CHAPTER VI

CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

Soil-transmitted helminthiasis is still a major public health problem in many developing countries with prominent morbidity among children in rural communities. This infection is mainly caused by three worm types namely common roundworms (*Ascaris*), whipworms (*Trichuris*) and hookworms (*N. americanus* and *A. duodenale*). Findings of the present study revealed that STH infections are very common among Orang Asli school children in Lipis, Pahang, Malaysia. Hence, there is an urgent need to identify and implement innovative and integrated control measures to reduce the prevalence and intensity of these infections significantly and to save these children from the negative impact of STH infections as part of the efforts to improve the quality of life of the Orang Asli population.

The findings also showed that the knowledge of Orang Asli people towards STH infections is inadequate. Moreover, their practices also favor the transmission of infections. Based on the findings, periodic school-based treatment distribution, providing proper and adequate sanitation and safe water supply, and providing proper health education regarding good personal hygiene practices should be considered in the control programme for this population.

A health education package named HELP was developed by the present study and used among school children in two rural schools for Orang Asli children in the Lipis district of Pahang state. The package was well received by the teachers, children and their community. After complete deworming, health education was given to children in one school while another school served as the control group. The follow-up assessments revealed that HELP was effective in reducing the incidence of hookworm infections during the 6 months follow-up and also *Ascaris* infections for 3 months only. The findings also showed that the intensity of *Trichuris*, *Ascaris* and hookworm infections was significantly lower among children who received HELP intervention compared to their counterparts in the control school. These findings clearly indicated that HELP was effective in reducing the exposure to these parasites by improving the personal hygiene practices of the children. After 6 months of complete deworming, the prevalence and intensity of STH infections among children in the control school were almost similar to pre-treatment level.

The present study also found that the knowledge about STH infections (helminth types, signs and symptoms, transmission and prevention) was significantly improved among teachers, children and their parents who received HELP when compared with their counterparts from the control school. The study further showed that the personal hygiene practices of children and their parents in the intervention school were positively improved and this explains the significant reduction in STH incidence and intensity among these children.

The followings are the main findings of the present study:

1. Overall, 98.4% of the children were found to be infected by at least one parasite species. Of those infected, 71.4% had polyparasitism (the concurrent infection with multiple parasite species) while 28.6% had monoparasitism (single

infection). The prevalence of trichuriasis, ascariasis and hookworm infections were 95.6%, 47.8% and 28.3%, respectively.

2. Almost two-thirds and half of the trichuriasis, and ascariasis, respectively were of moderate-to-heavy intensities while all hookworm infections were of light intensity. Ascariasis and trichuriasis were the most prevalent co-infections representing 47.6% of the overall prevalence while 18.6% of the infected children had the triad helminths (*Ascaris, Trichuris* and hookworm).
3. Not washing hands before eating, not wearing shoes when outside, not washing vegetables before eating, not cutting nails periodically, absence of toilet in house, using unsafe sources for drinking water, presence of infected family member and aged below < 10 years were the significant risk factors of STH infections and polyparasitism as well. It was also found that more than half (54.5%) of the STH infections cases could be reduced if these children had good standards of personal hygiene while providing toilet facilities and provision of safe drinking water will help in reducing 26.1% of the cases.
4. Overall, 79.9% of the participants have heard about helminth infections, however only 47.2%, 36.1% and 39.5% of them had knowledge about the transmission, signs and symptoms, and prevention of helminth infections, respectively. Moreover, only 56.9% of the participants considered intestinal helminths as harmful to people's health.
5. A health education learning package (HELP) was developed to improve the knowledge of Orang Asli population towards STH infections. The package focused on nine health messages which centered around the hygienic practices; hand washing practice, wearing shoes when going outside, washing vegetables/fruits before consumption, avoid open defecation, boiling drinking

water and covering food from flies. The development of the package was relied on the Health Belief and PRECEDE-PROCEED models.

6. After complete deworming, the intensity of trichuriasis was significantly lower throughout the first 5 months of assessments among HELP group when compared with control group. However, the impact of HELP on the incidence of trichuriasis was not significant.
7. Similarly, the intensity of ascariasis was significantly lower throughout the 6 months of assessments among HELP group when compared with control group. There was also significant difference in the incidence of ascariasis in the first 3 months and became not significant by the 4^{th} months onwards.
8. Likewise, the incidence and intensity of hookworm infection were significantly lower among HELP group when compared with control group.
9. The knowledge of teachers in HELP group was significantly improved compared to teachers in the control group. Similarly, the knowledge, attitude and practices (KAP) of children and their parents were significantly improved after the introduction of HELP compared to unchanged KAP among their counterparts in the control group.
10. It was observed that children in HELP group had enjoyed and taken their role seriously as health educators or health messengers to their families. During the visits to the villages, the children showed that they are wearing HELP slippers and their nails are cut and clean. Feedback from the mothers revealed that their children had taught them to wash their hands before preparing food and to wash vegetables/fruits before consumption. Many people had restored the toilets and promote usage of toilets and stop open defecation in the river.

6.2 RECOMMENDATIONS

1. There is a need to identify and implement innovative and effective control and preventive measures in order to reduce the prevalence and intensity of STH infections among these people. Hence, a school-based control programme including mass drug administration and providing health education should be introduced and incorporated in the school health programme.
2. The school-based programme should also include preschool children in the mass deworming and health education intervention. This can be done twice a year; at the beginning of each semester by inviting these children with their parents to school to celebrate "The Educational Day or The Deworming Day".
3. Orang Asli people should be empowered in their efforts to control STH infections and improve the quality of life. These people should be trained on how to create and promote proper hygienic practices and on how to use the available resources in their environment to support these efforts.
4. Orang Asli people should be involved in the decision and policy making process. For example, these people should be consulted on the design of the new houses to be built and on their requirements and cultural beliefs. An example from this study is that the government has provided new houses with proper toilets but these people use the toilets as store rooms and still prefer to spend most of their time in their old bamboo houses. This was due to the fact that the new houses did not meet their requirements and preference and also due to some cultural beliefs that toilets must not be inside the houses.
5. Health education should be given to these people as most of the risk factors of intestinal parasitic infections among these communities are related to poor personal hygiene practices.

6. HELP can also be incorporated with Doktor Muda Programme and to be implemented in schools in rural areas. Orang Asli school children should be empowered as the young doctors, and adults can also be empowered as community monitors to keep reminding people about the hygienic practices and to help promote these practices in the community.
7. HELP should be evaluated among many schools in different states and Orang Asli people from different tribes. A cluster randomized controlled trial is the design of choice. HELP should be revised and improved before confirming its positive impact and recommending it to be implemented or integrated into the curriculum.
8. There is a need for further research on the soil, water and food samples from the study area to further identify the main sources of STH infections among the people and provide more information about the dynamics of transmission of STH in these communities.
9. Poverty is the root cause of many health and social problems in these communities. Hence, long-term interventions such as providing job opportunities and providing more motivation for these people to continue their education are most likely to result in significant improvements in the health and nutritional status of children as well as the quality of life of Orang Asli population.

6.3 LIMITATIONS OF THE STUDY

Researchers conducting a community-based study or questionnaire survey among Orang Asli communities should expect many limitations and difficulties. The main limitation of the present study was the transportation and traveling to the villages every two weeks for the follow-up. Another limitation is recruiting participants and collecting fecal samples which were found to be difficult among Orang Asli people. However, the assistance from the principals and teachers in schools, heads of villages and JAKOA members helped a lot to get high response and compliance rate. It taken about 4-5 hours from the University of Malaya to reach the schools at the study areas. The nearest hotel was only at Kuala Lipis town; 50-70 km from the study areas. Although some students were lost to follow-up due to absenteeism or illness, but this did not affect the power of the study. In order to meet the parents for questionnaires survey at villages, interviews were conducted either during weekends or in the evening until late at night.

Although the present study is the first to develop a health education package against STH infections in Malaysia, some limitations related to the study design (open-label controlled trial) and methods should be considered when interpreting the study's findings. The study design might not be the ideal design to evaluate the impact of the package, however this study can be considered as a pilot study for a wider cluster randomized controlled trial that needs at least 15 schools. This is important to ensure the randomization which should be applied on the schools.

The comparison of two schools only might not be enough to rule out that the significant lower prevalence and intensity reported among the intervention group were not due to differences in the STH status between the two areas. However, the improvements in the knowledge and practices of children and people in this group were obvious and therefore explain most of this significant impact. Moreover, previous

studies among these children found that the prevalence and intensity of STH in both areas were similar at baseline and at 6 months after complete deworming (Nasr et al., 2013a; Ahmed et al., 2011; Al-Mekhlafi et al., 2008a). Furthermore, the high incidence rates of *Ascaris* and *Trichuris* reported in both groups by 6 months may indicate the similar STH status in both areas and support that HELP was effective in reducing the exposure to these parasites and thereby reducing the intensity of infections and the incidence of hookworm as well. Anthelmintic treatment was not distributed to preschool children and adults; however they still serve as a source of infections in these communities. In order to reduce transmission and achieve sustainable control, deworming should be extended to these age groups as well (Truscott et al., 2014).

Moreover, this study had to rely on a single fecal sample instead of the ideal three consecutive samples because of limitation of resources and the cultural belief of the Orang Asli against giving their fecal samples. Thus, the prevalence rate of parasitic infections is likely to be underestimated due to the temporal variation in egg excretion over hours and days (Knopp et al., 2008). Although *Strongyloides stercoralis* was not reported in the present study, a previous study detected *S. stercoralis* larvae in 7.1% of soil samples collected from the study area (Azian et al., 2008). It is shown in community-based studies that single stool examination generally underestimates the prevalence of *S. stercoralis* infection (Montes et al., 2010). The storage of fecal samples in cold temperature (4-6 ^{o}C) interfered with the parasitological diagnosis of strongyloidiasis (Inês et al., 2011), which may explain the absence of *Strongyloides* in the present study.