Nutrition

Effect of Anthelminthic Treatment on Helminth Infection and Anaemia Among the Female Workers of the Ayesha Abed Foundation in Bangladesh

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BRAC Research Report

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EXECUTIVE SUMMARY

Objective

To test the impact of anthelminthic treatment on the extent of change in the prevalence and intensity of intestinal parasite as well as nutritional status of female workers in different time and dose schedules.

Methodology

Study design	–	Single blind placebo control trial.
Study population	–	Female workers of all ages of Ayesha Abed Foundation (AAF).
Study area	–	Three centers were selected from Manikganj Sadar, Gorpara and Betila area in Manikganj district.
Intervention period	–	24 weeks.
Drug	–	Albendazol 400 mg.
Sample size	–	A total 668 female workers were randomly allocated into 5 groups and finally it was 620 after dropping out.

The groups were as follows:

Group 1 (n=127)	=	Single dose at baseline, single dose after 12 weeks, single dose after 24 weeks;
Group 2 (n=121)	=	Double dose at baseline, double dose after 12 weeks, double dose after 24 weeks;
Group 3 (n=124)	=	Single dose at baseline, single dose after 24 weeks;
Group 4 (n=125)	=	Double dose at baseline, double dose after 24 weeks;
Group 5 (n=123)	=	Placebo at baseline, placebo after 12 and 24 weeks.

Measurements

Haemoglobin (Hb) was measured by HemoCue machine in the study area directly, body weight by Uniscale with precision of nearest 100 g and height was taken in cm using a wooden board fixed with a plastic tape to the nearest 1 cm. Intestinal parasite infestation was estimated by stool examination on high power field. In addition, information on socioeconomic and demographic profiles, health status, hygiene knowledge and practice, and morbidity history were collected.

Results

Mean Hb concentration of the workers was 125 g/L at baseline, with no group difference. After 12 weeks of treatment, Hb concentration increased significantly (P = 0.000) to 134 g/L in groups 1 and 2, but not in placebo group. At the end of intervention (at 24 weeks) Hb concentration decreased to 121 g/L, which was significantly lower even then the baseline level. The decrease in Hb concentration between baseline and 24 weeks was also observed among groups 3, 4 and placebo groups, Hb concentration decreased from 126 g/L at baseline to 122 g/L at 24 weeks (P = 0.002), indicating progressive depletion of Hb in the women.

As a result of these changes in Hb concentration, anaemia prevalence (Hb <120 g/L) decreased from 29% at baseline to 9% after 12 weeks in groups 1 and 2 but increased to 43%

after 24 weeks, although worm infestation, especially *Ascaris*, became almost nil in these groups.

Conclusion

Treatment with Albendazol for 12 weeks even in single dose is enough to control infestation, which can raise Hb level and reduce anaemia significantly. However, this situation was not being sustainable at 24 weeks, even after receiving a second dose (single or double) at 12 weeks. Dietary supplementation is possibly needed to sustain the effect of deworming on anaemia control.

INTRODUCTION

Worm infestation is one of the most common infections in the world. In Asia and Latin America, roundworm and hookworm infections rank after tuberculosis and diarrhoeal diseases (Polowski 1984). According to WHO, about one quarter of the world's population are infected with roundworm, about one-eighth with whipworm and one-fifth with hookworm.

The magnitude of the problem of soil and water transmitted-intestinal parasitic infections has not been rigorously investigated in Bangladesh through a nationwide survey. It is generally recognized that people living in rural areas and urban slums are at greater risk, because of poor sanitation, unclean water and lack of adequate personal hygiene. Worm transmission is enhanced by poor socioeconomic conditions, deficiencies in sanitary facilities, improper disposal of human feces, insufficient supplies of potable water, poor personal hygiene, substandard housing, and lack of health education (Holland *et al.* 1988). Negative health consequences of the intestinal parasites are multiple, including higher morbidity, retarded to physical development and unsatisfactory school performance. In adult, increased load of intestinal parasites causes anaemia that leads to less available energy, low physical fitness and decreased output (Brooks *et al.* 1979).

ANTHELMINTHIC TREATMENT

Many types of anthelminthic treatments are practiced in different types of population in the world. In Bangladesh, Albendazole and Mebendazole threrapies are most common. But Albendazol is a famous broad spectrum anthelminthic drug used for the treatment of roundworm, whipworm, hookworm, pinworm, threadworm and tapeworm. It is also effective against Giardia. The manufacturers report cure rates based on a single dose of Albendazol, of 94% for *Ascharis,* 81% for hookworm, 63% for *Trichuris trichura*. Studies in Bangladesh have found cure rates of 93% for *Ascharis,* 85% for hookworm and 72% for *T. trichura*. It has no reported side effects and it has been known to be safe during pregnancy, after the first trimester. Albendazol is administered as single dose in tablet of 400 mg. This dose is similar for adults and children over 2 years of age. A single dose of 200 mg is recommended for under-2 children.

OBJECTIVES

General objective

- To test the impact of anthelminthic treatment on the extent of change in the prevalence and intensity of intestinal parasite as well as nutritional status of female workers in different time and dose schedules.

Specific objectives

- To find the prevalence of intestinal parasitic infestation among female workers of Ayesha Abed Foundation.
- To test the impact of anthelminthic treatment on prevalence in different time and dose schedules.
- To test the impact of anthelminthic treatment on anthropometric measurement of workers during intervention period.
- To test the impact of anthelminthic treatment on hemoglobin concentration as well as anaemia during intervention period.

METHODOLOGY

STUDY AREA

Three centers of Aysha Abed Foundation were selected from Manikganj sadar, Betila and Gorpara of Manikganj district nearly 80 km away from Dhaka city.

SUBJECTS

Participants were female workers, aged between 15-48 years, of Aysha Abed Foundation .The study was a single-blind randomized placebo trial.

SAMPLE SIZE AND SAMPLING TECHNIQUE

Sample size was determined on the basis of a number of factors, including mean numbers 16.7 ova per gram of stool sample, minimum detectable change of 6 ova per gram at the end of 24-weeks trial period, group standard deviation of 19.8 at baseline, level of the test 0.05 and power of the alternative 0.80. Considering these criteria a total number of 564 workers were selected from three centers. Considering the alteration rate of 10% by their attendance register a total of 104 were added with 564. Therefore, the total sample was 668 (564+104).

GROUPING

All female workers were randomly assigned into five groups according to number of doses and time given. A 24-weeks intervention trial involving 666 workers was carried out. Each group consisted of 133 workers initially at baseline. The five groups in the study were as follows:

Group 1: dewormed at the beginning of the trial and half way (week 12), and again after 24 weeks using a single dose of Albendazol 400 mg.

Group 2: received the anthelminthic in double doses in two consecutive days at baseline, half way (after12 weeks), and again after 24 weeks.

Group 3: received single dose of anthelminthic at baseline and after 24 weeks.

Group 4: received double doses of anthelminthic in two consecutive days at baseline and after 24 weeks.

Group 5: received only a placebo in the same schedule as group 3 had.

STUDY PERIOD

Data and biochemical samples (blood and stool) were collected during August 2003 – March 2004. Laboratory findings and analysis were done during March 2004 – July 2004. Final report was presented in September 2004.

QUESTIONNAIRE DEVELOPMENT

Questionnaire was based on socioeconomic information, health and hygiene practice, morbidity history, and anthropometry of female workers. The questionnaire was pre-tested. For haemoglobin and stool samples, two other forms were used – one for blood samples and one for stool samples.

DATA COLLECTION

Data were collected through person-to-person interview. A complete list of all non-pregnant and apparently healthy female workers of selected centers was prepared. Data were collected during August 2003 – March 2004 on the broad issues indicated below:

- Socioeconomic information of the study households,
- Weekly morbidity reports,
- Anthropometric measurements of the workers,
- Haemoglobin (Hb) concentration for anaemia, and
- Stool examination for ova counts.

All the sampled women were interviewed to collect baseline information on socio-economic and demographic factors and practices related to hygiene and sanitation that are known to be associated with worm infestations and anaemia, by using a structured questionnaire before intervention. Information on previous history of anthelminthic ingestion and also of other drugs was collected. Time required to complete an interview was 30-45 minutes. Using daily official attendance register weekly morbidity history of workers was recorded.

STOOL SAMPLE COLLECTION

Morning stool samples were collected from all female workers at baseline, 12 weeks and 24 weeks. The samples were collected and processed on the same day using the formal-ether concentration method. Stool samples were collected in clean covered pots. One cotton swab of stool (approx. wt. 1 mg) was transferred into 10 mg 1% formalin solution. This formalin solution was made by adding1 ml of formalin to 9 ml normal saline.

Formal-ether concentration method

One gram of faeces was emulsified in 7 ml of 10% normal saline and kept for 10 minutes, for 10 fixations. It was then stained through a wire gauge (40 meshes to an inch) and the filtrate was collected in a centrifuge tube. Three ml ether was added and the mixer was shaken vigorously for 1 minute. It was centrifuged at 2000 rpm for 2 minutes and then allowed to settle down. The debris were loosened with a stick, the upper part of the test tube was cleared of fatty debris and the supernatant fluid was decanted, leaving 1 or 2 drops. The deposit after shaking was poured on to glass slide, a cover slip was placed over it and the specimen was examined. The protozoal cysts or helminthic eggs were not distorted during this processing, which took 5 minutes. Cysts and ova were counted under high power microscopic examination.

ANTHROPOMETRIC MEASUREMENTS

Height, weight and MUAC of all workers were measured. Height was taken in cm using a wooden board fixed with a plastic tape to the nearest 1 cm. Weight was measured by using electronic bathroom scale (UNISCALE) to the nearest 100 g. TALK-MUAC tape was used to measure MUAC to the nearest 1 mm.

HAEMOGLOBIN CONCENTRATION MEASUREMENT

Haemoglobin concentration was measured at field setting by portable HemoCue photometer machine (Angelholm Sweden) using disposable microcuvettes and lancets. The assessment was done with a drop of capillary blood by finger pricking through home visits. Each lancet and microcuvette was used to take blood from one person only. HemoCue was examined everyday

before starting the fieldwork to check its accuracy and a standard microcuvatte supplied by the manufacturer with each machine.

ETHICAL CONSIDERATION

Ethical clearance was obtained from Bangladesh Medical Research Council of the Government of Bangladesh. Informed written consent was taken from all workers for interview and sample collection.

DATA MANAGEMENT AND ANALYSIS

All completed questionnaires were checked for inconsistency and other errors at the field level before sending to the BRAC/RED Dhaka office for computerization. A coding manual and a data entry layout were prepared by a trained data entry clerk at RED in close supervision of a researcher in head office. All questionnaires were coded and data were entered and analyzed using analysis software WINSPSS.

RESULTS

SOCIOECONOMIC AND DEMOGRAPHIC CHARACTERISTICS

Age distribution

Nearly half (47%) of the workers were aged 20-35 years, 31% were adolescents (10-19 years) and the rest (22%) were aged >35 years (Table 1).

Education and marital status

About 39% women were currently married and 40% were unmarried. The rest were divorced (7%), widowed (7%) and separated (7%) (Table 2). About 37% were illiterate and 40% got primary education. Only 7 % were SSC passed or above (Table 3).

Table 1. Distribution of subjects by age

Age (year)	Groups (%)					
	Single 12 wk (n=127)	Double 12 wk (n=121)	Single 24 wk (n=124)	Double 24 wk (n=125)	Placebo 24 wk (n=123)	Total (n=620)
13-19	31.0	29.2	35.5	30.1	32.0	31.5
20-35	47.6	46.7	46.0	45.5	47.5	46.7
>35	21.4	24.2	18.5	24.4	20.5	21.8

P = 0.966

Table 2. Marital status of the study workers

Marital status	Groups (%)					
	Single 12 wk (n=127)	Double 12 wk (n=121)	Single 24 wk (n=124)	Double 24 wk (n=125)	Placebo 24 wk (n=123)	Total (n=620)
Unmarried	37.8	38.8	42.7	37.6	42.3	39.8
Currently married	44.9	36.4	36.3	44.8	30.9	38.7
Divorcee	7.1	9.1	4.8	5.6	9.8	7.3
Widow	3.9	10.7	8.9	5.6	8.1	7.4
Separated	5.5	5.0	7.3	6.4	8.9	6.6
Lost	.8	0	0	0	0	.2

P = 0.509

Table 3. Educational qualification of the study workers

Education status	Groups (%)					
	Single 12 wk (n=127)	Double 12 wk (n=121)	Single 24 wk (n=124)	Double 24 wk (n=124)	Placebo 24 wk (n=123)	Total (n=620)
Illiterate	33.9	36.4	37.9	32.8	43.9	36.9
I-V	39.4	43.0	41.1	46.4	31.7	40.3
VI-IX	18.1	16.5	16.1	11.2	18.7	16.1
SSC and above	8.7	4.1	4.8	9.6	5.7	6.6

P = 0.347

Family characteristics

The mean family size was 5 (national average of 5.2, BBS 2000). The husbands of the workers were mainly skilled laborers (43.6%), while only 11.2% were farmer and 7% were jobless (Table 4).

Perceived economic status

About 70% of the workers had a perceived 'no deficit' status of their economic condition during the last one year (Table 5). When asked about their economic status compared to other village women, 61.9% of the women reported better than other inhabitants in their village and 2.3% reported that they felt poorer. Their average income in the preceding month from the Foundation was Tk. 1,405.72 (Table 5). Almost all women had a mosquito net and one had a bed, a radio and a TV in their houses (Table 5).

Table 4. Family characteristics of the workers

Family characteristics	Groups (%)					
	Single 12 wk n=57	Double 12 wk n=44	Single 24 wk n=46	Double 24 wk n=56	Placebo 24 wk n=38	Total n=620
Husband's occupation*						
Farmer	14.0	9.1	10.9	12.5	7.9	11.2
Business	12.3	13.6	17.4	21.4	13.2	15.8
Skilled labour	45.6	40.9	45.7	39.3	47.4	43.6
Unskilled labour	14.0	13.6	13.0	12.5	13.2	13.3
No occupation	3.5	15.9	4.3	8.9	2.6	7.1
Others	10.5	6.8	8.7	5.4	15.8	9.1
Family size**	n=127	n=121	n=124	n=125	n=123	n=620
<2	10.2	9.9	8.1	7.2	11.4	9.4
3-4	40.9	42.1	43.5	40.8	37.4	41.0
≥5	48.8	47.9	48.4	52.0	51.2	49.7

P = ∗ 0.809 *P = ∗∗ 0.963*

Table 5. Perceived economic status and household assets of the workers

Perceived economy	Groups (%)					
	Single 12 wk (n=127)	Double 12 wk (n=121)	Single 24 wk (n=124)	Double 24 wk (n=125)	Placebo 24 wk (n=123)	Total (n=620)
Non-deficit	70.1	64.5	65.3	72.8	76.4	69.8
Deficit	29.9	35.5	34.7	27.2	23.6	30.2
P = 0.206						
Self perception (economy)						
Good	59.5	59.3	59.8	65.6	65.0	61.9
Medium	36.5	39.8	38.5	32.8	31.7	35.8
Bad	4.0	.8	1.6	1.6	3.3	2.3
Household assets						
Mosquito net	94.5	95.0	93.5	97.6	95.1	95.2
Chowki	86.6	87.6	92.7	86.4	87.8	88.2
Bed	25.2	21.5	20.2	26.4	23.6	23.4
Clock	64.6	68.8	66.1	62.4	65.9	65.5
Radio	34.6	28.9	29.8	29.6	34.1	31.5
Bicycle	24.4	23.1	17.7	20.0	26.0	22.3
TV	26.8	23.1	24.2	26.4	22.8	24.7
Income in last month						
From foundation	1473.66	1476.02	1231.81	1380.84	1405.72	1405.72
Other sources	3.54	.99	10.60	0	18.70	6.75

P = 0.630

Water and environmental sanitation

Regarding water and sanitation, the workers' self reported information were noted. More than three quarters (77%) of the workers used tubewell water for drinking purpose while 22% used tap water (Table 6). About 53% of the workers used tubewell water for cooking and 75-78% of the workers used it for hand washing and cleaning utensils. About 54% of the workers used pond water for bathing, while about 10% bathed in the river. Nearly 80% of the workers used safe latrine (56% pit and 22% sanitary). Around 19% of the workers used unsafe hanging latrine (Table 7).

Table 6. Water sources for various purposes

Water sources	Group (%)					
	1 (n=127)	2 (n=121)	3 (n=124)	4 (n=125)	5 (n=123)	Total
Drinking (%)						
Tubewell	74.8	75.2	82.3	76.0	75.6	76.8
Well	1.6	0.8	1.6	0.8	0	1
Tap	23.6	24.0	16.1	23.2	24.4	22.3
$P = 0.70$						
Cooking (%)						
Tubewell	49.6	56.2	63.7	46.4	47.2	52.6
Pond	18.9	14.0	14.5	20.8	22.8	18.2
Canal	0	1.7	0	1.6	0.8	0.8
River	6.3	2.5	6.5	9.6	7.3	5.6
Well	1.6	0.8	0	0	0	0.5
Tap	23.6	24.8	15.3	21.6	22.0	21.5
$P = 0.15$						
Cleaning utensils (%)						
Tubewell	78.0	76.9	74.2	72.8	74.8	75.3
Pond	4.7	4.1	5.6	5.6	7.3	5.5
Ditch	0	0	0.8	0	0	0.2
Canal	0	0.8	2.4	0	0.8	0.8
River	0	1.7	1.6	0.8	0	0.8
Well	0.8	0	0.8	0.8	0	0.5
Tap	16.5	16.5	14.5	20.0	17.1	16.9
$P = 0.76$						
Hand washing (%)						
Tubewell	77.2	81.0	79.8	76.8	73.2	77.6
Pond	3.9	1.7	4.0	0.8	6.5	3.4
Canal	0	0	0.8	1.6	0	0.6
Well	1.6	0	0.8	0.8	0.8	0.8
Tap	16.5	17.4	13.7	20.0	17.9	17.1
$P = 0.59$						
Bathing (%)						
Tubewell	6.3	12.4	13.7	11.8	13.0	11.3
Pond	63.8	53.7	52.4	47.2	51.2	53.7
Ditch	0.8	0	0.8	0	0	0.3
Canal	3.1	8.3	8.1	7.2	7.3	6.8
River	18.9	19.8	16.9	22.4	20.3	9.7
Well	0.8	0	0.8	0	0	0.3
Tap	6.3	5.8	7.3	12.0	8.1	7.9
$P = 0.61$						

Hygienic practices

Only 56.9% of the workers used shoes or sandal at home. Only 11.9% of workers used soap after defecation of child below 5 years for cleaning the baby, while 1.3% of the workers used nothing but only water for cleaning the children after defecation. It was found that about a quarter of the workers were having long unclean nails (Table 8).

Table 7. Type of latrine used

Type of latrine	Group %					
	1 (n=127)	2 (n=121)	3 (n=124)	4 (n=125)	5 (n=123)	Total (n=620)
Sanitary	24.4	17.4	16.9	28.0	25.2	22.4
Pit	50.4	60.3	62.1	53.6	54.5	56.1
Hanging	22.8	19.0	19.4	16.8	16.3	18.9

P = 0.48

Table 8. Hygiene practices in everyday life

Type	Group %					
	1 (n=127)	2 (n=121)	3 (n=124)	4 (n=125)	5 (n=123)	Total (n=620)
Use of shoe/sandal						
Yes	55.9	57.9	52.4	57.6	61.0	56.9
No	44.1	42.1	47.6	42.4	39.0	43.1
P = 0.74						
Hand wash after defecation of <5 years child						
Soap	12.6	12.4	12.1	12.0	10.6	11.9
Ash	0	3.3	6.5	4.8	3.3	3.5
Mud	4.7	5.8	5.6	4.0	4.1	4.8
Only water	1.6	0.8	2.4	1.6	0	1.3
P = 0.67						
Nail						
Long	22.0	24.0	25.0	27.2	25.2	24.7
Short	78.0	76.0	75.0	72.8	74.8	75.3

P = 0.92

NUTRITIONAL STATUS

Weight

At baseline there were no significant differences in mean body weight (*P* = 0.214) of women of the different intervention schedules. Weight increased in all groups by 0.32 kg to 0.67 kg during the intervention period. However, there were no significant differences in the increases of body weight between intervention and placebo groups. According to age, this increase was highest in the adolescent group (1.8 kg) (Tables 9 and 10, Fig. 1). Figure 1 shows weight change between groups after 24 weeks of intervention.

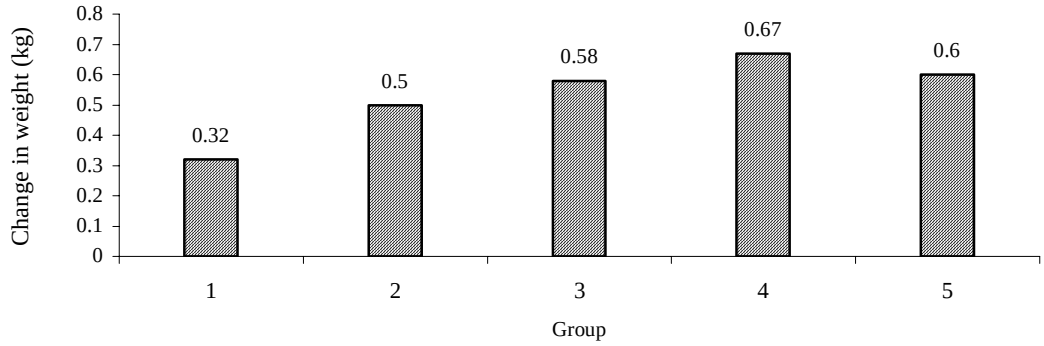
Table 9. Baseline weight of workers in different age group

Age group	Weight (kg)			
	10-19	20-35	>36	Total
1	41.9±5.5	47.4±9.2	47.4±8.3	45.6±8.4
2	41.2±4.2	46.7±8.7	45.4±6.2	44.7±7.5
3	41.2±5.4	44.9±6.6	44.5±8.6	43.5±6.8
4	41.3±6.2	45.4±7.0	46.9±9.0	44.3±7.8
5	39.9±5.8	46.2±7.9	44.7±7.8	43.8±7.7

Table 10. Weight of workers in different age group after 24 weeks of intervention

Age group	Weight (kg)			
	10-19	20-35	>36	Total
1	42.6±5.8	48.1±9.5	48.2±8.6	46.7±8.8
2	41.4±4.4	47.4±8.8	46.9±6.5	45.6±7.7
3	42.3±5.1	44.6±6.9	44.8±8.7	43.8±6.8
4	41.3±5.2	47.2±7.7	45.1±7.3	44.9±7.4
5	41.7±4.9	46.6±8.0	46.3±7.7	44.3±7.1

Figure 1. Change in weight after intervention



Height

Mean height of the workers was 150.3±5.6 cm at baseline. There were no significant differences in height of the workers of different groups at baseline (Table 11). Height measurements after 24 weeks appeared unreliable and data on height measurements therefore discarded.

Table 11. Baseline height of workers in different age group

Age group	Height (cm)			
	10-19	20-35	>36	Total
1	147.9±5.5	151.9±5.2	151.8±4.3	150.6±5.4
2	148.9±5.9	149.9±6.1	151.9±3.6	150.1±5.9
3	149.2±5.3	150.3±7.0	149.9±3.7	149.8±5.9
4	147.9±6.0	151.2±5.8	151.7±3.6	150.2±5.6
5	148.8±4.4	151.6±5.5	151.7±5.7	150.7±5.4

Between intervention group; $P = 0.710$

Body mass index (BMI)

The mean Body Mass Index (BMI) of the study workers was 19±3.1 kg/m^2 at baseline. Percentage of women with BMI <18.5 kg/m^2 (indicating under nutrition) was 36.5% at baseline. No significant differences were seen among the groups (Table 12).

Table 12. Percentage of BMI <18.5 in different groups at baseline

Group	BMI (kg/m^2)	
	Baseline (n=620)	% Worker with BMI <18.5 kg/m^2
1	20.1±3.2	36.0
2	19.8±3.2	36.0
3	19.3±2.6	38.8
4	19.6±3.1	37.7
5	19.3±3.2	41.9
Total	19.6±3.1	39.4

Mid-upper arm circumference (MUAC)

At baseline there was no difference in MUAC among groups (P = 0.213). It was improved after 24 weeks, increased by 3.5 – 3.8 mm in groups 2 and 4, who received double doses at baseline, compared to 2.6 – 3.0 mm in groups 1 and 3 who received a single dose at baseline, and 2.7 mm in placebo group. Again, the differences in theses increases were not statistically significant (P = 0.958) (Table 13 and 14, Fig. 2). Figure 2 shows changes of MUAC over the intervention period.

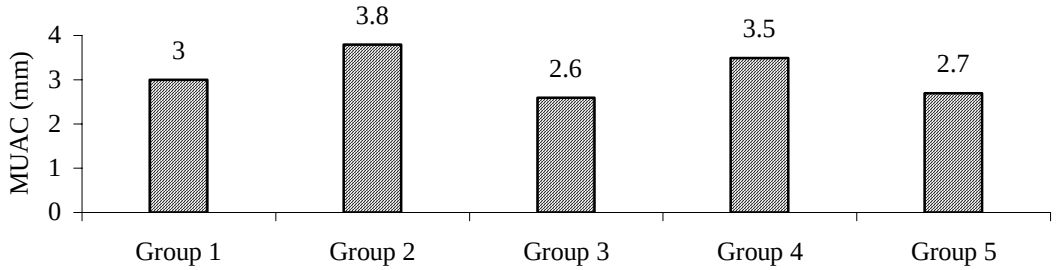
Table 13. MUAC of workers in different age groups at baseline

Group	MUAC (mm)		
	10-19	20-30	>30
1	232.3±21.3	241.3±22.6	260.5±36.1
2	229.4±16.7	251±30.9	246.1±28.7
3	230.7±21.1	245±25	241.8±23.9
4	230.5±19.1	240.8±27.1	257.2±31.7
5	228.2±19.4	243.4±35	242.9±30.7

Table 14. MUAC of workers in different age groups after 24 weeks of intervention

Group	MUAC (mm)		
	10-19	20-35	>36
1	231.3±18.4	249.1±32.6	251.3±31.4
2	229.4±15.8	248.7±33.6	245.8±26.9
3	230.4±18.3	238.4±23.3	242.2±27.2
4	252.2±14.8	249.5±28.9	245.7±30.3
5	225.2±15.1	242.2±29.2	237.2±36.5

Figure 2. Changes in overall MUAC during intervention period



INTESTINAL PARASITIC INFESTATION

At baseline, about one-fourth of the workers had parasitic infestation. Prevalence of *Ascaris* infestation was highest (21%) followed by hookworm (8%) and *T. trichura* (1.4%) in all groups (Fig. 3). After Albendazol treatment at different schedules and dose, prevalence of worm loads reduced significantly ($P < 0.05$) in all intervention groups except placebo (Group 5) within the first three months. Figure 3 presents the gross prevalence of different intestinal parasite at baseline. Figure 4 shows the prevalence of *Ascaris* at baseline and at 12 and 24 weeks after intervention.

Figure 3. Gross prevalence of intestinal parasite at baseline (%)

Figure 4. Prevalence of *Ascaris* in different groups at 3 phases

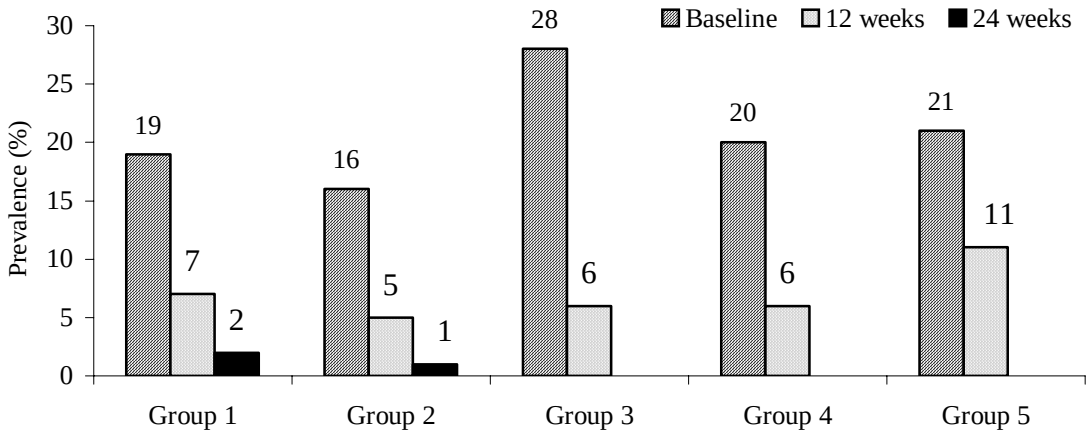
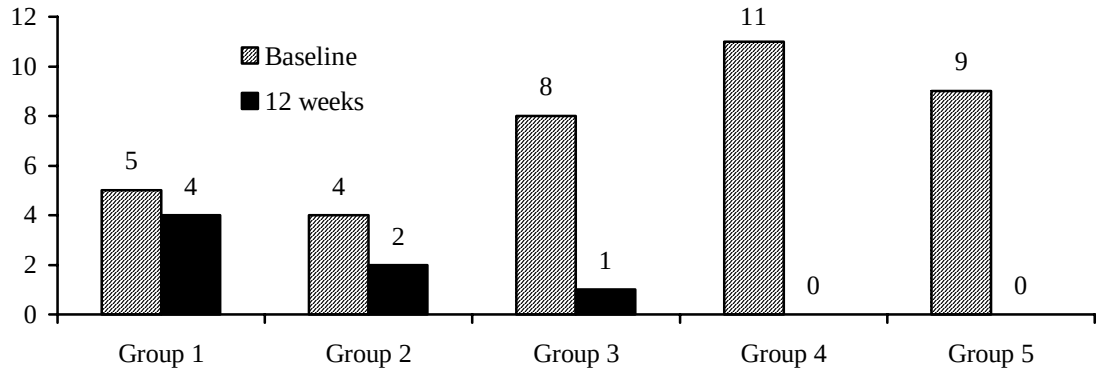


Figure 5 shows the prevalence of hookworm at baseline and at 12 weeks of intervention. It should be mentioned here that there were no significant effects of Albendazol on *T. trichura.*

Figure 5. Prevalence of hookworm in different groups at different phases



HAEMOGLOBIN CONCENTRATION AND ANAEMIA

Mean haemoglobin concentration of the workers was 125.1 g/L and there were no significant differences between groups at baseline (P = 0.235) (Table 15). It was observed that after 12 weeks of treatment Hb level increased significantly from baseline level (P = 0.000) in groups 1 and 2. But in contrast, this level decreased significantly after 24 weeks of treatment (P = 0.000).

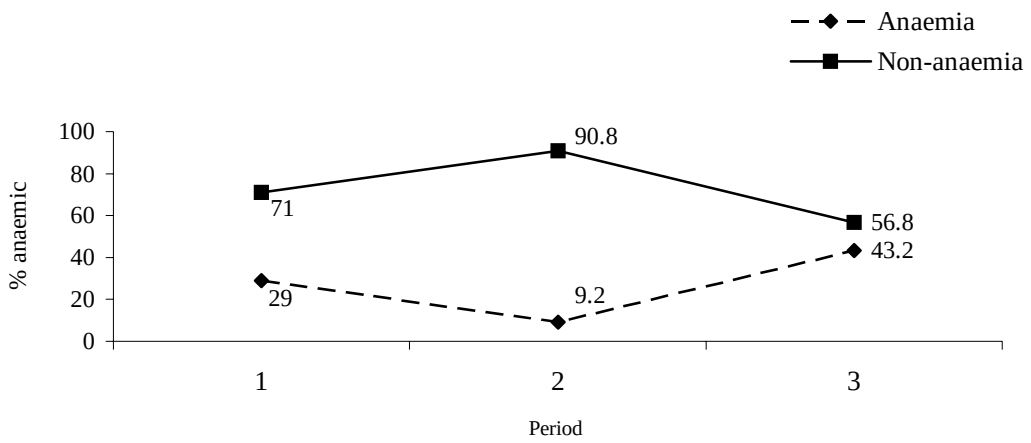
In group 3 and group 4 who also received one single intervention either single dose or double dose at baseline, haemoglobin concentration at 24 weeks was significantly lower than that of baseline (Table 15). At baseline anaemia prevalence was 29%, after 12 weeks of intervention this percentage decreased to 9.2%, whereas after 24 weeks it increased to 43.2%. Figure 6 indicates the anaemic and non-anaemic percentage in the three phases.

Table 15. Mean Hb level of workers in different groups in all phases

Group	Baseline	2nd phase	*P - value	3rd phase	*P - value
1	124.±12.0	134.6±11.8	0.000↑	121.7±12.3	0.000↓
2	126.6±12.3	133.9±12.7	0.000↑	121.1±13.8	0.000↓
3	124.7±12.7			120.7±12.4	0.002↓
4	123.7±12.7			121.1±12.5	0.022↓
5	126.1±11.3			122.4±12.2	0.002↓
Total	125.1±12.2	134.3±12.2	0.000↑	121.4±12.6	0.000↓

*P = Paired t-test

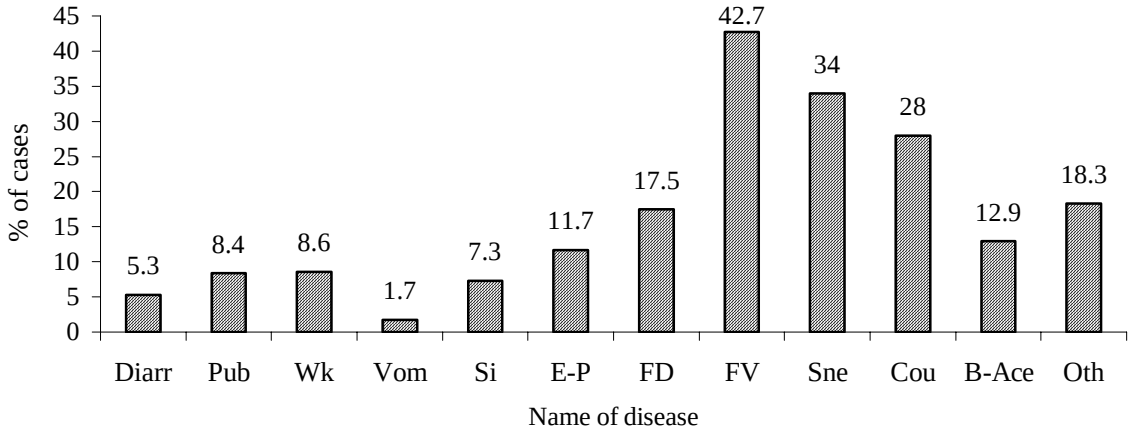
Figure 6. Anaemia percentage in different phases



MORBIDITY

It was observed that the highest illness incidence among the workers was fever (42.7%), followed by sneezing (34%) and coughing (28%). Some occupational hazards like backache and eye problem were seen among the workers. Prevalence of female disease was also remarkable (17.5%). Figure 7 describes the morbidity profile of the workers.

Figure 7. Morbidity pattern of worker in total study period



Note: Diarr-Diarrhoea, Pub- Pain in upper abdomen, Wk-Weakness, Vom-Vomiting, Si-Skin disease, E-P- Eye problem, FD- Female Disease, FV- Fever, Sne-Sneezing, Cou- Cough, B-Ace-Back-Ace, Oth-Others

DISCUSSION

The main purpose of this study was to test the effect of anthelminthic treatment (by Albendazol) on worm load, haemoglobin concentration and general health as well as nutrition status of the female workers of the Ayesha Abed Foundation of BRAC. Because, high worm infestations lead to anaemia (Cline *et al.*1984) that results in reduction of work capacity (Nokes and Bundy 1994; Morrow 1984). Our ultimate objective was to observe the extent of improvement of the general health and well-being of the workers (including anaemia) so they could enjoy a healthier life and increase their work output.

Nearly half of the study subjects were adult. In this age group possible and positive benefit of the anthelminthic treatment is improve economic productivity of women, improve well-being and quality of life, improve anthropometric indices, and iron status (R. Stoltzfus for WHO 1994). However, we did not find any significant differences in body weight ($P = 0.214$) compared to placebo in this age group.

This study was a randomized single-blinded placebo-controlled trial in which participants were deviated into 5 groups. They were similar in their socioeconomic and demographic and nutritional characteristics and also in the level of Hb and worm infestations. Groups 1 and 3 were administered by single dose; whereas, groups 2 and 4 were by double doses. In both schedules, the effect of a single dose and that of a double dose were observed. Group 5 was administered by one dose of placebo at baseline and after 24 weeks. The anthelminthic treatment was given in two schedules at 12 and 24 weeks. The effect of anthelminthic treatment was observed after 12 and 24 weeks.

It was found that the intervention (Albendazol) given as a single or a double dose at baseline resulted in sharp decrease of helminthiasis at 12 weeks and further slow decrease at 24 weeks. Those given interventions at baseline both for single and double dose also showed marked drop in worm infestation at 24 weeks, indicating that the effect of anthelminthic treatment (with Albendazol) persisted for at least 24 weeks. This result supported by the previous findings (Gilgen *et al.* 2001).

Gilgen *et al.* found a significant change in Hb level after 24 weeks in adults' women population. Concomitant with this effect of the anthelminthic drug on worm infestation, there was marked increase in haemoglobin concentration (and decrease of anaemia) between baseline and 12 weeks post intervention. Almost comparable results were seen with single and double dose treatment. Since no extra iron supplementation was given, the increase in haemoglobin could be attributable to decrease in worm load. However, this higher level of haemoglobin at 12 weeks did not last for the following 12 weeks, the concentration fell even below the baseline value at the end of study period, although a second intervention was given at 12 weeks (single or double dose) and the worm load decreased further. Similar decrease of haemoglobin concentration was also seen at 24 weeks in those who received a single intervention at baseline.

The fall of Hb level at 24 weeks may represent the poor nutritional status of the women and the poor sanitation and unhygienic environment they live in, in absence of any iron supplementation intervention.

The overall results thus lead to the conclusion that one single anthelminthic intervention (with a single dose) helps improve anaemia and the general nutritional status but this

improvement of anaemia status lasts for 12 weeks only. So there is a strategy of iron supplementation has to be developed to sustain the increased level of haemoglobin concentration achieved by deworming of the women.

CONCLUSION

It is observed from this study that the economic status of the female workers of AAF was comparatively better than that of other village women. Their nutritional status is also satisfactory. Worm infestation rate is also relatively less in this population.

A single dose of Albendazol is enough to control worm infestation up to 12 weeks, which can raise Hb concentration and reduce anaemia significantly. However, this situation did not sustain after 24 weeks, even after receiving a second dose at 12 weeks. Dietary supplementation is possibly needed to sustain the effect of deworming on anaemia.

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