

Status of intestinal helminthic infections of borderline residents in North Korea

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Abstract: The present authors investigated intestinal parasitic infections among North Korean residents and refugees in China in 2003. The Kato-Katz method was applied to 236 residents and soldiers in a town on the North Korea-China border and to 46 people at a refugee camp in China. Only eggs of *Ascaris* and *Trichuris* were detected, with egg positive rates of 41.1% and 37.6%, respectively. The total egg positive rate was 55.0% and most of those who were egg positive were only lightly infected. Women of 61.2% and men of 53.1% were egg positive. The refugees from rural areas showed higher egg positive rates than those from urban areas. The present investigation confirmed high prevalence of soil-transmitted intestinal helminths in rural borderline areas of North Korea.

Key words: *Ascaris*, *Trichuris*, egg positive rate, refugee, North Korea

Recently, only a few people infected with intestinal helminths are found in South Korea (S. Korea). However, soil-transmitted helminthiasis (STH) used to be widely prevalent throughout the Korean peninsula in the past (Kobayashi, 1928; Korea Association of Health Promotion - KAHP, 2004). Ascariasis, trichuriasis and hookworm diseases are main STHs and were the target of serious concern in S. Korea when agriculture was the main field of employment (Seo et al., 1969). During this comparatively past in S. Korea, human feces were used as a fertilizer for cultivation purposes, which perpetuated STHs and reinforced their abilities to reinfect the human population.

Helminth egg positive rates were similar in South and North Korea (N. Korea) before the Korean War in 1950 according to previous reports (Kobayashi, 1928; Brooke et al., 1956). However, many records are available on the prevalence of helminthiasis in S. Korea after the Korean War, including national surveillance records, but it is hard to find any report on prevalence of helminthiasis in N. Korea. Only the infection of malaria is well understood in N. Korea due to the involvement of WHO (WHO, 2000), when the seriousness of the situation became evident in late 1990s.

Recently collaborations between S. and N. Korea have increased in non-political areas, e.g., economy, sports, science, and tourism. In particular, cooperation in medical fields has become a hot topic between the 2 countries. Several non-governmental organizations of S. Korea have started to support hospitals in N. Korea by supplying medical equipments, clinical techniques,

• Received 26 June 2006, accepted after revision 17 August 2006.

• This work was supported by the Reunification Research Grant, Seoul National University, 2003.

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Table 1. Egg positive rates of North Korean residents, soldiers, and refugees in China for intestinal helminths

Areas ^{a)}	No. examined	No.(%) of egg positives		Total (%)
		<i>Ascaris</i>	<i>Trichuris</i>	
A shi	40	27 (67.5)	16 (40.0)	29 (72.5)
B gun	150	73 (48.7)	66 (44.0)	94 (62.7)
C gun (soldiers)	46	2 (4.3)	13 (28.3)	13 (28.3)
Residents subtotal	236	102 (43.2)	95 (40.3)	136 (57.6)
Refugees	46	14 (30.4)	11 (23.9)	19 (41.3)
Total	282	116 (41.1)	106 (37.6)	155 (55.0)

^{a)}Areas included a city and 2 rural counties (= guns) in Hamgyeongbuk-do, North Korea.

and drugs including anthelmintics (Lee et al., 2001). In this context, one of interesting topic for south-north cooperation is the control of helminths because of its potential practical impact and cost-effectiveness.

We investigated the prevalence of intestinal helminthiasis by fecal examination of some N. Korean residents in 2003. The data have an important impact on perspectives concerning medical cooperation programs between S. and N. Korea. The cohort enrolled in this limited survey comprised 236 residents and soldiers in 3 neighboring villages in Hamgyeongbuk-do, which is located near the N. Korea/China border, and 46 N. Koreans living in a refugee camp in China. The subjects were between 4 and 75 years of age, and 131 males and 145 females (6 unknown). The Kato-Katz method was used for the fecal examinations.

The helminth egg positive rate of the N. Korean people was 64.7% in 190 residents of Hamgyeongbuk-do, 28.3% in 46 army soldiers ($P < 0.001$), and 41.3% in 46 refugees in China ($P = 0.052$) (Table 1). It is clear that STHs are highly prevalent among civilians of N. Korea but no systematic interventions have been running. Soldiers must be a special group of population in N. Korea, and thus they may be possibly covered by a certain anti-helminthic activity because they showed significantly lower egg positive rates than the residents.

We were informed that the refugees were often medicated with anthelmintics in China, and thus, their STH prevalence was likely to be lower than that of N. Korean residents. Though sample numbers of the present subjects were insufficient, it must be true

that the egg positive rate of refugees in China seemed to be dependent on their places of residence in N. Korea (Table 2). For example, refugees from urban areas like Pyeongyang and Cheongjin showed only 12.5% and 14.3% egg positive rates, respectively, as compared with the rates of over 50% among those from rural areas ($P = 0.004$ for rural vs. urban). The finding revealed that residents of rural areas were infected more by STHs than those of urban areas in N. Korea. The intestinal helminthiasis especially STHs tend to be more prevalent in rural communities, as was found by the 7 national status surveys conducted in S. Korea (KAHP, 2004).

Among those residents in N. Korea, the egg positive rate of women was 61.2% and that of men was 53.1%. The egg positivity among children of less than 10 years was 33.3% and this increased by age 31-40 years to 74.3%. For those aged over 40, the positivity was as high as 60%. The egg positive rates of *Ascaris* and *Trichuris* were high in all age categories over 20, but were lower exceptionally in soldiers.

In the present study, only eggs of *Ascaris* and *Trichuris* were identified. Not surprisingly the fauna of the intestinal helminths in N. Korea was similar to that once found in S. Korea, since STHs were ubiquitously distributed in Korea. However, other commonly found helminths in S. Korea, such as, *Clonorchis*, *Metagonimus* or other intestinal flukes, and *Taenia* were not observed during this study. These helminth parasites are transmitted by fish or meat, and found focally in endemic foci, where they maintain their transmission cycles. Therefore, it is quite possible that

Table 2. Helminths egg positive rates of refugees by locality in North Korea

Localities	No. examined	No.(%) of egg positives		Total
		<i>Ascaris</i>	<i>Trichuris</i>	
Pyeongyang-shi	7	1 (14.3)	1 (14.3)	1 (14.3)
Cheongjin-shi	8	0	1 (12.5)	1 (12.5)
Musan-gun	15	8 (53.3)	5 (33.3)	11 (73.3)
Munseong-gun	4	2 (50.0)	1 (25.0)	2 (50.0)
Hoiryeong-shi	4	2 (50.0)	2 (50.0)	2 (50.0)
Shinseong-gun	1	0	0	0
Shinpo-shi	1	0	0	0
Dancheon-shi	1	0	1 (100.0)	1 (100.0)
Unknown	5	1 (20.0)	0	1 (20.0)
Total	46	14 (30.4)	11 (23.9)	19 (41.3)

the subjects of the present study were living in non-endemic areas of those food-borne helminthiases.

The present data involved only 236 residents and soldiers in a N. Korea/China border locality, and 46 refugees from different areas of North Korea, and thus our results are unlikely to accurately reflect the real situation regarding intestinal helminthiasis in N. Korea. Nonetheless, our findings suggest that STHs are highly prevalent in N. Korea at present. For example, it appears that approximately half of the population is likely to be infected with *Ascaris* and/or *Trichuris*, and that the overall situation in N. Korea is comparable with that in S. Korea during the 1970s (KAHP, 2004). In S. Korea, the prevalence of intestinal helminths was very high as 63.2% positivity for helminth eggs and 89.6% cumulative egg rate, and 41.0% for *Ascaris* and 42.0% for *Trichuris* in 1976 (KAHP, 2004).

In S. Korea, parasitologists and health workers recommended systematic and continuous approaches for control of STHs, and the national control activity for schools and periodic national surveillance were implemented throughout the country. It was socially agreed that a control program of STHs was essential for Korea to become a developed country. The national control program of STHs was remarkably successful, and this success is regarded as a best model of parasite eradication program over the world (Lee, 2005). Thanks to the control efforts, STHs have almost disappeared today, and only food-borne helminths remain focally in S. Korea. However, the present

study confirms that STHs are highly prevalent as ostensibly unchanged in N. Korea over the past 50 years from the Korean War.

Eggs per gram of feces (EPG) counts were obtained from 190 of the 236 residents enrolled in this study. The mean and SD count of *Ascaris* EPG in positive individuals was 89.3 ± 195.8 , and only one individual was over 1,000. Similarly, the mean EPG count for *Trichuris* among positive individuals was also low, at 91.1 ± 143.9 , and 2 persons were over 1,000. These findings reveal that all of the present subjected population was lightly infected by *Ascaris* and/or *Trichuris* though the egg positive rates were high, which may be due to limited number of subjects enrolled.

In conclusion, STHs are found to be highly prevalent in N. Korea. We suggest that control measures of STHs should be considered in line with the requirements of national reunification program, and that strict inspection of vegetables imported from N. Korea is required if any.

ACKNOWLEDGMENTS

The present authors express their thanks to staffs of Yanbian University and the refugee camp in China, and to the North Korean health personnel involved in this study for their kind technical assistance. The present data were recorded in Korean language in the Journal of Korea Association of Health Promotion, 3: 172-180, December 2005.

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