

Impact of schistosomiasis on quality of life and productivity of workers

M.I. Kamel,¹ Y.A. Moustafa,¹ N. Foda,¹ S. Khashab¹, M. Moemen¹ and R.M. Abo El Naga¹

أثر داء البلهارسيا على جودة الحياة والإنتاجية لدى العمال

محمد إبراهيم كامل، يحيى عبد الغفار مصطفى، نوري فودة، سحر حشاش، مها مؤمن، راندا أبو النجا

الخلاصة: تمت دراسة أثر داء البلهارسيا على جودة الحياة والإنتاجية لدى العمال في مصنع للنسيج في الإسكندرية، مصر وذلك بتجميع المعطيات الشخصية والمهنية والاجتماعية والديمقراطية من 172 عاملاً من المصابين بداء البلهارسيا ومن 172 عاملاً من غير المصابين بالداء. واستخدمت في تحديد تأثير داء البلهارسيا عدة مؤشرات معتمدة، مثل مؤشرات الإنتاجية ومؤشرات منظمة الصحة العالمية لجودة الحياة. وقد ثبت تأثير الداء على الجوانب البدنية والاستقلالية والروحية والسيكولوجية (النفسية) والاجتماعية للمصابين به. وعلى الرغم من أن حرز الإنتاجية لدى العاملين المصابين بداء البلهارسيا لم يختلف اختلافاً يُعتدُّ به عما هو عليه لدى المجموعة الشاهدة، إلا أن عدد ساعات العمل الإضافي وحوافزهم الشهرية كانت أقل بشكل ملحوظ من غير المصابين. وقد تبيّن أن هناك علاقة يُعتدُّ بها بين شدة داء البلهارسيا وبين مؤشرات جودة الحياة والإنتاجية.

ABSTRACT The effect of schistosomiasis on quality of life (QOL) and productivity of workers was examined. In a textile factory in Alexandria, Egypt, personal, occupational and sociodemographic data were collected from 172 workers with schistosomiasis and 172 workers without schistosomiasis. Several indicators of productivity and the World Health Organization QOL brief were used to determine the impact of schistosomiasis. The disease affected the general, physical and independence, psychological and spiritual, and social domains of QOL. Although the productivity score of workers with schistosomiasis did not differ significantly from the control group, they had significantly lower additional hours of work and lower total incentives/month. A significant relationship was found between severity of schistosomiasis and QOL domains and productivity indicators.

Impact de la schistosomiase sur la qualité de vie et la productivité des travailleurs

RESUME L'effet de la schistosomiase sur la qualité de vie et la productivité des travailleurs a été examiné. Dans une fabrique de textiles à Alexandrie (Egypte), des données personnelles, professionnelles et socio-démographiques ont été recueillies auprès de 172 travailleurs atteints de schistosomiase et de 172 travailleurs non atteints. Plusieurs indicateurs de productivité et la version courte de l'échelle d'évaluation de la qualité de vie de l'Organisation mondiale de la Santé ont été utilisés pour déterminer l'impact de la schistosomiase. La maladie affectait les domaines de la qualité de vie suivants : général, état physique et indépendance, psychologique et spirituel, et social. Bien que le score de productivité des travailleurs ne diffère pas de manière significative de celui du groupe témoin, les travailleurs avaient un nombre significativement moins important d'heures supplémentaires et un total de primes moins élevé par mois. Une relation significative a été constatée entre la gravité de la schistosomiase, les domaines de la qualité de vie et les indicateurs de productivité.

¹Department of Community Medicine, Faculty of Medicine, University of Alexandria, Alexandria, Egypt.
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Introduction

Schistosomiasis is an important health problem worldwide. Globally, schistosomes infect 1 in 30 people [1]. In subtropical and tropical parts of Africa, Asia and South America, the disease affects millions of people [2]. In Egypt it is the most frequent endemic parasitic disease [3,4]. The impact on public health can be assessed in terms of the frequency and severity of schistosomiasis-related disease, incapacity and premature death [5].

Tropical diseases have an effect on the health status and functional capacity of the individual and ultimately on the social and economic performance of the individual's household. Therefore, job performance and work capacity are both used to measure productivity of workers. Job performance is the more conventional concept and historically has been the most widely used measure of employee productivity, especially among employers and managers [6]. An emerging important concept is "work capacity". It is a comprehensive term including physical, mental and social functional capacities as well as the nature of work itself, specifically work demands.

Quality of life (QOL) has been recently used as an endpoint measure of many health problems such as cardiovascular [7], chest [8], musculoskeletal [9] and nervous [10] diseases. Also the impact of life-limiting disorders, surgical operation [11], nutrition [12] and oral health [13] problems have been investigated using this measure. Other health problems have also been suggested to affect the QOL.

QOL is measured as physical and social functioning and perceived physical and mental well-being. Health-related quality of life (HRQOL) includes aspects of physical, psychological and social well-being issues for people [14].

In Egypt, very few studies have dealt with economic aspects of schistosomiasis for both the individual and the household. No studies are available in Egypt on the impact of schistosomiasis on QOL of infected persons. Thus, this study was performed to address the gap of knowledge on this topic.

In the present study we compared the productivity of people with and without schistosomiasis; we compared the QOL measures of individuals with schistosomiasis and those without the disease; and we investigated the relationship between the stage of schistosomiasis and QOL measures, absentee rates and productivity.

Methods

The present study was observational and a case-control design was used. All workers with schistosomiasis at the Misr Textile Company, Kafr al-Dawar, Beheira Governorate, Egypt during the field study period 1 October 1998 to 30 September 1999 were included. A similar number of workers without schistosomiasis (negative urine and stool for *Schistosoma* eggs) and job matched one to one were selected as a control group. Written informed consent was obtained from all the workers participating in the study.

All the workers underwent urine and stool analysis and clinical examination for detection of schistosomiasis. A specially designed interviewing schedule was used to obtain data from the schistosomiasis and control workers. The questionnaire included occupational, sociodemographic and family data. Data about schistosomiasis such as age at infection, type of *Schistosoma* infection, current signs and symptoms, presence of complications, previous operations, examination of liver and spleen and

presence of ascites were included. Results of stool and urine analysis for presence of *Schistosoma* eggs were also recorded.

The brief scale of the World Health Organization Quality of Life was used to measure QOL of the studied workers [15,16].

Special forms were designed to collect data from the medical, personnel and work records of studied workers. Productivity scores during the study period were determined from the recorded rates from employee records according to the company criteria of production for each job. Disability data were obtained directly from the Social Insurance Department and verified from the Labour Office at Kafr al-Dawar according to the criteria of Kamel et al. [17].

The severity of schistosomiasis was graded as follows:

- Active infection: passing eggs in urine and/or stool.
- Stage I: hepatomegaly/urinary bladder ulcer.
- Stage II: hepatosplenomegaly/ureteric stricture.
- Stage III: ascites/renal changes.
- Stage IV: haematemesis/cor pulmonale.

For the statistical analysis, descriptive measures were used, including frequency, percentage, arithmetic mean and standard deviation. Statistical tests included Student *t*-test, Mann-Whitney test, Friedman ANOVA (because the QOL score is categorical) and matched multiple logistic regression. The level of significance selected for this study was $P < 0.05$.

Results

The study included 170 workers with schistosomiasis and 170 control workers. The mean age of the workers with schistosomiasis was 43.14 ± 8.257 years in com-

parison to 42.41 ± 8.102 years for the control workers ($t = 0.82$). All participants were males with the exception of one female (0.06%).

The mean duration spent at work was 20.51 ± 7.024 years for the schistosomiasis group and 22.64 ± 7.695 years for the control group ($t = 2.76$, $P < 0.05$). Of all the participants, 44.7% were engaged in production work, 29.4% in maintenance work, 15.3% in administrative work and the rest (10.6%) in auxiliary work.

We found that 78.8% of the workers with schistosomiasis had *S. mansoni* infection, 7.6% had *S. haematobium* and 13.5% had mixed infections. Common symptoms of the disease included dysentery (22.9%), burning on urination (21.2%), frequent micturition (21.2%), blood in stool (18.8%), difficult urination (15.9%) and blood in urine (10%).

The liver was felt for 28.8% of workers with schistosomiasis, while the spleen was felt for 37.8% of them; 40% of the group with schistosomiasis had undergone splenectomy.

Haematemesis was seen in 19.4% of cases, ankle oedema in 17.1%, bladder ulcer in 4.1%, ureteric stricture in 2.9%, renal changes (hydronephrosis, renal stones, and renal failure) in 2.9%, cor pulmonale in 1.2% and heart failure in 0.6%.

Table 1 gives the indicators used for the assessment of productivity and QOL. These included monthly additional hours, monthly total incentives and productivity scores. Control workers tended to have longer additional hours and to get significantly higher incentives per month than the workers with schistosomiasis. In the control group, the means were 32.65 ± 19.05 hours and 56.15 ± 26.20 Egyptian pounds (LE) while in the schistosomiasis group the means were 26.47 ± 15.28 hours and $46.25 + 21.74$ I.E. respectively [US\$ 1 = LE 3.4

Table 1 Hospital admission, productivity and quality of life indicators of schistosomiasis workers and control group

Indicators	Schistosomiasis group (n = 170)	Control group (n = 170)	Mann-Whitney Z
Total hospital admission days	1.435 ± 3.754	1.141 ± 3.785	Z = 1.649
<i>Productivity indicators</i>			
Additional hours/month	26.473 ± 15.283	32.652 ± 19.053	t = 3.286*
Total incentives/month	46.250 ± 21.743	56.150 ± 26.202	t = 3.791*
Productivity score	1058.846 ± 208.423	1112.556 ± 141.891	Z = 0.8371
<i>Quality of life</i>			
General	59.853 ± 9.039	63.603 ± 20.162	Z = 3.204*
Physical and independence	60.630 ± 7.857	64.013 ± 19.258	Z = 3.264*
Psychological and spiritual	59.877 ± 7.005	62.941 ± 16.543	Z = 4.107*
Social	75.490 ± 6.644	82.500 ± 17.264	Z = 6.529*
Environmental	60.993 ± 9.079	51.967 ± 15.522	Z = 6.459*

*Significant at P < 0.05.

(February 1999)]. These differences were statistically significant. The productivity score was calculated for only 27 workers (15.9%) of each group whose type of work allowed for such calculation. There was no significant difference between the two groups regarding productivity score (Z = 0.8371). Workers with schistosomiasis tended to have significantly lower mean general domain scores (59.85 ± 9.039 compared with 63.60 ± 20.162, Z = 3.204), physical and independence domain scores (60.63 ± 7.857 compared with 64.01 ± 19.258, Z = 3.264), and social relationship domain scores (75.49 ± 6.644 compared with 82.50 ± 17.264, Z = 6.529) than the control workers. The control group also had a significantly higher psychological and spiritual domain score (62.94 ± 16.54) than the schistosomiasis group (59.87 ± 7.00, Z = 4.107). The control group however had a significantly lower mean percent of the environmental domain scores (51.96 ± 15.522) than the schistosomiasis group (60.99 ± 9.079, Z = 6.459).

The relationships between the mean percentage of QOL domains and productivity indicators and the stages of schistosomiasis are shown in Table 2. The differences for the general, the psychological and spiritual, the social relationship and the environmental domains were not statistically significant, nor were there any significant differences in the productivity scores, although the mean decreased successively from the active infection stage to stage IV. Significant differences were seen in for the physical and independence domain, the mean additional hours and the incentives.

Table 3 shows the results of multiple logistic regression of the studied factors. Of the five domains of QOL, four appeared in the results. The environmental domain was the most significant followed by the psychological and spiritual domain and the social relationship domain. The model succeeded to discriminate 83.53% of the schistosomiasis cases and 77.06% of the control group.

Table 2 Relationships between stage of schistosomiasis and quality of life and productivity indicators

Indicator	Stage of schistosomiasis*				Friedman ANOVA (χ^2)	
	Active infection (n = 28)	I (n = 5)	II (n = 82)	III (n = 20)		IV (n = 35)
<i>General domain</i>						
Mean	59.93	60.00	60.37	63.13	57.50	5.905
s	9.54	5.59	8.74	4.93	11.02	
<i>Physical and independence domain</i>						
Mean	59.31	65.00	61.85	61.61	57.65	26.24*
s	9.90	3.91	4.86	5.29	11.70	
<i>Psychological and spiritual domain</i>						
Mean	60.27	62.50	60.924	60.625	56.310	5.767
s	6.052	7.217	4.795	5.318	10.994	
<i>Social relationship domain</i>						
Mean	76.488	75.00	75.711	75.00	74.524	1.904
s	5.099	0.00	6.442	2.704	9.681	
<i>Environmental domain</i>						
Mean	57.813	66.875	62.110	61.406	59.821	4.273
s	12.601	7.844	6.934	5.936	11.143	
<i>Additional hours</i>						
Mean	20.420	32.367	20.167	28.817	20.661	14.453*
s	15.641	14.551	11.820	9.756	9.648	
<i>Incentives</i>						
Mean	51.436	53.650	45.637	55.246	38.293	13.130*
s	23.627	24.51	20.527	21.284	18.284	
<i>Production score</i>						
Mean	1089.0	1081.0	1070.3	1037.5	1026.13	2.118
s	221.37	142.836	233.498	212.839	230.414	

*Active infection: passing eggs in urine and/or stool; stage I: hepatomegaly/urinary bladder ulcer; stage II: hepatosplenomegaly/ureteric stricture; stage III: ascites/renal changes; stage IV: haematemesis/cor pulmonale.

*Significant at $P < 0.05$.

Discussion

The impact of schistosomiasis is not only measured in terms of the economic consequences of the disease. Its impact should be also assessed in terms of the frequency

and severity of schistosomiasis-related disease, incapacity and premature death. The consequences of these morbidity patterns should be characterized in terms of the impact on the physical and the socioeconomic development of an affected individual and

Table 3 Multiple logistic regression analysis of schistosomiasis and controls groups*

Factor	B	Significance	R	Exp. (B)
Environmental domain	0.1189	0.0001	0.3423	1.1263
Psychological and spiritual domain	-0.0477	0.0083	-0.1027	0.9534
Social relationship domain	-0.0466	0.0002	-0.1582	0.9545
Total incentives	-0.0126	0.0650	-0.0546	0.9875
General domain	-0.0298	0.0150	-0.0911	0.9707
Additional hours	-0.0231	0.0150	-0.0912	0.9771
Admission days	-0.1981	0.0517	-0.0616	0.8203
Constant	2.7539	0.0099	-	-

*Variables are arranged by order of entry (forward likelihood method).

Model predictions: control = 77.06%; schistosomiasis = 83.53%; overall = 80.29%; Model $\chi^2_4 = 151.964$.

P < 0.05 was significant.

The control group was coded as zero and the schistosomiasis group as one.

his/her family and on the economic and social consequences for community development [18].

An infected worker had to pay on average for one monthly visit to the outpatient clinic of the factory (13.5 ± 12.67 visits per year) where he or she received medicines, laboratory and non-laboratory investigations as well as other medical procedures. This mean was significantly higher than that of the control workers (10.1 ± 10.73 visits, $Z = 2.088$). Also, workers with schistosomiasis were more frequently admitted to hospital than the control workers (1.44 ± 3.754 compared with 1.14 ± 3.785); however, this difference was not statistically significant ($Z = 1.649$).

We found that 40 workers had given up their jobs during 1998 because of schistosomiasis. These individuals suffered from severe complications of the disease that prevented them from holding onto their

jobs. They constituted 24% of the partially or totally disabled workers whose employment was terminated because of sickness. About the same percentage had been observed over the last five years. In fact schistosomiasis has caused immeasurable misery to people, innumerable deaths and a marked loss of productivity. In 1981 an extensive study of the Ghana Health Assessment Team estimated healthy days of life lost per 1000 population for 48 diseases and schistosomiasis ranked 25th [19].

Attempts have been made to measure the effect of schistosomiasis on the work capacity and the productivity of the infected population. A 1992 study of a village in Gezira, Sudan on the effect of schistosomiasis on productivity of women showed that infection with *S. mansoni* significantly affected activity patterns in the cotton fields. A significant number of infected women felt too weak to sustain the morning and afternoon work regimen. Not only did

schistosomiasis affect productivity, it also lowered the women's ability to undertake personal care activities between the cotton-picking seasons. However, that study included only 11 infected women and a similar number of controls [20].

We found that the schistosomiasis group worked for a significantly shorter duration of additional hours/month than control workers. This might reflect their lower capacity for work. Additional work hours also significantly decreased with increase in the severity of schistosomiasis. This highlights the relationship between severe complications of the disease and work capacity. In Egypt, Al-Hawey found that the physical work capacity of individuals measured by an ergometer and step test was significantly more affected among individuals suffering from schistosomiasis than those who were not (A.M. Al-Hawey, unpublished report, 1989).

The results of studies on physiological tests of work performance in people infected with *Schistosoma* have been conflicting. Physiological tests of work performance and measurement of field productivity were carried out for 194 Sudanese cane cutters in order to study the effect of *S. mansoni* infection [21]. There was a statistically significant higher mean haemoglobin concentration in those not infected. The mean productivity (mean daily weight of cane cut per man) was significantly correlated with the individual's estimated maximum aerobic capacity determined in the laboratory, but not with the degree of *S. mansoni* infection. The non-infected group was less "efficient" (mean productivity: oxygen intake) during cutting than the infected groups [21]. Other studies from other countries have given contradicting results. In Brazil, a highly endemic area of *S. mansoni*, a prospective study was con-

ducted on a sugar estate where the severe hepatosplenic clinical form of the disease was seen in 4% of the field-working population. Reduction of productivity was observed among workers with the hepatosplenic form compared to those with the intestinal form (35.1%) [22].

We found that workers with schistosomiasis had a lower mean percentage productivity score per year than that of the control group; however, this difference was not statistically significant. This reduction represented about 4.8% of the productivity score of the control group. However, as previously mentioned, the productivity score was calculated for only 15.9% of the workers from each group. In 1982, Wolgemuth et al. studied 224 Kenyan road construction labourers [23]. They estimated that the presence of *Schistosoma* infection reduced productivity by 6%. This effect was also not significant statistically [23].

We also found that productivity score decreased with severity of schistosomiasis; however, this decrease was not statistically significant. The workers in the current study were in relatively good health and were an active population from whom the more seriously ill were excluded. These results do not, therefore, necessarily reflect the effects of the disabling stages of schistosomiasis when there is no work productivity.

Total incentives per month, which reflect the overall performance and productivity of the worker in addition to other factors such as type of job and duration at work, were significantly lower among the schistosomiasis group than the control workers (16.3 ± 21.74 LE compared with 56.2 ± 26.2 LE, $Z = 3.890$). This trend reflects the longer hours worked by the latter group.

Schistosomiasis as a chronic disease is expected to affect the QOL of the individual. Basic needs of an individual include a range of physiological, safety, social, self-esteem and self-realization factors [15,16]. The priority of such needs can be decided by the cultural and socioeconomic status of the community.

Generally, we found that schistosomiasis workers had significantly lower scores for most of the QOL domains than the control group. This trend was reversed for the environmental domain, in which the control workers had a significantly lower score. This might appear peculiar; however, in Egypt many people regard schistosomiasis as an inevitable part of their lives and it is less important than poverty, hunger and lack of basic services, such as electricity and roads (A. Al-Garem, unpublished re-

port, 1991). Also, as demonstrated in the current study, a large proportion of the infected workers were suffering from mild forms of the disease.

We also found a relationship between stage of schistosomiasis and the physical and independence domain whereby schistosomiasis cases with stage IV of the disease had the lowest mean score percentage. Furthermore, three QOL domains appeared on the top of the list of factors discriminating between cases and controls, in addition to the general domain which ranked seventh. The list also included the additional hours, total incentives, admission days, total cost and absence days. This confirms with univariate analysis the importance of the QOL scale and some productivity indicators as factors related to schistosomiasis.

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