Effect on weight gain of routinely giving albendazole to preschool children during child health days in Uganda: cluster randomised controlled trial

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Editorial by Chopra

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BMJ 2006;333:122–4

Abstract

Objective To estimate the effectiveness of delivering an anthelmintic through a community child health programme on the weight gain of preschool children in Uganda.
Design Cluster randomised controlled trial.
Setting Eastern Uganda.
Participants 48 parishes participating in a new programme for child health: 24 offered children an additional service of anthelmintic treatment. The outcome is based on measurements from 27 995 children.
Intervention Treatment of children aged between 1 and 7 years with 400 mg albendazole added to standard services offered duringchild health days over a three year period.
Main outcome measure Weight gain.
Results The provision of periodic anthelmintic treatment as a part of child health services in Uganda resulted in an increase in weight gain of about 10% (166 g per child per year, 95% confidence interval 16 to 316) above expected weight gain when treatments were given twice a year, and an increase of 5% when the treatment was given annually.
Conclusion Deworming of preschool children in Uganda as part of regularly scheduled health services seems practical and associated with increased weight gain.

Introduction

Many children in low income countries are commonly infected with parasitic helminths and this can have important consequences for their development.[1] Treatments at home may not be practical and sustainable, and periodic mass deworming without diagnosis, as recommended by the World Health Organization in areas with more than 50% of children infected, may be needed to have an effect on growth during a programme or health project.

The Ugandan government has established a programme of regular child health days during which health and nutrition interventions are delivered to preschool children. We assessed whether including anthelmintic treatment in such a programme could result in additional weight gain in young children.

Participants and methods

In 25 districts of Uganda, the parents of children aged less than 7 years were offered a range of health services at child health days.

The study was a cluster randomised effectiveness trial in which the unit of randomisation was the parish, the administrative unit at which child health days were organised within each district. Five districts in eastern Uganda were selected (see bmj.com) because a survey had indicated that about 60% of children aged 5-10 years were infected with nematodes, most commonly hookworm.[2] Fifty parishes selected by the local governments were randomly allocated into two groups (see bmj.com): 25 were assigned to standard services and 25 to standard services plus albendazole. One parish from each group was subsequently removed from the project. Albendazole was offered as a 400 mg tablet (Zentel: GlaxoSmithKline) to all healthy children aged 1-7 years attending any child health day. Anthelmintics were not then a standard treatment offered by the government, thus the other parishes without treatment constituted the control group. The children's weight and height (children older than 2 years) was measured at each child health day.

In a parallel data collection on service delivery we administered a household questionnaire in the same parishes between January and March 2000. Each caregiver was asked if the child had been treated for worms, the source of the treatment, and how much it cost. The questionnaire was readministered during repeat visits between January and March 2003.

The main outcome measure was weight gain—the difference in weight between the first and last child health day. We used EpiInfo to calculate Z scores of weight and height for age. We controlled for the effect of personal and environmental factors on weight gain (see bmj.com) by using multivariate regression models in Stata. We also examined alternative models. See bmj.com for further details of the statistical methods.

As some children attended more child health days than others and received more treatments, in a portion of the analysis we divided the treatment group into three based on intervals between attendance: ≤ 7.5 months, 7.5-13 months, and ≥ 13 months. These intervals corresponded to practical targets of biannual, annual, or less frequent treatment during a programme, and were used to indicate the potential benefit of treatments given at those frequencies.

Results

The study was undertaken between November 2000 and June 2003 during which five child health days occurred in each parish. Table 1 presents descriptive statistics on the child health days and the percentage of children classified as underweight at each round. The absence of any apparent difference in the percentage of underweight children or in the mean Z scores

Additional information on statistical analysis is on bmj.com

This is the abridged version of an article that was posted on bmj.com on 21 June 2006: http://bmj.com/cgi/doi/10.1136/bmj.38877.393530.7C

Table 1 Dates of child health days in rural Uganda, sample sizes, proportion of children classified as underweight (–2 SD below reference vales), and mean Z scores of weight for age of children in treatment and control parishes

	Round				
Variable	**1**	**2**	**3**	**4**	**5**
Start of child health days	2 Nov 2000	14 Aug 2001	18 Feb 2002	2 Sep 2002	18 Mar 2003
End of child health days	8 Dec 2000	30 Nov 2001	29 Jun 2002	19 Oct 2002	26 Jun 2003
No of children weighed	37 165	33 711	21 124	20 787	20 443
Percentage of girls	50.0	50.3	50.6	51.1	50.7
Percentage receiving treatment	50.7	51.2	51.9	53.8	56.8
Mean (SD) age (years)	3.69 (1.66)	3.64 (1.80)	3.69 (1.77)	3.63 (1.63)	3.54 (1.54)
Proportion underweight:					
Treatment parishes	0.26	0.24	0.23	0.23	0.24
Control parishes	0.26	0.25	0.25	0.23	0.24
Mean (SD) Z scores of weight for age:					
Treatment parishes	–1.14 (1.48)	–1.06 (1.52)	–1.07 (1.45)	–1.14 (1.32)	–1.23 (1.25)
Control parishes	–1.17 (1.45)	–1.11 (1.52)	–1.14 (1.44)	–1.17 (1.29)	–1.20 (1.25)

between the groups does not indicate the absence of an effect, as new children entered the project at each round, whereas others did not always attend.

At least two measurements of body weight were made on 14 940 treated children and 13 055 control children (table 2). A statistically significant difference was found in extra weight gained of 154 g (95% confidence interval 96 to 214, $P < 0.01$). This is equivalent to an extra 166 g per year (163 to 16 g) or nearly 10% of average initial body weight.

See bmj.com for the results of six regression models, five using total weight gain and the sixth using weight gain per month. In model 1 weight gain was greater in children who attended more child health days but children in the treatment parishes gained 55 g (9 to 104 g) more weight per visit than children in control parishes.

Model 2 controls for the interval between the first and last measurements, which was highly correlated with total weight gain, but the difference in total weight gain per visit between groups did not change.

Model 3 shows the effect of attending child health days in which the treatment effect is divided into about twice a year, annually, or longer. The children treated twice a year gained more weight than children treated less often.

Model 4 controls for initial weight. No biological interpretation can be assigned to the coefficient of initial weight in this model since any measurement error in the initial weight is also in the dependent variable, total weight gain, leading to a bias towards minus one for that coefficient. This initial weight variable, however, picks up unexplained variance without biasing the variable of interest.

Model 5 repeats model 4 but uses a value for initial weight predicted from the height of children aged more than 2 years, their sex and age, and fixed effects of the parish.

Model 6 uses the variables in model 3, but standardises the outcome per unit time by using weight gain per month as the outcome variable. It shows an average additional weight gain of 13.8 g per month among children treated about twice a year, but weight gain was not significant if the interval between treatments was a year or more. The interval between the first and last measurement was negatively associated with monthly weight gain. This probably reflects the fact that weight gain declines with age so that, as the interval between the first and last measurements increases the longer participants were studied, the velocity of weight gain decreases. The length of time each child was studied has a strong correlation with the total weight gain.

The percentage of households who dewormed their children before the programme started was similar in both parishes (see bmj.com). By 2003 three times as many children in the treatment parishes had been dewormed, but this practice had also increased by 50% in the control parishes. Most treatments for the control group were obtained from private clinics or shops: average cost Ugandan shillings (USH) (SD 705) 748 or about £0.20 (€0.30, $0.40).

Discussion

Treatment with albendazole twice yearly as a part of child health services in Uganda led to a 10% extra gain in weight of about 166 g per child per year compared with untreated controls—an extra weight gain of around 5% if children were treated annually. This study involved nearly 30 000 children, and the data were collected as a part of routine growth monitoring to minimise the effect of the study on implementation. The effect of treatment may have been underestimated because about a third of children in the control parishes were dewormed by their parents. As the predominant helminth was hookworm, and infections in young children in the same districts were generally light,[3] a greater effect of treatment may be achieved elsewhere.

A meta-analysis of deworming in young people aged up to 16 years[4] found a similar magnitude of weight gain, but the studies lacked consistency in trial design and follow-up. A review of randomised trials of anthelmintic treatment in preschool children found that growth was improved (four trials), unaffected (n=4), and had an inverse relation with treatment (n=1).[5] Although only one study showed an increase in linear growth, the four trials with positive results

Table 2 Average weight gain, months in programme, and number of visits to child health days in Uganda for all children with two or more measurements

No of children with repeated measurements	**Treatment parishes (n=14 940)**	**Control parishes (n=13 055)**	**All (n=27 995)**
Mean (SD) weight gain (g)	2413 (2536)	2259 (2474)	2341 (2508)
Mean (SD) months in programme	16.9 (7.7)	16.2 (7.5)	16.6 (7.6)
Mean (SD) visits to child health days	2.7 (0.9)	2.6 (0.8)	2.7 (0.9)

What is already known on this topic

Clinical trials of anthelmintic treatments have shown increased linear growth in young people up to age 16 years, whereas in younger people the increase is mainly in weight

Little evidence exists of the benefits of giving periodic mass treatment through public health programmes, and none is targeted at preschool children

What this study adds

Giving anthelmintic treatments routinely as a part of periodic child health days can lead to extra weight gain in preschool children in Uganda

The weight gain of children who attended child health days every six months was 10% greater than in untreated controls

reported benefits in ponderal growth, as in our study. The meta-analysis pointed out that most studies have been done in populations infected with *Ascaris lumbricoides*, but the largest effect on weight gain in preschool children has been in those infected predominantly with hookworm, as in our study.

Deworming has benefits beyond those measured in our study, such as reducing anaemia.[6 7] Moreover, treating children alone can reduce the prevalence of worms among untreated people.[8]

On average, each child health day costs between $500 and $600, exclusive of the costs of volunteers. Each event reaches about 450 children, suggesting a cost of about $1 to $1.33 per child. A dose of albendazole added $0.21 (USH 385) to the costs of materials at child health days (2002 prices) but added little to the costs of staff since they were already dispensing vitamin A. This cost could be reduced to $0.03 by bulk purchase of the drug. But even when applying the prices in 2002 and ignoring the other benefits of deworming, the 10% increase in weight gain with twice yearly treatment at a cost of $0.42, or a 5% increase at a cost of $0.21, represents an attractive return.

We thank Shally Awasthi and Lani Stephenson for comments on an earlier draft.

Contributors: See bmj.com.

Funding: The research was funded by the nutrition and early child development project, government of Uganda, which contracted the Institute of Public Health and the research committee of the World Bank. The World Bank employes HA and DB and contracted AH.

Competing interests: None declared.

Ethical approval: This study was approved by the ethics review committee of the Institute of Public Health and conforms to human study protocols for the government of Uganda.

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(Accepted 24 March 2006)

doi 10.1136/bmj.38877.393530.7C

Reliability of self reported form of female genital mutilation and WHO classification: cross sectional study

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Editorial by Conroy

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BMJ 2006;333:124–7

Abstract

Objective To assess the reliability of self reported form of female genital mutilation (FGM) and to compare the extent of cutting verified by clinical examination with the corresponding World Health Organization classification.
Design Cross sectional study.
Settings One paediatric hospital and one gynaecological outpatient clinic in Khartoum, Sudan, 2003-4.
Participants 255 girls aged 4-9 and 282 women aged 17-35.
Main outcome measures The women's reports of FGM,the actual anatomical extent of the mutilation, and the corresponding types according to the WHO classification.

Results All girls and women reported to have undergone FGM had this verified by genital inspection. None of those who said they had not undergone FGM were found to have it. Many said to have undergone "sunna circumcision" (excision of prepuce and part or all of clitoris, equivalent to WHO type I) had a form of FGM extending beyond the clitoris (10/23 (43%) girls and 20/35 (57%) women). Of those who said they had undergone this form, nine girls (39%) and 19 women (54%) actually had WHO type III (infibulation and excision of part or all of external genitalia). The anatomical extent of forms classified as WHO type III varies widely. In 12/32 girls

ELPS *This is the abridged version of an article that was posted on bmj.com on 27 June 2006: http://bmj.com/cgi/doi/10.1136/bmj.38873.649074.55*