PREVALENCE AND ASSOCIATED RISK FACTORS OF WORM INFECTIONS AMONG CHILDREN IN RURAL COMMUNITIES OF NORTHERN SABAH

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I hereby declare that this thesis is my own work and effort and that it has not been submitted anywhere for any award. Whereby other sources of information have been used including quotations, excerpts, summaries and references, have been duly acknowledged.

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ABSTRACT

The lack of access and level of knowledge, attitude, practices and understanding of associated environmental and social risk factors have led to increased human infection with parasitic worms. Infection of parasitic worms such as *Ascaris lumbricoides*, hookworms, *Trichuris trichiura, Fasciolopsis* and *Taenia* among the rural communities have been reported in Sabah, Malaysia but the prevalence and study on the risk factors of these worm infestation in Sabah are scarce and may not be available. Hence, further in-depth study was carried out to estimate with certainty the overall incidence of infection with parasitic worms as well as to determine and understand how infections with such worms are closely related with environmental and social factors. This cross-sectional study was carried out from April 2015 until January 2018 in 13 villages involving children aged between six months until 17 years old in the District of Kota Marudu, Sabah. This study involved assessment of surrounding environment, collection of stool as well as soil and water samples, interviewing villagers using questionnaires to collect baseline data, microscopy, statistical analysis and genetic characterization. The overall prevalence of soil-transmitted helminth (STH) infections in these children was 14.3% with *A. Lumbricoides* at 63.9%, hookworm 18.0% and *T. trichiura* 18.0%. The risk factors found to be associated with these infections were mothers with low or no formal education; household income of less than RM500; use of untreated water as drinking water; unavailibility of toilets; children who usually walk barefooted and not washing feet before entering the house; and the presence of domestic animals at the house. About 35% of the soil samples were found to contain eggs of one or two soil-transmitted helminth (STH) species. Through genetic characterization via Polymerase Chain Reaction, *A. Lumbricoides, Necator americanus* and *Ancylostoma* species were recorded.

ABSTRAK

PREVALENSI DAN FAKTOR RISIKO BERKAITAN INFEKSI CACING DI KALANGAN KANAK-KANAK KOMUNITI LUAR BANDAR DI UTARA SABAH

Kekurangan akses dan tahap pengetahuan, sikap, amalan dan pemahaman faktor risiko alam sekitar dan sosial yang berkaitan telah membawa kepada peningkatan infeksi cacing parasit kepada manusia. Jangkitan cacing parasit seperti Ascaris lumbricoides, cacing kerawit, Trichuris trichiura, Fasciolopsis dan Taenia di kalangan masyarakat luar bandar telah dilaporkan di Sabah, Malaysia. Namun jangkitan dan kajian terhadap faktor-faktor risiko jangkitan cacing ini di Sabah adalah terhad dan mungkin terlalu sedikit. Oleh yang demikian, kajian yang lebih mendalam perlu dilakukan untuk menganggarkan dengan pasti kejadian keseluruhan jangkitan cacing parasit serta menentukan dan memahami bagaimana jangkitan cacing tersebut boleh berkait rapat dengan faktor alam sekitar dan sosial. Kajian keratan rentas ini dijalankan dari April 2015 sehingga Januari 2018 di 13 buah kampung yang melibatkan kanak-kanak berumur di antara enam bulan sehingga 17 tahun di daerah Kota Marudu, Sabah. Kajian ini melibatkan pemerhatian sekeliling di lapangan, pengumpulan sampel tinja serta tanah dan air, wawancara penduduk kampung menggunakan borang soal selidik untuk pengumpulan data asas, mikroskopi, analisis statistik dan pencirian genetik. Prevalensi keseluruhan infeksi cacing yang ditularkan melalui tanah (STH) di kalangan kanak-kanak adalah 14.3% dengan A. lumbricoides pada 63.9%, cacing kerawit 18.0% and T. trichiura 18.0%. Faktor risiko yang didapati berkaitan dengan infeksi cacing parasit ini adalah para ibu yang tiada atau berpendidikan formal rendah; pendapatan isi-rumah yang kurang daripada RM500; penggunaan air tidak dirawat sebagai air minuman; ketiadaan tandas; kanak-kanak yang selalu berkaki ayam dan tidak mencuci kaki sebelum masuk ke rumah; dan kehadiran haiwan domestik di rumah. Terdapat kira-kira 35% sampel tanah yang mempunyai satu atau dua telur spesies STH. Melalui perincian genetik, A. lumbricoides, Necator americanus dan Ancylostoma spp telah direkodkan.

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LIST OF ABBREVIATIONS

COI	-	Cytochrome c oxidase I
DNA	-	Deoxyribonucleic Acid
DPR	-	People's Democratic Republic
ITS	-	Internal Transcribed Spacer
JKKK	-	*Jawatankuasa Kemajuan dan Keselamatan*
KD	-	*Klinik Desa*
Kg.	-	*Kampung*
KK	-	*Ketua Kampung* or *Klinik Kesihatan*
MDG	-	Millennium Development Goal
NaCl	-	Sodium Chloride
NaOH	-	Sodium Hydroxide
NGO	-	Non-Governmental Organization
PCR	-	Polymerase Chain Reaction
PETRONAS	-	Petroliam National Berhad
RNA	-	Ribonucleic Acid
SEA	-	South East Asian
SDG	-	Sustainable Development Goal
SDS	-	Sodium Dodecylsulfate
SPSS	-	Statistical Package of Social Sciences
SSA	-	Sub-Saharan African
STH	-	Soil-Transmitted Helminth
TADIKA	-	*Taman Didikan Kanak-Kanak*
UMS	-	Universiti Malaysia Sabah
UN	-	United Nation
WHO	-	World Health Organization
$ZnSO_4$	-	Zinc Sulphate

LIST OF SYMBOLS

%	percentage
<	less than
>	more than
/	or
&	and
=	equals to
cm	centimetre
d	level of precision
km	kilometre
L	Litre
m	metre
m.a.s.l.	metre above sea level
mg	milligram
mL	millilitres
mm	milimetres
n	Minimum required sample size
N	Total of Respondents
OR	Odd Ratio
P	Proportion of the population infected
rpm	revolution per minute
SD	Standard Deviation
sg	specific gravity
µg	Microgram
µM	microMolar
µL	Microliter
χ^2	Chi-square
x	Multiply
^oC	degree celcius
z	Confidence level at 95%

LIST OF APPENDICES