APPROACHES FOR EPIDEMIOLOGICAL INSIGHTS INTO THE IODINE NUTRITION OF RUMINANT LIVESTOCK UNDER NATURAL CONDITIONS IN

ZIMBABWE

By

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A thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy

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December, 2004

DEDICATION

I dedicate this thesis to all those who value the satisfaction that comes with perseverence. In particular my late father, S.M.M. Ushewokunze whose motto to family was "if others can, why can't I?" and my late mother who was resolute that a lot of solutions are a result of common sense.

I also dedicate this thesis to my husband Oluseye and my only daughter Fadeke, who stood by me in demanding times when I had to stay up late and often, away from home both physically and in mind, in order to make my dream of self-actualisation a reality.

ABSTRACT

This thesis is based on work founded on an hypothesis that Zimbabwe is endemic for hypothyroidism as previously indicated in human studies, therefore a case for hypothyroidism for livestock was presumed.

The studies conducted for this thesis sought to establish population diagnostic systems for thyroid status, hence iodine status, that could be used in cattle and goats while establishing some reference values and epidemiological factors that could be used in herd health decision-making.

The approaches used for the epidemiological studies included a population cross-sectional study using cattle and goat sera, testing of pasture materials for iodide levels, a station supplementation experimental study and a farmer participatory field trial testing an iodised feed supplement. The diagnostic methods tested included radiommunoassay (RIA) for thyroid hormones, the iodide ion selective electrode (ISE) method for feed materials and the enzyme linked immunosorbent assay (ELISA) for serum thyroid stimulating hormone (TSH).

The RIA was able to detect serum free triiodothyronine and free tetraiodothyronine in cattle and goats. The results are presented confirming the effect of factors such as animal age, body weight, sex, lactation status and natural agro-ecological region in cattle and goats. The range for cattle was 0.089 to 1.900ng/dl with a median of 0.46ng/dl; while for goats the range and median were 0.430 to 1.49 ng/dl and

0.933ng/dl, respectively. An attempt to validate the RIA findings in cattle against levels of thyrotropin did not succeed because the ELISA method attempted suffered from cross-reaction with leutenising hormone (LH) and follicle stimulating hormone (FSH).

Despite that observations of goitre in goat kids were made in an area previously recorded as highly endemic for human hypothyroidism, a field trial involving iodine supplementation to dairy cattle in the same area could not substantiate hypothyroidism in lactating animals. On the contrary, the iodine containing supplement appeared to depress milk yield. Similarly, a controlled station experiment with weaner calves could not indicate a performance advantage resulting from iodine supplementation.

The studies have therefore established the RIA and the ISE as methods which can be used to study the iodine status of cattle and goats and some data to assist further investigations into supplementation regimes aimed at improving productivity in cattle and other livestock.

ACKNOWLEDGEMENTS

The invaluable assistance in the tedious literature search by the librarian Mr C Madziwa is gratefully acknowledged, so is the support to him by the late Mrs Grace Makoni.

For laboratory analysis, I am most thankful to Mrs Anne Bernie and Mrs Esi Chinyanga for their most valuable technical support on the RIA assays. I gratefully acknowledge the leadership of Dr Suman Mahan on the ELISA assays which were empirically generated with his guidance and the excellent support of Ms Shalt Semu. I thank Mrs Lydia Mabikacheche for her untiring work in the evaluation of the ELISA test and Mrs Ethel Nyagani for valuable advice on the chemical calculations for the supplementation study at Mazowe. Dr I. Mpofu and Mr Govere both of University of Zimbabwe (UZ) Animal Science were instrumental in UZ accepting to host and guide the ion selective electrode (ISE) work on feeds at the University of Zimbabwe. For that, I am most grateful.

The arduous task of statistical analysis would not have been entirely accomplishable without the unwavering back-stopping support of the biometrician, Mrs Theresa Munyombwe-Choga. My invaluable personal assistants for many years, Mrs Erica Zvaita and the late Mr O Chinyandura, worked tirelessly on the innumerable preliminary drafts of proposals, publications, reports and finally this thesis. I thank them for being so loyal in support of my research and thesis.

I thank Dr W.N. Madzima and his team of field Veterinary staff for opening the way to let me work with them and farmers at all the points that were used in this study. In particular, I am thankful for the loyal and honest support of Mr Farai Tinarwo, for being my energetic right hand in working with the farmers of the Chikwaka small-holder dairy scheme and rallying them to understand the basis of the work I was doing with them. Similarly, I am indebted to Mr Hilton Majonga and Dr O Kakono for looking after experimental animals at the Mazowe

Veterinary Field Station and ensuring the safekeeping and transfer of samples to the laboratory in Harare regularly during the course of that study.

My utmost thanks go to my supervisors at various stages. I am most grateful to Dr A Majok for his support and suggestions at the initial stages of the project conception and design. Others whose backstopping was crucial were Prof A Brand, Prof Van Leengoed, Dr Hilda T. Marima-Matarira; and for giving me the last push when hope almost failed me, Professors A Bobade and M Obwolo. External oversight support by Professor Karl Zessin and Dr Moses Kyule of the Free University of Berlin, Germany is acknowledged with thanks.

This work would not have been possible without the funding from the European Union arrangement for local research through the University of Zimbabwe. I remain grateful to the Faculty of Veterinary Science for recognizing the importance of supporting development-oriented veterinary research by public sector researchers.

Finally, I wish to thank the Ministry of Lands, Agriculture and Rural Resettlement, for recognizing the importance of permitting capacity enhancement in senior research management by allowing these studies to be carried out under their auspices

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ACRONYM	EXPANDED FORM
ABTS	2,2'-azinobis-bis(3-ethylbenz-thiazoline-6-sulfonic acid) diammonium salt
BEI	Butanol extractable iodine
ANCOVA	Analysis of covariance
ARC	Agricultural Research Council
CTRL	Crown-to-rump length
CV	Coefficient of variation
dc	direct current
DIT	Diiodotyrosine
DPC	Diagnostic Products Corporation
dl	Deci-litre
EDDI	Ethylene diamine-dihydroiodide
ELISA	Enzyme linked immunosorbent assay
FA	Freund's antigen
FCA	Freund's complete antigen
Fig.	Figure
FSH	Follicle stimulating hormone
FT_3	Free triiodothyronine
FT_4	Free thyroxine (tetraiodothyronine)
GC	Gas chromatography
HRP	Horse radish peroxidase
IgG	Immnoglobulin gamma
ISE	Ion selective electrode
kg	Kilogram

ACRONYM	EXPANDED FORM
KPL	**Kirkgaard Perry Laboratory**
KOH	**Potassium hydroxide**
LC	**Liquid chromatography**
LH	**Leutenising hormone**
MS	**Microsoft**
mg	**milligram**
ml	**millilitre**
mv	**millivolt**
µg	**microgram**
µl	**microlitre**
ng	**nanogram**
NHPP	**National hormone and pituitary programme**
NRC	**National Research Council**
OD	**Optical density**
p	**probability of getting as extreme a value given the null hypothesis is true**
PBI	**Protein-bound iodine**
ppm	**Parts per million**
ppb	**Parts per billion**
PBS	**Phosphate buffered saline**
r	**correlation coefficient**
RIA	**Radio-immuno assay**

ACRONYM	EXPANDED FORM
T_3	Triiodothyronine
T_4	Thyroxine (tetraiodothyronine)
TBG	Thyroid binding globulin
TRH	Thyroid releasing hormone
TSH	Thyroid stimulating hormone or Thyrotropin
x	Horizontal axis
y	Vertical axis