AN ATLAS OF HELMINTH INFECTIONS IN CATTLE, SHEEP AND GOATS IN

KENYA:

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

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ABSTRACT

Maps that are reliable and up to date are necessary in helminth infection control and have been used in human medicine to target control strategies in populations with greatest need. Cost effective designs of control programmes can be realized easily and accurately if information on geographical distribution of helminth infections is available (Brooker et al., 2009).

Helminthosis is a major challenge to livestock production in Kenya. The control of ruminant helminths has not been well coordinated compared to control of soil transmitted helminths (STH) infections in humans where an increasing number of countries are implementing national treatment programmes. Data concerning infection distribution for various livestock helminths is available but not in a form that is accessible to policy makers. Various geographical areas have different risks of helminthosis. This means therefore different regions require different interventions. The overall objective of this study was to develop an atlas detailing the spatial distribution of cattle, goat, and sheep helminth infections in Kenya for easier and more convenient comprehension of the information by policy makers. The specific objectives were to determine empirical data on cattle, sheep and goats helminth infections, spatial distribution of previous studies on helminths infections in cattle, sheep and goats in Kenya, and additionally the spatial distribution and summary infection prevalence estimates of the same in Kenya.

The study area included counties in Central, Rift valley, Nairobi, Western, Coast, Nyanza, and Eastern regions of Kenya. Relevant information on the prevalence of each of the major ruminant strongyles and Fasciola gigantica species in Kenya was identified through systematic literature review which consisted of structured searches of electronic bibliographic databases complemented with manual searches of local archives and libraries and direct contact with various authors of published articles and thesis. A manual search of archives of Kenya
Agricultural Research Centre (KARI), University of Nairobi, and Veterinary Investigation Laboratory (VIL) libraries provided a particularly useful source of information. References from identified publications were checked for additional surveys. The exclusion criteria entailed any survey data with prevalence reported without provision of the population, surveys with errors in prevalence calculation, and abattoir surveys because of difficulties in animal traceability. Inclusion criteria entailed that the studies consist of clear prevalence information, a well-defined study area, clear diagnostic techniques as well as those conducted in Kenya between 1970 and 2013. Multiple surveys available from same location but surveyed at different times were included as separate entities. Titles and abstracts of survey data were screened for relevant information after which full text screening would follow. Processing of the data was by abstracting data information into standardized Microsoft Excel spreadsheets. Abstracted information included details on the source of the data, date, and location of survey, characteristics of the surveyed population, survey methodology, and method of diagnosis, species, the number of animals examined, and the number positive with specific helminths. The Microsoft Excel table consisting of data attributes that included study location and coordinates were added to QGIS 2.2.0 Valmiera and layered with a georeferenced map of Kenya to form a dot map illustrating the previous helminth infections study points.

For prevalence maps, Microsoft excel sheets consisting of county data and the corresponding prevalence rates were layered and joined in QGIS 2.2.0 Valmiera with a georeferenced map of Kenya showing 47 counties. On County layer properties a text diagram of assigned attributes was added giving prevalence circles indicating the prevalence estimates of different helminths in various counties.
Single group summary which was the outcome of summary prevalence’s was done in Microsoft Excel by calculating the outcomes (prevalence) of each study, their individual standard errors and computing individual variance, weights and each weighted effect size. Q and I² statistics were then computed followed by adjusting each weight using a random effects model since the assumption was that variability was not only due to sampling error but also due to population of studies. Using confidence intervals, study outcome size (study effect size) and values of the random effects model effects summary forest plots were constructed.

Sixty three studies were geolocated and mapped. Published data constituted 84% of data mapped whereas grey literature of MSc, PhD thesis and communiqué with authors constituted 16%. Single group summaries of prevalence for major helminth genera and classes were realized with Fasciola gigantica species in cattle recording 25.64 % (18.23; 33.05 CI), cattle strongyles at 34.43 %( 31.66; 37.21CI) and goat strongyles at 27.0 %( 25.34; 28.71 C.I).These were as per the surveys included in the study.

Geographical distribution of mapped studies showed 29%, 25% and 8% of studies were carried out in the Central, Rift Valley and Eastern counties of Kenya respectively. North eastern region had only one study included. Spatial distribution of cattle helminth prevalence estimates revealed 64% (55.50;72.40 CI) of Fasciola gigantica in Kisumu 47.2%(39.98;54.85 CI) in Kwale, 40.21%(33.82;46.60 CI) in Kilifi, 33.93%(25.05;42.82 CI) in Kiambu, 25%(19.27;31.28 CI) in Makuenei, 24% (21.96;26.55 CI) in Busia and 18%(13.44;21.91 CI) in Murang’a counties.

Cattle strongyle prevalence estimates were 19.8%(13.67;25.93CI) in Nakuru, 51% (43.51;58.50 CI) in Kisumu, 46%(43.65;54.12CI) in Kiambu, Kajiado 46%(20.03;78.32CI), Busia 45%(41.65;47.88 CI), Laikipia 30%(26.17;34.68 CI), Nyeri 24%(19.19;28.80 CI) and 26%(21.10;30.97CI) in Machakos counties.
Turkana and Kisumu counties had the highest goat strongyle prevalence estimates ranging over 90% (75.8; 100 CI). Embu, Machakos and Kiambu counties had 45-69% while Kajiado, Nakuru, Murang’a and Nyeri counties recorded 22-45%.

The fact that grey literature contributed to mapped studies albeit at a lower percentage compared to the published ones showed none the less that unpublished data was important in study collation.

The single group summary prevalence estimate of *Fasciola gigantica* was 25.64% (18.23; 33.1 CI) in this study. This is almost in agreement with Mango and others (Mango et., al 1974) who observed that fasciolosis in Kenya mainly affected cattle and usually was by *Fasciola gigantica* with an overall prevalence in slaughtered cattle of 17%. Lower prevalence of *Fasciola gigantica* in the Coastal region as compared to Nyanza and Western regions is supported by a report by Food and Agriculture Organization (F.A.O) who estimated the prevalence at 0-8% in coastal region and 16-43% in Nyanza region of Kenya. The study findings further supports what has been documented before that strongyles are the most important nematodes of livestock ruminants (Kanyari et., al 2010).

In conclusion, the atlas demonstrated single group summaries, prevalence and spatial distribution of studies of helminth infections in cattle, sheep and goats in Kenya. A major recommendation would be to have active helminth prevalence studies undertaken in the 47 counties in order to come up with an up to date atlas that would be of use to policy makers and for purposes of advocacy. Additionally Geographical information system and Meta-analysis techniques used in this study can be used to map prevalences and generate Single group Summaries of other animal diseases of epidemiological importance given presence of reliable secondary data.