suspected avocado poisoning. HE X400**

sounds increased and she coughed occasionally. Goat 4, which was heavily pregnant, had a temperature of 39,5°C, a heart rate of 180 min^{-1} and a respiratory rate of 60 min^{-1}. The intensity of her respiratory sounds also increased and she tended to lie down. Both had a decreased appetite, but no other abnormalities were found.

Haematological examinations demonstrated a leucocytosis due to an increase in both mature and immature neutrophils. The leucocytosis was more pronounced in Goat 4, mainly due to larger numbers of immature neutrophils. Toxic granulation of the neutrophils and monoblasts was present in both goats

The faeces of both goats were normal. Urine could only be collected from Goat 4. This was examined by means of a reagent strip for urinalysis (Multistix, Miles Laboratories), and had a pH of 8,5, an S.G. of 1,010 and was positive for protein (4+), blood (2+) and ketones (3-4+).

A specific clinical diagnosis could not be made on the available information. The mild ketosis in the older goat was regarded as secondary and it did not cause severe clinical abnormalities.

Serum creatinine concentrations in both goats were normal. Blood glucose concentrations in Goat 3 and 4 were respectively 5 and 3,8 mmol l^{-1}.

In view of the post mortem findings on Goats 1 and 2, muscle enzyme levels were determined in Goats 3 and 4 (Table 1).

Goat 4 went into partus seven days after admission. She developed a dystocia and a live lamb was subsequently removed by means of a caesarian section under local anaesthesia. Although the ewe appeared quite strong after the operation, she died within hours and a necropsy was performed. Goat 3 made an uneventful recovery and was discharged.

In the 3 animals which were examined severe pulmonary oedema, hydrothorax, hydropericardium and a varying degree of ascites, were constant findings. Hyperaemia of the rumen wall was also seen in all the cases, while Goats 1 and 4 also showed hyperaemia of the intestinal wall. Perirenal oedema was present in Goats 2 and 4, while petechiae were present on the serosal surfaces in Goat 2, and in the pancreas of Goat 1. Moderate congestive hepato- and splenomegaly were also seen. Except in Goat 4 where the myocardium had a mild, greyish-white mottled appearance, no specific myocardial lesions were noticed.

Table 1: **Serum concentrations of muscle enzymes in goats suspectedly poisoned by avocado pear *(Persea americana)***

Enzyme $\mu\ell^{-1}25°$	Goat 3	Goat 4
Creatinine kinase	640	12750
Lactate dehydrogenase	655	5375
Hydroxybutyrate dehydrogenase	368	2705

Light microscopical examination of sections stained with haematoxylin and eosin (HE), revealed congestion of the myocardium and multifocal areas of granular degeneration, necrosis and rarifaction of myocardial fibres in Goats 1 and 2 (Fig. 1). These lesions were present in the ventricular walls and the interventricular septa and were characterised by the presence of karyopyknosis, contraction bands, vacuolisation and lysis of the sarcoplasma. In certain areas, this latter change left empty sarcolemmal tubes. The presence of necrotic myocardial fibres were confirmed with the Modified Cardiac Necrosis staining technique[5]. In Goat 1 this lesion was most striking in the subendocardial area, while it appeared more diffuse in Goat 2. Stasis of neutrophils were present in some blood vessels, while a few myocardial fibres showed reduplication of nuclei and giant cell formation. Sections stained with the Mason's Trichrome method revealed multifocal areas of early fibrosis. In Goat 4, which had survived 7 d longer since first exposure to the avocado leaves, the fibrosis was more advanced and mature, while the acute necrosis and cellular infiltration were less striking. Other abnormalities included congestion and oedema of the lungs, centrilobular hepatic congestion and congestion of the gastrointestinal tract. A mild nephrosis characterised by severe cellular swelling was evident in all 3 cases.

Varieties of avocado vary in their toxicity to animals and it would appear that the syndromes caused by them may differ. In the outbreak reported here, a cardiac-failure syndrome was observed. The clinical and pathological findings correlate well with those reported by Grant et al[4] in which the Fuerte strain of avocado was also involved. More recently, however, it was shown that mastitis was the primary lesion in cases poisoned by the Gautamalan variety[1,2]. Unfortunately, in these animals the hearts were not properly examined and as they showed subcutaneous oedema and coughing, cardiac involvement cannot be ruled out. Clinically there was no evidence of mastitis in the outbreak caused by the Fuerte variety reported on in this paper. Unfortunately, mammary tissue was not examined histologically. It would therefore appear that the primary syndrome induced by different varieties may differ.

The toxic dose of leaves in the case of avocado poisoning is unknown. From our own observations and from experimental evidence[4], it would seem that the leaves are toxic at a relatively high dose in the case of farm animals, but that low doses of the fruit might kill cage birds[6].

It will be difficult to distinguish the macroscopical pathology from that seen in cases with heartwater. The most important differential feature is the presence of varying degrees of splenomegaly due to lymphoid hyperplasia and the presence of the causative organisms in brain smears. No *Cowdria ruminantium* organisms were detected in brain smears of any of the 3 cases.

The histopathological lesions can easily be confused with that of gousiekte, *Cotyledon* poisoning, chronic gifblaar poisoning and ionophore toxicity. The history, and proof that avocado had been eaten, will be of great value in reaching a final diagnosis. Appropriate chemical analysis should exclude ionophore poisoning.

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Book review/Boekresensie

RESTRAINT OF DOMESTIC ANIMALS

TERESA F. SONSTHAGEN, RVT

1st edn. American Veterinary Publications, Inc. 1991 149 pages Price $21.50 US (ISBN 939674-28-9)

This 149-page book which is easy to read and amply illustrated with simple clear line-drawings for most of the handling methods as well as for the section on knot tying, is highly recommended for all people who have anything to do with handling domestic animals. In particular veterinary technicians, veterinary nurses, stock inspectors, veterinary students and even experienced veterinarians may derive great benefit from having this book either on their shelves for quick reference or even from carrying it with them when going out to attend to animals. For those who have never worked with animals before, the author clearly describes typical behaviour encountered in each species and hence different approaches to handling and restraint. She emphasises safety of the animal as well as the owner and handler and suggets always working quietly and with minimum restraint before moving on to heavier restraint if necessary. She stresses the proper care and inspection of equipment such as ropes, and mentions all possible sources of danger to man and beast in the handling of the various species. Chapter I is an Introduction, Chapter 2 deals with Knot Tying and Chapters 3-11 cover restraint in cats, dogs, horses, cattle, pigs, sheep, and goats respectively. One chapter deals with rodents, rabbits and ferrets, and Chapter 11 with restraint of birds.

There are 3 appendices: one for gender names, another for physiologic data (rectal temperatures in Fahrenheit, pulse rates and respiratory rates), and the third contains a glossary of terms which may be unfamiliar to those not involved in the veterinary field. The index is at the end of the book and only a few words used will be slightly foreign to South Africans eg. "chute" instead of "crush".

This is a simple, practical and yet thorough book on a very important and often neglected aspect of working with animals and will reduce mishandling, danger and trauma to both man and animals if the methods described are practised.

J H Williams

SUSPECTED CYCAD *(CYCAS REVOLUTA)* INTOXICATION IN DOGS

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ABSTRACT

Three dogs which ingested part of the stem of a Japanese cycad *(Cycas revoluta)* vomited repeatedly within hours after ingestion, showed marked depression, severely congested mucous membranes, increased thirst and profuse salivation. Subsequent haematological and blood chemical investigation revealed elevated serum concentrations of alanine transaminase, an initial mild lymphocytopenia, thrombocytopenia and a leucocytosis. The dogs recovered uneventfully.

Key words: *Cycas revoluta*, Japanese cycad, dogs, cycad poisoning, vomition, hepatotoxicity

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Cycads belong to the order *Cycadales* of which 3 families are recognised: Cycadaceae (with one genus: *Cycas*); Stangeriaceae (with only a single species: *Stangeria eriopus* (Kunze) Nash) and Zamiaceae (with 8 genera, including *Encephalartos, Zamia* and *Dioon,* amongst others)[6 10]. The indigenous cycads of southern Africa are *S. eriopus* and 28 species of *Encephalartos*[6 10].

In South Africa members of the genus *Encephalartos* are also known as "broodbome" (literally bread trees), Hottentot- or Kaffirbread[1 10]. The indigenous tribes used the starchy pith from the stems or trunks of *Encephalartos* species to bake bread. The pith was removed from the stem, wrapped in an animal skin and buried in the ground for a period of a month or 6 weeks to induce it to ferment partially[1 10 12]. The fibrous mass was then ground to a flour (meal or sago), mixed with water to a paste and finally baked or roasted[1 10 11 12]. Detoxification is probably due to fermentation and water-solubility of the toxin[10].

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The cycads are popular garden shrubs in South Africa, but due to strict nature conservation regulations to protect the indigenous cycads, the exotic cycads are frequently planted as substitutes. A further advantage of these exotic species is that they grow faster than the indigenous varieties.

The earliest and most well-known record of cycad toxicity occurring in South Africa was reported by Reitz[7]. He accounted his experiences in the eastern Cape Province during the Anglo-Boer war (1899-1902) after the hungry Boer soldiers ate the fruit (cone) of the "Hottentots bread" (*Encephalartos altensteinii*): "I had not eaten any, and returning to the firing-line, after going to tie up some horses that had broken loose, I was astonished to find more than half our men groaning and retching on the ground in agony, some apparently at their last gasp....." Dyer states that the species most likely to have caused this particular outbreak was probably *E longifolius* (Jacq.) Lehm.[1].

Wells as cited by Dyer (1966)[1] (and personal communication 1991; Botanical Research Institute, Pretoria) reported the death of 2 head of cattle in the Riebeeck-East district of the eastern Cape Province in 1965. The autopsies by Rossiter (State Veterinarian, Regional Veterinary Laboratory, Grahamstown, 1965) showed that the forestomachs contained many seeds of *E. longifolius.*

Cycad or zamia poisoning in cattle and sheep in Australia is well known and has been reported widely[3 4]. There are 2 distinct syndromes, viz: acute severe gastro-intestinal disturbance and liver necrosis; and chronic partial paralysis. In cattle the latter is better known and is caused by degenerative lesions in the spinal cord that lead to posterior ataxia, commonly known in Australia as "wobbles", "rickets" or "staggers"[2 3 4 12].

Nishida, Kobayashi and Nagahama as cited by Laqueur & Spatz[5] isolated an azoxyglycoside from the seeds of *Cycas revoluta* (Thunb.) and named the compound cycasin. Later the same group isolated new azoxyglycosides from *C revoluta* and named them neocycasins. Yagi & Tadera[13] determined the azoxyglycoside contents in various parts of *C revoluta* and reported that the pith contained slightly less cycasin than the seeds on a percentage fresh weight basis. After ingestion, intestinal bacteria enzymatically convert cycasin to the hepatotoxic and carcinogenic aglycone, methylazoxymethanol (MAM)[9]. MAM is the common aglycone of all the different azoxyglycosides isolated from various cycad species[2].

The only published report that we could find of cycad intoxication in dogs, is the article published by Senior et al[8]. Two dogs in Florida (USA) ingested seeds of *Zamia floridana* and died. Both dogs vomited persistently, and developed severe liver necrosis followed by icterus and a haemorrhagic syndrome.

Recently we investigated a suspected case of cycad poisoning in dogs after they ingested parts of the stem of *Cycas revoluta* (Thunb.).

Three Bull Terriers, a 3-year-old bitch and 2 of her offspring (a dog and bitch, 16 months old), uprooted and destroyed a potted exotic cycad, *C revoluta* (Thunb.) (Fig. 1). They tore off the leaves and chewed at the 30 cm diameter, fibrous stem and ingested an unknown quantity of plant material. Shortly after ingestion, the old bitch started vomiting. The male subsequently, ingested the vomitus (containing plant material) and then also started showing signs of nausea and vomited repeatedly. The other female started vomiting within an hour of ingesting the material. The dogs then became depressed and prostrated. They all salivated profusely and drank water repeatedly.

Four hours after exposure, the dogs were presented to the Department of Pharmacology and Toxicology, Faculty of Veterinary Science, University of Pretoria. On clinical examination, both

Fig. 1: **An example of *Cycas revoluta,* Japanese cycad or sago palm**

females were markedly depressed and the mucous membranes of all the dogs were severely congested. Although all the dogs had slightly elevated temperatures, we concluded that this was probably caused by transport during the heat of the day. The respiratory and heart rates were within normal limits. All 3 dogs were treated with magnesium sulphate (Elvet Epsom Salts, Elvet) as a laxative and were taken home.

The next day all 3 dogs were moderately depressed and their mucous membranes were still congested. The older bitch exhibited a tender abdomen on palpation. During the following days their habitus and colour of the mucous membranes returned to normal and they all made an apparently uneventful recovery. The young female showed proestrus 18 d after exposure and was later successfully mated. On Day 31 of gestation, pregnancy was confirmed by sonar scanning. On Day 60 of gestation one stillborn puppy with a cleft palate was born.

Haematological and blood chemical investigations revealed elevated serum concentrations of alanine transaminase (ALT), an initial mild lymphocytopenia, thrombocytopenia and a leukocytosis.

Increases in the serum concentration of ALT and in the total white blood cell count were the most prominent changes observed in all dogs. An increase in immature neutrophils and a mild lymphocytopenia and thrombocytopenia, in the female dogs only, also occurred. The haemoglobin and mean corpuscular haemoglobin concentrations and monocyte counts showed only slight deviations from the norm.

Morton as cited by Senior et al[8] observed vomiting, lethargy, anorexia and increased thirst beginning 2 h after a dog had ingested seeds of *Dioon edule.* All clinical signs disappeared within 12 h and no complications were reported[8]. Following ingestion of parts of the stem of *Cycas revoluta,* severe vomiting and prostration occurred, but was not fatal in this case and the dogs made an uneventful recovery. The conception and birth of a still-born puppy with a cleft palate to the young bitch subsequent to exposure, is probably incidental. In view of the known carcinogenicity of this plant family, the exposed dogs will be closely observed for possible future development of neoplasms.

The rise in serum ALT concentration encountered is indicative of possible liver necrosis and is consistent with that reported by Senior et al[8]. The increases in the white blood cell counts with the neutrophil left shift could denote an inflammatory reaction and was also reported by the same authors. In addition they also described a severe coagulopathy with thrombocytopenia and a lymphopenia[8]. In this case the 2 females also developed an initial mild thrombocytopenia and lymphopenia.

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THE CARBON DIOXIDE LASER SCALPEL

E J DURANTE*

ABSTRACT

The CO_2-laser is currently used as a scalpel by a large number of medical surgeons, but in the field of veterinary surgery, relatively little has been published on the subject. A review of the origin of medical lasers, the basic physics of laser energy production and the characteristics of laser light was therefore considered necessary. This review includes a discussion on how the optical radiation generated by the different lasers is absorbed, the cutting power of the CO_2-laser, and the effect on healing, tensile strength and haemostasis when used in the skin, *linea alba* and gastrointestinal tract.

Key words: CO_2-laser, physics, absorption, veterinary surgery, healing, tensile strength, haemostasis.

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INTRODUCTION

Albert Einstein developed the theory of stimulated emission of light which is the basis of what is known today as the laser. In 1950 the precursor of the modern-day lasers was assembled and named MASER (Microwave Amplification by Stimulated Emission of Radiation). In 1960, Maiman was the first scientist to build a laser from a rod of crystalline ruby[35]. The word LASER was created as an acronym for Light Amplification by Stimulated Emission of Radiation[4,20]. The two lasers used most commonly in the medical field, the carbon dioxide and neodymium-yttrium-aluminum-garnet (neodymium-YAG). lasers, were introduced in 1964[4].

Fisher[16] defined the laser as a generator of a unique form of light or electromagnetic waves, known as coherent radiation, which is not found in nature. This light can be produced by the excitation of a solid active medium (solid state lasers) or as gaseous medium (gas lasers), the latter being the type most commonly used in medicine and surgery. A gas laser is formed by a laser tube filled with a gas or laser medium (e.g. CO_2-laser). Two mirrors placed at both ends of the tube enclose the so-called optical resonator[47] (Fig. 1). Under normal circumstances of light generation, an atom absorbs a photon, and as a result the electrons move to higher energy orbits. Subsequently, the atom emits the photon and the electrons move back to their lower energy orbits, releasing in the process a disarranged form of energy termed "incoherent light". This is a spontaneous physical process. On the other hand, "coherent light" is only generated inside a laser tube during the process of amplification by stimulated emission. This is usually triggered by an electric discharge inside the optimal resonator (Fig. 1) that causes the excitation of a number of atoms of the laser medium. This discharge is larger than the discharge that occurs during the spontaneous process. The above-mentioned phenomenon is known as "population inversion"[47] because, under normal circumstances, most atoms are at rest. The laser medium is now excited and unstable and therefore the atoms begin to move to the lower energy level, each one releasing a photon in the process. When a photon, produced in this manner, strikes an excited atom, the atom moves to the low energy level, releasing an extra photon identical to the original one. In this way the process is "stimulated". The multiplication of photons has been called "light amplification" and the energy thus generated in known as "laser light"[23,47]. This is a cycle during which the atoms reaching the lower energy level are re-excited, producing a continuous flow of laser energy. The atoms leaving the higher energy level must reach and leave the lower energy level as fast as they arrive in order to accomplish their process of de-excitation. This is important because quick de-excitation contributes to the power of the laser output and secondly, only the atoms at rest are available for re-excitation.

Laser energy has 3 unique characteristics: coherence, monochromacity and collimation[23]. This means that laser waves travel in space in phase (coherence), as a beam formed by waves of the same length (monochromacity) and in almost parallel configuration (collimation). It is because of these particular properties that the laser beam can be transported by mirrors and lenses and focused in very small spots where the power density can be as high as 1 MW/cm^2 [16]. At a distance of 30 m the energy beam still maintains almost the original cross-section and can be focussed upon a lens as small as 50 mm[16]. The scattering of laser energy increases with the decrease in wavelength. The gas used as laser medium determines the wavelength and therefore the light produced is either visible or invisible (infrared).

ABSORPTION OF LASER ENERGY

Laser light is absorbed by living tissues and immediately converted into thermal energy, in a manner determined by the type of laser used (CO_2, neodymium-YAG, argon, etc.) and the wavelength. The termal effect of a surgical laser is essentially one of denaturation of the complex substances that form the different body tissues and with which the laser beam interacts. The absorption of laser energy is influenced mainly by 2 of the body's chromophores, namely water and haemoglobin[11]. It is also influenced by the scattering properties peculiar to a particular type of laser. Consequently, penetration may range from deep to superficial. Haemoglobin absorbs the light of some lasers, for example argon, rendering them ineffective as cutting tools unless the surgical field is completely free of blood. Otherwise the energy is absorbed entirely by this layer, causing its coagulation without having reached the tissues which it is meant to

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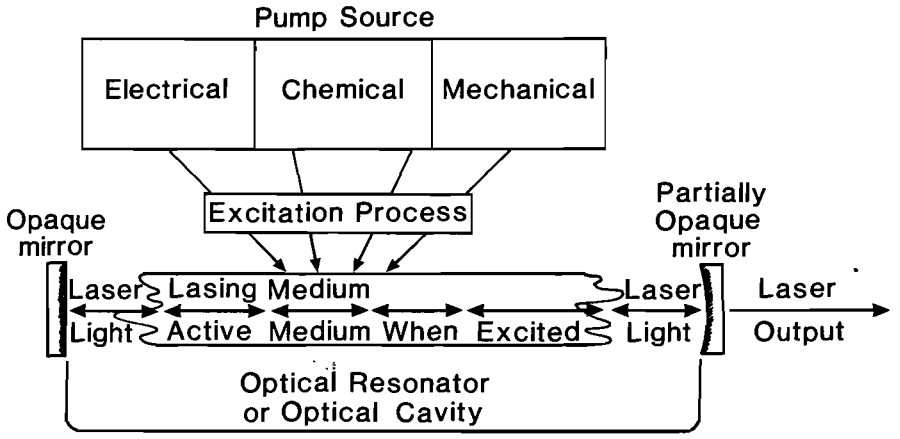

Fig. 1:**Mechanism of laser light production (modified from Bailin et al.[4])**

incise. The energy generated by the neodymium-YAG laser is poorly absorbed by water and haemoglobin, and thus, penetrates deeply into the tissues. The CO_2-laser is almost completely absorbed by water and as a result only penetrates the tissues superficially, with little scattering[6 26 27]. Heat conduction will determine the volume of tissue beyond the incision line which will be affected by the thermal energy. The temperature generated in a tissue exposed to the laser beam is determined by its water content. Tissue water acts as a buffer, maintaining the temperature in the interaction site at 100°C[16 27]. Once the water in the tisue has evaporated, the buffer effect will disappear and the temperature will increase substantially. If irradiation is prolonged, carbonisation may occur[36]. The temperature at an impact site in tissues with very low water content, such as bone, can reach 1 000°C.

ORIGIN AND DEVELOPMENT OF MEDICAL LASERS

After the creation of the ruby laser, medical researchers spent a great deal of time investigating the potential applications of lasers in the medical field. The first experiments were done with the ruby laser and later the neodymium laser in areas such as oncology, dermatology and ophthalmology[40]. The energy produced by these lasers was delivered in the form of short pulses. Therefore the excision of even small tumours was extremely impractical, since only a minute amount of tissue could be destroyed with every pulse. The high-energy pulsed ruby and neodymium lasers that appeared later were more effective, but it was soon discovered that their effect on tisues was very turbulent. This was probably due to shock waves produced by the sudden formation of steam deep down in the tissue. This in turn can be explained by the deep penetration of the beam at the impact site due to the reduced absorption of these types of laser energy by the body tissues[56]. For this reason pulsed ruby and neodymium lasers were not suitable for surgical use. In 1970 a CO_2-laser for surgical purposes was introduced and its potential medical applications were discussed[49].

THE CARBON DIOXIDE LASER

The CO_2-laser light is emitted in the infrared region at a wavelength of 10,6 nm. It is well absored by all the body tissues, with the exception of bone. This tissue has a very low water content which causes the laser energy to generate very high temperatures, leading to carbonisation and thermal necrosis. In contrast with the lasers emitted in the visible region of the light spectrum, the absorption coefficient of CO_2-laser light is not affected by the colour of the tissue it penetrates[1 55].

The ability of this laser to incise or vaporise a tissue is determined by the instantaneous transformation into heat of the absorbed light within a depth of about 0,2 mm[22]. The effect of this thermal interaction is determined by the energy density[26]. The depth of the incision, therefore depends primarily on both the power used and on the speed at which the beam is swept across the area. The light of a CO_2-laser can be delivered to the surface of a tissue in 2 ways. Firstly, the beam may be focussed on a very small spot causing the division of the tissues. Secondly, the beam may be unfocussed by withdrawing the handpiece from the target so that it enlarges its diameter. This results in the vaporisation of a large area. When the focussed beam of the CO_2-laser reaches the tissue, division occurs due to cell vaporisation[1 9 24]. The high-power of the beam determines a sudden increase in the temperature of the exposed area that causes the inter- and intracellular water to boil voilently (100°C). This process results in the disintegration of the cells due to the expansion of steam and the ejection of the cell's solid components[27]. This cellular debris is heated further to the point of combustion as it moves through the beam's path, resulting in a thick plume of smoke. At the same time, part of this carbonised material is deposited along the wound edges giving the erroneous impression that the incision of the tissue is due to burning[24]. A photographic study of laser wounds has shown that burning temperature is not reached at the impact site. During tissue evaporation, the thermostatic effect of boiling water would maintain the temperature at the wound edges close to 100°C[24]. The small size of the beam and the poor heat conduction of soft tissues account for the destruction of a very thin layer of cells when this laser is used as a scalpel[36]. Unlike the stainless steel blade, the laser beam produces a conical incision with a width proportional to the power and inversely proportional to the speed of the incision When the laser power is high and the speed of incision is slow, the conductivity of the heat away from the centre of the crater also increases. This leads to devitalisation of the wound's margins which can be seen macroscopically as a blanching of the area around the crater, and is microscopically demonstrated by the presence of coagulation necrosis and nuclear-cytoplasmic modifications in the cells close to the impact site[37]. For this reason, the CO_2-laser scalpel should be used at the maximum possible power that the surgeon can manage, and for the shortest possible time. This will ensure that minimum secondary damage occurs[3 17]. When an unfocussed beam is used, the spot of light is considerably larger. This allows for the vaporisation of large volumes of tissues or the coagulation of blood vessels larger than 0,5 mm or the occurrence of both of these phenomena at the same time[5 50].

WOUND HEALING, TENSILE STRENGTH AND HAEMOSTASIS IN TISSUES INCISED WITH THE CO_2-LASER

Until 1970, all research related to the healing process of surgical wounds was based on incisions made with steel scalpel blades. With the advent of the CO_2-laser, surgeons needed more

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