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Improvements of growth, appetite, and physical activity in helminth-infected schoolboys 6 months after single dose of albendazole

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The effect of treatment for helminth infections on growth, appetite, and physical activity was investigated in Indonesian schoolchildren with *Ascaris* and *Trichuris* infections. Groups of schoolboys were selected for this substudy from a large study in which two groups received a single dose of 400 mg albendazole (AL, $n = 86$) and one group received an identical placebo (PL, $n = 43$). All boys were measured for parasitic infection, growth, appetite, and physical activity at baseline and 6 months after treatment. At baseline, all variables measured were not significantly different. After 6 months of treatment, the prevalence of *Ascaris* and *Trichuris* infections did not change significantly for both groups but the intensity of *Ascaris* and *Trichuris* infections significantly reduced in both groups ($P < 0.05$) except for *Trichuris* in the PL group. Increases in mid-arm circumference and height-for-age, after treatment, in the AL group were significantly greater than in the PL group ($P < 0.05$). In addition, appetite scores were higher in the AL group than in the PL group ($P = 0.014$). Free play activity, measured by Caltrac accelerometers, increased by 28% in the AL group after treatment ($P = 0.004$) and did not change in the PL group. We conclude that treatment with a single dose of albendazole may improve growth, appetite, and activity in areas with a high transmission of helminth infections.

Key words: helminth infection, growth, appetite, physical activity, Indonesia, *Ascaris*, *Trichuris*, Ujung Pandang.

Introduction

Intestinal helminthiases are among the most common chronic infections in the world, especially in developing countries. It has been estimated that more than one billion people are infected with at least one of the three more common intestinal helminthiases: *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworms. The two first infections, *Ascaris* and *Trichuris*, are mostly found in poor urban slum areas in developing countries.[1] In some areas, all the three infections are prevalent, sometimes together with another parasitic infection, such as schistosomiasis.

Control of helminth infections is recommended in school-age children in some communites.[2] The results of some studies have shown that targeting the school-age group for such a program not only reduced the prevalence and intensity in the school-age group, but also it affected all age groups in the community.[3]

Effects of treatment for helminth infections on growth, appetite, food intake, physical fitness, and physical activity have been shown in some studies. For instance studies on Kenyan school children[4–6] showed that children infected with *Ascaris*, *Trichuris*, and hookworms, improve in growth, physical fitness, and appetite after treatment. Recently, a study from the same areas also showed that 9 weeks after treatment with albendazole, children exhibited improved growth, appetite, and physical activity.[7] This last study was quite important since physical activity may reflect improved quality of life and productivity and could explain the improvement of other health-related factors such as growth, appetite, and physical fitness. As different conditions in various geographic areas have different types and intensities of helminth infections, similar studies are needed for a variety of locations.

The current study was done concurrently with a large study examining the effects of once and twice yearly doses with different anthelminthic drugs.[8] This substudy was conducted with a group of boys who received either albendazole or a placebo. The primary objective was to determine the effects of deworming on growth, appetite, and activity. We

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hypothesized that groups receiving albendazole would have significantly increased growth, appetite, physical activity.

Materials and methods

Study population and experimental design

This study was carried out in a slum area of Ujung Pandang municipality, South Sulawesi, Indonesia, where the prevalence and intensity of both *Ascaris* and *Trichuris* infection are very high in school-age children while hookworm infection is very low. Two primary schools in this area were the focus of this study. Detailed information on the study areas, the reasons to choose the two primary schools, and the inclusion procedures of the children in the study has been published elsewhere.[9]

The subjects of this substudy were boys in groups that received either albendazole (two groups) or a placebo (one group). Subjects were generally healthy without any signs and symptoms of severe malnutrition (marasmus and kwashiorkor). Subjects who were severely anemic (hemoglobin (Hb) less than 8 g/dL) were excluded, while the average Hb of all subjects was 12.0 g/dL. Children received a single dose of 400 mg of albendazole or an identical placebo and were examined at baseline and 6 months after receiving drug or placebo. Single doses of albendazole was used as recommended for areas where *Ascaris* and *Trichuris* are predominant.[10] A high efficacy of albendazole on *Ascaris* and *Trichuris* has been shown in several community studies.[11,12] In addition, studies in Burma and Kenya[13,14] showed that deworming every 6 months with albendazole decreased more transmission rate of infection compared with deworming every 12 months. These studies recommended that a deworming program could be carried out twice a year in the community.

One hundred and sixty-nine boys were initially in the three groups included in this study. However, due to a high rate of drop-out and continued absences, only 154 boys were measured for physical fitness and activity, and 137 boys came to the initial appetite test. Several children did not show up during the second exam or 6 months after treatment. Finally, 129 children were completely measured and could be used for analyses for all variables except for appetite (only 123 children). The 40 boys who dropped out were not different from the 129 children in terms of helminth infections and anthropometry variables.

Permission from the local government was obtained prior to the study. A meeting with parents, teachers, the head of the local health department, and investigators was held to clarify the objectives and benefits of the study. Informal parental consent was obtained for children's participation. Children had free access to the Community Health Center, located just opposite the schools, and they were free to withdraw from the study at any time. The study protocol was approved by the Human Subjects Committee of Cornell University and by the Indonesian Government.

Methods of Examination

Parasitology

Stool samples, collected in the morning from the children, were brought to the parasitology laboratory at the Medical School of Hasanuddin University, Ujung Pandang. All stool samples were examined for the presence of parasite eggs using a modified Kato–Katz technique.[15] A cardboard template with a hole of known capacity (28 mg) and a cellophane coverslip soaked in glycerin–malachite green solution were used. Eggs of *Ascaris* and *Trichuris* were counted about 1 h after smear preparation and expressed as eggs per gram (epg) of feces, as estimates of worm burden or as intensity of infection.

Anthropometry

The anthropometric examination included measurements of weight, height, mid-arm circumference, and triceps skinfold thickness. Age was derived from the birth date obtained from official school records. All examination procedures followed the Anthropometric Standardization Reference Manual.[16] Weight, to the nearest 0.1 kg, was measured using a Seca 7700 (Germany) portable beam balance. Standing height was measured using a Microtoise anthropometer (Indonesia). Mid-arm circumference (MAC), to the nearest 0.1 cm, was measured at the mid-point of the upper left arm using a polyvinyl-coated fiberglass tape measure. Triceps skinfold (TSF) thickness was also measured, to the nearest 0.1 mm, at the mid-point on the left arm using Holtain Skinfold Calipers (Germany). Height-for-age (HA), weight-for-age (WA), and weight-for-height (WH), MAC and TSF Z scores were calculated by using the nutritional anthropometry modules.[17,18]

Appetite

A method of '*ad lib* consumption test', as developed in Kenya,[19] using a food familiar in the study areas (Bubur Kacang Ijo or a porridge of mung beans) was used in this study. The food was made with mung beans, coconut milk, and brown sugar and a standard procedure was followed throughout the study. The recipe produced approximately 6 L of porridge which contained 1490 kcal/L porridge. The examination was performed at 09.00 to 10.00 in the morning, and each session included five to seven children. Before entering the examination room, each child was interviewed about the food he had eaten since waking up in the morning that day. Cups of 250 mL of porridge were provided, and each child was encouraged to eat as much as he desired. When they finished, the amount consumed was recorded. At the end, the child was asked about his own appetite (known as a subjective assessment of child's appetite). Responses were coded as an appetite score ranging from 1 to 5: 1 = very poor and 5 = very good.

Physical activity

Physical activity was measured during three free-play periods using Caltrac (Homokinetic Inc., Madison, WI, USA).[20] This is an electronic accelerometer which some studies suggest is an affordable, practical, and valid physical activity monitor.[21,22] This measures quantity and intensity of vertical movement. In order to measure for activity only, the personal data was first predetermined as follows: sex = 0, age = 99, weight = 25, height = 36. This predetermination inactivates the internal program to calculate basal metabolism rate.

Children were gathered at the beginning of break time. As primary schools have two break time sessions (15 min each) in each schoolday (except for Friday), we used a group of 13 boys for each session. The Caltrac was placed in a small pouch attached to a belt that was placed around the child's waist. The pouch was about the size of the Caltrac, and it was buttoned to prevent it from moving around when the child was running and playing. Each child had the same number for each exam in order to avoid Caltrac intervariation. When the time was finished, the Caltrac was detached, and the number displayed on its screen was recorded. An attempt was made to measure each child on three consecutive days in different sessions of break time. The activity level in this study was presented in average METS (activity level per minutes). The number seen on the screen reflected half the METS minutes; for example, if 24 appeared, this meant 48 METS minutes. The average of activity level from 3 days' measurement was recorded for each exam.

Statistical analysis

Data were analysed using the statistical package SYSTAT, version 5.2 for Macintosh (SYSTAT Inc., Evanston, IL, USA).[23] Differences of prevalence and intensity of infections, and most of the outcome variables between groups, were examined by a group Student's *t*-test and a Chi-square test, whereas the changes between the two exams were assessed by a paired *t*-test and McNemar's test. Regarding appetite scores, nonparametric tests, a Kolmogorov-Smirnov two sample test and a Wilcoxon signed rank test, were employed to assess differences between groups and exams, respectively. The intensities of helminth infections, which have negative binomial distribution, were transformed by conversion to natural logarithms (log × + 1) wherever possible. The percentage of egg reduction rates of *Ascaris* and *Trichuris* infections between the two exams was calculated from both arithmetic and geometric mean egg counts with the formula:

$$\% \text{ egg reduction} = [(\text{initial epg} - \text{final epg}) \div \text{initial epg}] \times 100.$$

Multivariate analysis was performed to assess the interrelationship of the intensity of helminth infections, growth, physical fitness, and activity. This analysis followed the interactive stepwise procedure of General Linear Models to include any significant predictors into the models. A probability of < 0.05 was considered significant in all statistical tests.

Results

Baseline data and results of treatment

The children were 6–11 years old with the mean being 8.5 years. Based on the quality of their usual food intake, 57% of the children were categorized in a high score for socioeconomic status. All children were infected with helminth infections; 94% were infected with *Ascaris*; 97% were infected with *Trichuris*; and 94% were infected with both infections. There were no significant differences between groups for these age, socioeconomic status, and helminth infections variables.

Regarding malnutrition, more than half of the children studied (63%) were stunted, as indicated by the percentage of HA Z-scores below –2, and a total of 8% of the children were categorized as wasted (WH Z-scores below –2).

Prevalence and intensities of *Ascaris* and *Trichuris* infections in the albendazole and the placebo group did not differ significantly before treatment (Table 1). Six months after treatment, no differences were seen in the prevalence of both *Ascaris* and *Trichuris* infections. However, the intensity of *Ascaris* was significantly reduced in both albendazole and placebo groups ($P = 0.005$ and $P = 0.03$, respectively), whereas the intensity of *Trichuris* was significantly reduced only in the albendazole group ($P = 0.003$). In addition, the egg reduction rate (geometric mean epg) in the albendazole group for both infections was higher compared to those in the placebo group (65 *vs* 62% and 47 *vs* 39%, respectively, for *Ascaris* and *Trichuris* infections).

Growth, appetite, and physical activity

Anthropometric measurements in both albendazole and placebo groups are presented in Table 2. Weight, height, MAC, TSF, and corresponding Z-scores did not differ significantly between the albendazole and the placebo groups before treatment. After treatment, most growth indices increased significantly in both groups. The changes in MAC, MAC-for-age Z-scores and HA Z-scores were significantly greater for the albendazole group than for the placebo group ($P < 0.05$). The albendazole group showed a larger increase in MAC (0.3 cm, or 100% more than the placebo group), MAC Z-score (0.14 scores more), and HA Z-score (0.06 score more). Figure 1 presents graphic illustrations of changes in MAC together with the change with activity level.

Table 1. Parasite prevalence and intensity in albendazole and placebo groups of schoolchildren before and 6 months after treatment*

Parasitic infection	Group (*n*)	% positive Study 1	% positive Study 2	Change McNemar *P*	Arithmetic (geometric) mean epg Study 1	Arithmetic (geometric) mean epg Study 2	Eggs reduction (%)	Paired *t* test *P*
Ascaris lumbricoides	PL (43)	95	88	ns	23 368 (7331)	12 880 (2801)	45 (62)	0.03
	AL (86)	93	87	ns	21 738 (3925)	10 257 (1365)	53 (65)	0.005
Trichuris trichiura	PL (43)	98	98	ns	6632 (2594)	3248 (1588)	51 (39)	ns
	AL (86)	97	98	ns	6535 (2383)	2841 (1255)	57 (47)	0.0025

*Study 1 = baseline, Study 2 = 6 months after treatment. McNemar and Student's paired *t*-test (on geometric mean) was two-tailed for the placebo group and one-tailed for the albendazole group (hypothesized decrease). At Study 1, geometric mean counts between groups were not statistically significant. PL, placebo group; AL, albendazole group.

Table 2. Anthropometric measurements in albendazole and placebo groups of schoolchildren before and 6 months after treatment*

Variable	Group	Study 1	Study 2	Paired *t*-test	Increase (exam 2–1)	Group *t*-test
Weight (kg)	PL	19.3 ± 2.4	20.3 ± 2.7	0.00002	1.08 ± 0.6	0.49
	AL	19.5 ± 2.6	20.6 ± 2.9	0.00002	1.09 ± 0.8	
Height (cm)	PL	117.1 ± 6.8	120.5 ± 6.8	0.00002	3.44 ± 0.8	0.27
	AL	116.5 ± 5.3	120.0 ± 5.5	0.00002	3.54 ± 0.9	
Mid-arm circumference (cm)	PL	16.3 ± 0.9	16.6 ± 1.1	0.002	0.33 ± 0.7	0.01
	AL	16.3 ± 1.3	16.9 ± 1.4	0.00002	0.62 ± 0.6	
Triceps-skinfold (mm)	PL	6.5 ± 1.3	7.2 ± 1.4	0.0005	0.70 ± 1.3	0.15
	AL	6.8 ± 1.7	7.8 ± 1.8	0.00002	0.98 ± 1.5	
Weight-for-age Z-score	PL	–2.1 ± 0.6	–2.1 ± 0.6	0.03	0.06 ± 0.2	0.44
	AL	–2.1 ± 0.7	–2.0 ± 0.7	0.01	0.05 ± 0.2	
Height-for-age Z-score	PL	–2.1 ± 0.9	–2.0 ± 0.9	0.001	0.10 ± 0.2	0.03
	AL	–2.4 ± 0.9	–2.2 ± 0.9	0.00002	0.16 ± 0.1	
Weight-for-height Z-score	PL	–1.1 ± 0.8	–1.2 ± 0.8	0.01	–0.10 ± 0.3	0.33
	AL	–0.9 ± 0.8	–1.0 ± 0.8	0.0005	–0.13 ± 0.3	
Mid-arm circumference-for-age Z-score	PL	–1.8 ± 0.7	–1.9 ± 0.7	0.16	–0.07 ± 0.5	0.02
	AL	–1.9 ± 0.9	–1.8 ± 0.8	0.01	0.07 ± 0.4	
Tricep skinfold-for-age Z-score	PL	–0.9 ± 0.6	–0.7 ± 0.5	0.02	0.19 ± 0.5	0.30
	Al	–0.8 ± 0.7	–0.6 ± 0.6	0.00005	0.22 ± 0.6	

* Values are means ± SD. PL, placebo group; AL, albendazole group. Sample size: PL = 43 AL = 86. Study 1 = baseline; study 2 = 6 months after treatment. At Study 1, there were no significant differences between the albendazole and placebo groups in all variables. Paired *t*-tests are one-tailed for PL and AL groups (expect all to increase). Group *t*-test are one-tailed (hypothesis is AL > PL).

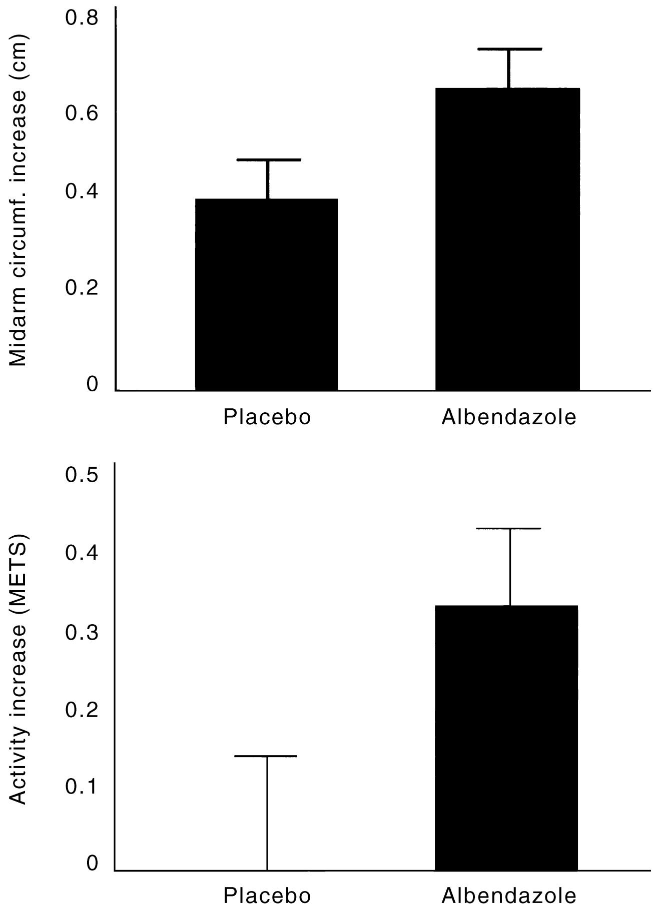

Figure 1 Increase in mid-arm circumference (cm) and activity (METS) at 6 months after treatment in Indonesian school children. There were no significant differences between groups at baseline exam. Increase in midarm circumference (P = 0.00002) and activity (P = 0.001) were significantly greater in the albendazole groups than in the placebo group. Values are means + SEM, n = 43 (placebo) or n = 86 (albendazole).

Results of the appetite test in the albendazole and the placebo groups before and 6 months after treatment are presented in Table 3. At baseline porridge intake was not significantly different between the groups. After treatment, intake in both albendazole and placebo groups increased significantly (P = 0.0005 and P = 0.04, respectively). However, the increase between both groups was not significantly different. On the other hand, the baseline appetite scores were not significantly different. The changes in both groups between study 1 and study two were not significant. However, the change in the albendazole group was higher than that in the placebo group. In addition, the test difference between the groups at 6 months after treatment was significant (Kolmogorov-Smirnov, P = 0.014).

The activity level during free play was not significantly different between the groups at baseline. After treatment, the average activity level was significantly increased in the albendazole group (P = 0.004) but not in the placebo group (see Fig. 1). The average activity level for the albendazole group increased by 28%, but the level decreased in the

Table 3. Result of appetite test in albendazole and placebo groups of schoolchildren before and 6 months after treatment*

Variable	Group	Study 1	Study 2	*P*-value
Porridge intake (mL)	PL	251 ± 97	294 ± 121	0.04
	AL	263 ± 87	301 ± 103	0.0005
Appetite score	PL	3.81 ± 1.1	3.86 ± 0.8	0.65
	AL	3.83 ± 0.9	3.98 ± 0.7	0.10

* Values are means ± SD. PL and AL = placebo (n = 42) and albendazole (n = 83) groups, respectively. Study 1 = baseline, Study 2 = 6 months after treatment. At Study 1, there were no significant difference between groups for both variables. At Study 2, there was significant difference between groups for appetite score (Kolmogorov-Smirnov two sample test, P = 0.014) but not for porridge intake. Paired tests are two-tailed for PL and one-tailed for AL groups (expect to improve).

Table 4. Multivariate analysis of mid-arm circumference and increase in activity at 6 months after treatment*

Independent variables	Beta	B	SE of B	*t*	*P*
Dependent variable: mid-arm circumference at 6 months					
Age (months)	0.123	0.012	0.008	1.40	0.164
Intensity of *Trichuris* at 6 months (log)	–0.175	–0.142	0.071	–2.00	0.048
Constant	—	16.659	1.056	15.78	0.00004
F for equation = 3.39 (P = 0.037), R^2 = 5.1%; adjusted R^2 = 3.6%					
Dependent variable: increase in activity at 6 months (study 2 – study 1)					
Activity, at study 1	–0.656	–0.876	0.087	–10.13	0.00004
Increase in mid-arm circumference (study 2 – study 1)	0.140	0.120	0.093	2.151	0.033
Ascaris infection status at 6 months	0.150	0.428	0.186	2.302	0.023
Socioeconomic status (SES)	0.116	0.221	0.124	1.787	0.076
Constant	—	1.352	0.220	6.158	0.00004
F for equation = 29.46 (P < 0.0001), R^2 = 49%; adjusted R^2 = 47%					

* Dummy variable for *Ascaris* status (uninfected = 1 and infected = 0) and for SES (high = 1 and low = 0). SE of B, Standard error of unstandardized coefficient for each parameter in multivariate analysis.

placebo group. The changes in activity levels in the albendazole group were significantly greater than for the placebo group (P = 0.03).

Multivariate analysis

Multivariate analyses were done to determine which variables measured were significant predictors of increases in growth, appetite, and activity level after treatment. The best models were observed in MAC at 6 months and in an increase in activity level at 6 months (Table 4). The intensity of *Trichuris trichiura* at 6 months was a predictor of MAC at 6 months after controlling for age. It showed that children who had a lower intensity of *Trichuris trichiura* infection had higher MAC (P = 0.048).

The increase in activity at 6 months was negatively predicted by the baseline activity level (P = 0.0004). In addition, the increase in MAC (P = 0.033), the infection status of *Ascaris* at 6 months (P = 0.023), and socioeconomic status (P = 0.076) were positive predictors. These variables accounted for 47% of the increased activity level at 6 months. The increase in activity level in children who were not infected with *Ascaris* at 6 months was four times higher compared with the level of infected children (0.57 *vs* 0.14).

Discussion

This study showed that treatment for helminth infection in school-age children may increase growth, appetite, and activity level 6 months after treatment in areas where malnutrition and helminth infections are endemic. To our knowledge, this is the first study of this type to examine the effects of deworming 6 months after treatment in areas where *Ascaris lumbricoides* and *Trichuris trichiura* infections are endemic. A duration of 6 months between exams is very important since regular treatments are recommended for such endemic areas, two to three times per year, or every 4–6 months. Therefore, improvement of the health status of the schoolchildren found in this study are better indicators for the impact of deworming than using percentage reduction of prevalence and intensity of helminth infections.

It is interesting to note that the intensity of both infections in the placebo group decreased throughout the study although a significant reduction was seen only in *Ascaris* infection. In addition to seasonal variation,[24] the reduction can be related to the effect of the treatment itself on untreated groups, as deworming in targeted children has been reported to decrease helminth transmission within a study population. Several studies have shown that anthelminthic drugs administered to targeted children also had an impact on the non-targeted population. [3,25–27]

The findings in this study are in good agreement with the results of studies on Kenyan schoolchildren wherein treatment for hookworms, *Trichuris* and *Ascaris* increased growth, appetite, physical fitness, and physical activity.[5–7,19] Moreover, the changes of activity level were in accordance with an early study conducted with South African schoolchildren infected with *Schistosoma haematobium*.[28] The magnitude of improvement in the present study was not as great as in the above studies. This might be partly due to the differences of type and intensity of helminth infections, as well as the duration between the baseline exam and the final exam.

The increase in activity at 6 months in this study can be explained by two mechanisms. First, the improvement of growth indicated an improvement of nutritional status. This study showed that an increase in mid-arm circumference was associated with an increase in activity (P = 0.03). It is plausible that if a child has enough energy he/she will be more active or be able to do other activities (such as running, walking) during free time. These results also suggest that children with low stored energy will conserve their energy by being less active. Second, the level of tumor necrosis factor (TNF) or interleukin-1 (IL-1) may be elevated with parasitic infection.[29,30] They could lead to lethargy and other symptoms,[31] wherein decreased locomotor activity was observed in male Wistar rats after infusion of IL-1.

Growth improvement was seen in three indices in this study: MAC, MAC-for-age Z score, and HA Z-scores. Mid-arm circumference and height consistently showed significant improvement, whereas other growth indices did not.[8] This suggests that the variation of measurements in MAC and height indices are lower than other measurements such as weight, and this leads to highly sensitive detection in the analysis. Therefore, this type of measurement should always be undertaken in similar studies.

It is important to note that the appetite scores in this study were in good agreement with the appetite scores in Kenyan schoolchildren.[6,7] This present study showed that the change of appetite score in the albendazole-treated group was higher than that in the placebo group. However, we did not observe a significant difference of porridge intake between the two groups in this study. This result is different from the results of our study in other schoolboys from the same areas, wherein after 3 and 7 weeks of treatment, treated children had a higher porridge intake compared with those who received placebo.[32] Again, the duration between the baseline and final exams could explain this result. As seen in this study, despite the results of treatment, almost all children in the treated group became reinfected by the final exam.

In conclusion, this study showed further evidence that deworming targeted to schoolchildren improves their growth, appetite, and physical activity. This supports the recommendation made by WHO that control of helminth infection, targeted to schoolchildren, is a priority in a malnourished population where more than 50% of the children harbour helminth infections.[2]

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一次劑量 albendazole 六個月後對腸虫感染的學齡男童生長、胃口和體育活動的改進

摘　要

本文研究了感染蛔虫和鞭虫的印尼學齡兒童，經治療後對生長、胃口和體育活動的影響，研究對象中，兩組每人接受一次 400 毫克劑量 albendazole （ AL ，總人數 n = 86 ），另一組每人接受同樣的安慰劑（ PL ， n = 43 ），服藥前及服藥六個月後，所有男童均測量寄生虫感染、生長、胃口和體育活動。結果發現服藥前測得的所有變數無明顯差異，服藥六個月後，兩組感染蛔虫和鞭虫的發病率亦無明顯差異，除 PL 組鞭虫外，服藥後兩組感染蛔虫和鞭虫的程度明顯減少（ $P<0.05$ ），治療後 AL 組的中臂圍和身高明顯大於 PL 組（ $P<0.05$ ）。此外，AL 組的胃口大於 PL 組（ $P<0.014$ ）， AL 組治療後，用 Caltroe 加速計測量自由活動增加 28%，而 PL 組沒有改變（ $P=0.004$ ）。作者得出結論，在腸虫高傳染區給予一次劑量的 albendazole ，也許會改善兒童生長、胃口和活動水平。

Abstrak

Efek pemberian obat cacing terhadap pertumbuhan, nafsu makan, aktifitas fisik telah diteliti pada anak sekolah yang terinfeksi *Ascaris* dan *Trichuris* di Indonesia. Kelompok anak sekolah pria dipilih dari suatu studi besar dimana ada 2 kelompok yang menerima obat cacing albedanzole 400 mg (AL, total n=86) dan satu kelompok lainnya yang menerima placebo (PL, n=43). Seluruh subjek diukur tentang infeksi parasit, pertumbuhan, nafsu makan, dan aktivitas fisik sebelum dan setelah 6 bulan pengobatan. Sebelum pengobatan, keseluruhan variabel yang diukur tidak berbeda secara bermakna. Setelah 6 bulan pengobatan, prevalensi *Ascaris* dan *Trichuris* tidak berubah secara bermakna pada kedua kelompok namun intensitas kedua infeksi menurun secara bermakna pada kedua kelompok ($p<0.05$) kecuali *Trichuris* pada kelompok PL. Peningkatan lingkar lengan atas dan tinggi badan per umur setelah pengobatan, pada kelompok AL lebih besar secara bermakna dibanding pada kelompok PL ($p<0.05$). Disamping itu, skor nafsu makan lebih tinggi pada kelompok AL dibanding kelompok PL ($p=0.014$). Aktivitas yang diukur dengan Caltrac accelerometers meningkat 28% pada kelompok AL setelah pengobatan ($p=0.004$) dan tidak berubah pada kelompok PL. Disimpulkan bahwa pengobatan infeksi cacingan dengan albendazole dosis tunggal dapat meningkatkan pertubuhan, nafsu makan, dan aktifitas fisik di daerah yang tinggi penyebaran infeksi cacingan.

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