

## THE EPIDEMIOLOGY OF SCHISTOSOMIASIS IN EGYPT: QENA GOVERNORATE

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**Abstract.** Qena is the southernmost governorate of Egypt included in the Epidemiology 1, 2, 3 national study. A probability sample selected 17,822 individuals from 2,950 households in 34 ezbas and 10 villages from a total rural target population of 1,731,252 (based on the most recent 1986 census of the population by the Egyptian Central Agency for Public Mobilization And Statistics). Parasitologic examination of urine and stool were made for *Schistosoma haematobium* and *S. mansoni*, respectively, and physical and ultrasound examinations were made on a 20% subsample. The overall estimated prevalence of *S. haematobium* was  $4.8 \pm 0.7\%$  ( $\pm$ SE) and geometric mean egg count (GMEC) was 7.0 ova per 10 ml of urine. Considerable variation in prevalence was observed between the villages and ezbas, ranging from 0.0% to 20%, with the smaller ezbas having a slightly higher overall prevalence. The age- and sex-specific patterns of *S. haematobium* showed typical peak prevalence in early adolescence, with males having a higher prevalence than females. A history of hematuria was associated with current infection (odds ratio = 3.6, 95% confidence interval = 2.32–5.63). Hepatomegaly and splenomegaly determined by physical examination present in 7.9% and 3.0%, respectively. Ultrasonography-determined hepatomegaly of the left liver lobe was found in 10.1%. Ultrasonography-detected hepatomegaly in both the left and right lobes increased in prevalence from approximately 5% in children to 15–20% in adults. The prevalence of ultrasonography-detected splenomegaly increased slightly with age. Grade III periportal fibrosis was detected in only 2 individuals in the sample. Bladder wall lesions and obstructive uropathy were also very infrequent. Other associations with these measures are given. Most villages and ezbas had an *S. mansoni* prevalence of less than 1%. The exception was Nag'a El-Sheikh Hamad, where the prevalence was  $10.3 \pm 0.5\%$  (GMEC =  $57.4 \pm 2.6$ ). Two other communities also had a prevalence >1% (Ezbet Sarhan and Kom Heitin).

The Qena governorate, in Upper Egypt, is best known as the location of some of Egypt's most famous Pharaonic temples, such as Karnek and Dendera, and its Pharaonic tombs, the Valley of the Kings, in Tebes on the west bank of Luxor. The governorate is located about 535–650 km south of Cairo on the Nile River, as shown on the map in Figure 1 of the report in this supplement by El-Khoby and others.<sup>1</sup> Qena is bordered on the north by Sohag and on the south by the Aswan governorate. The Nile valley is at its narrowest in Egypt here and the arable land, a green strip only 1 or 2 km on either side of the river, is bordered by barren desert on both sides. The governorate is perennially irrigated throughout by principal main and distributory canals (Egyptian Ministry of Irrigation, unpublished data). The major crop is sugar cane, which requires large quantities of water drawn by pumps from surrounding canals. Other food crops are grown in small plots adjacent to the villages and are irrigated manually. In this region where the arable land is so limited, many of the villages and hamlets have been built at the edge of the irrigated fields and others are located entirely on higher arid land especially where the valley narrows.

Much of the population of Qena is rural and many of the villagers are agriculturalist. Nevertheless, many adult males also are employed in skilled and unskilled occupations in nearby towns and cities (Naga Hammadi, Qena, and Luxor).

As mentioned in the introductory paper of this supplement,<sup>2</sup> Qena, like the rest of Upper Egypt, has been endemic only for *Schistosoma haematobium* and was one of the last governorates to be converted to perennial irrigation. Data presented by Wright<sup>3</sup> showed that *S. haematobium* prevalence was very low in 1955, whereas the prevalence had increased since the 1930s in both Sohag to the north and

Aswan to the south. Only patchy data for the Qena governorate are available until the 1980s. Studies by Kitron and Higashi,<sup>4</sup> Mansour and others,<sup>5</sup> and King and others<sup>6</sup> indicated that the prevalence of *S. haematobium* had increased to levels similar to the surrounding governorates, i.e., in the 30–40% range with a peak in the 10–14-year-old children reaching >70%.

The most recent information for Qena come from reviews of the National Schistosomiasis Control Program surveillance data for Qena.<sup>7,8</sup> From 1981 to 1984, all measured outcomes, prevalence, incidence, intensity of infection, and cohort studies showed a consistent decrease in *S. haematobium* endemicity.<sup>7</sup> Prevalence decreased from 30.8% to 16.0% over this period. By 1988, prevalence had decreased to 10.3%.<sup>8</sup> These results were generated from rural health facilities, the extent of which the catchment populations are representative of the rural population of Qena is not known. Data from this report of the Epidemiology 1, 2, 3 (EPI 1, 2, 3) Qena governorate study provide more recent information from a probability sample of the rural population.

### SUBJECTS AND METHODS

The population sample, selected by multistage stratified cluster sample, was calculated to detect a prevalence of *Schistosoma* sp. as low as 5% in each ezba or mother village with an 80% precision and 90% confidence level. The findings are considered representative of the rural areas of the entire governorate.<sup>9</sup> The total sample population, 17,822 individuals from 2,950 households in 34 ezbas and 10 villages, were selected. Details of the methods used have been described in an accompanying paper in this supplement.<sup>10</sup>

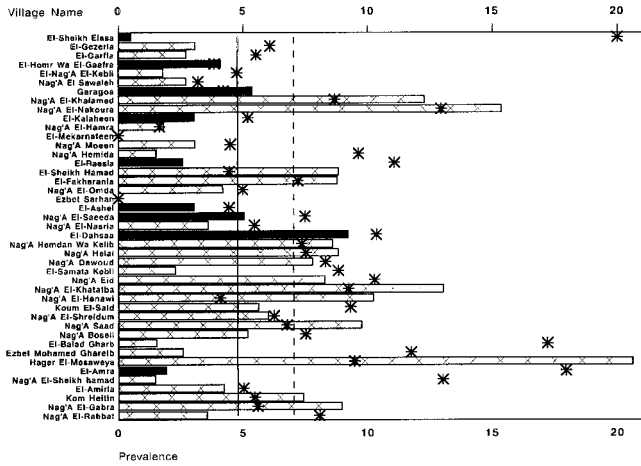


FIGURE 1. Prevalence (%) (bars) and intensity (asterisks) of *Schistosoma mansoni* infection in Qena Governorate. Solid horizontal bars show prevalences in villages, hatched horizontal bars show prevalences in ezbas, the solid vertical line is the mean prevalence for all communities, the broken vertical line is the mean intensity of infection, and the asterisks are the geometric mean egg counts/10 ml of urine for each community.

Quantitative microscopic counting of *Schistosoma* ova in stool (using a modified Kato technique) in 11,502 persons and in urine (using the Nuclepore [Pleasanton, CA] filter technique) in 12,327 persons was performed and recorded as described.<sup>10</sup> Physical examination and abdominal ultrasonography were performed on 2,454 inhabitants from 468 households using the standardized EPI 1, 2, 3 methods.<sup>11</sup>

The data for the 2,454 subjects who had physical ultrasonographic examinations were incomplete for some analyses for the following reasons: 1) 488 (19.9%) did not provide urine specimens for parasitology hematuria or proteinuria examination; 2) 625 (25.5%) did not provide stool specimens for parasitology examinations; 3) 120 (4.9%) did not have height and weight measured and recorded; 4) 248 (10.1%) did not respond to a question regarding past history of schistosomiasis; 5) 253 (10.3%) did not respond to a question regarding prior treatment for schistosomiasis; 6) 83 (3.4%)

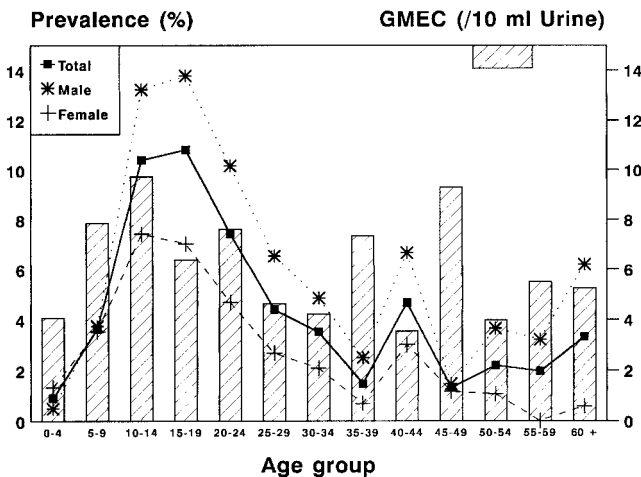


FIGURE 2. Age and sex prevalence and intensity of infection of *Schistosoma haematobium* in Qena Governorate. GMEC = geometric mean egg count.

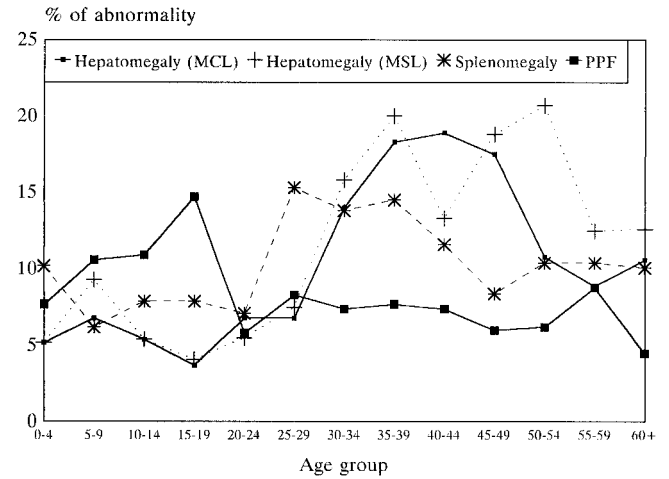


FIGURE 3. Hepatomegaly, splenomegaly, and periportal fibrosis (PPF) detected by ultrasonography in relation to age in Qena Governorate. MCL = midclavicular line; MSL = midsternal line.

did not respond to a question regarding burning micturition; and 7) 103 (10.3%) did not respond to a question regarding blood in the urine.

The most important among these non-response rates were 1) the absence of urine specimens from 20% of the subjects, which excluded them from any analysis based upon *S. haematobium* infection; and 2) the absence of height measurements in 5%, which excluded them from any analysis of hepatic enlargement.

Descriptive analysis was completed as described previously.<sup>9</sup> Further analysis was performed after exporting data to SPSS/PC + 4.01 (SPSS Inc., Chicago, IL). This software was used to calculate odds ratios (ORs) and 95% confidence intervals (CIs). The community burden of schistosomiasis was calculated by using the GMEC (x + 1) of the predominant *Schistosoma* species. Product moment correlation coefficient (r) and its statistical significance (P) was used for testing the association of the morbidity variables of interest, e.g., splenomegaly by ultrasonography, with the community

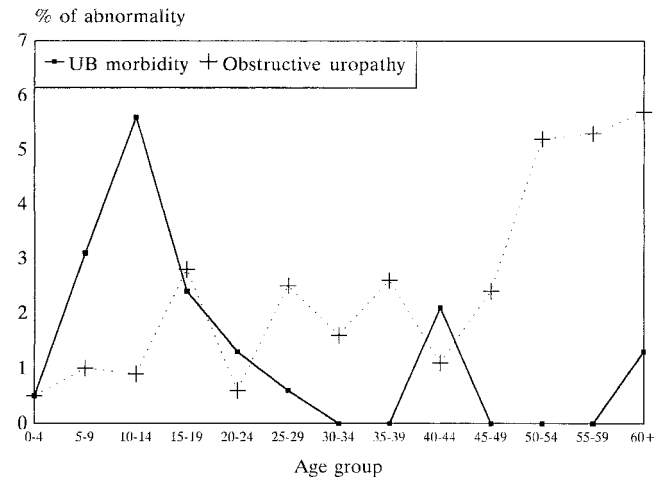


FIGURE 4. Urinary bladder (UB) morbidity and obstructive uropathy (detected by ultrasonography) in relation to age in Qena Governorate.

TABLE 1  
Odds ratio and confidence limits for risk factors for infection with *Schistosoma haematobium* in Qena Governorate\*

Risk factor	Total in group	Infected No. (%)	Odds ratio	Confidence limits
<b>Demographics</b>				
<b>Age groups (years)</b>				
0–10	4,068	174 (4.3%)		
11–20	2,937	311 (10.6%)	2.65	2.19–3.21
21–35	2,484	103 (4.1%)	0.97	0.75–1.24
36–55	1,912	48 (2.5%)	0.58	0.42–0.80
>55	926	30 (3.2%)	0.75	0.51–1.11
<b>Gender</b>				
Female	6,416	244 (3.8%)		
Male	5,911	422 (7.1%)	1.94	1.65–2.29
<b>Domicile</b>				
Village ( $\geq 500$ houses)	3,364	136 (4.0%)		
Ezba (<500 houses)	8,963	530 (5.9%)	1.49	1.23–1.81
<b>Exposure to canal water</b>				
<b>Bathing (males)</b>				
No	3,503	217 (6.2%)		
Yes	1,719	175 (10.2%)	1.72	1.39–2.11
<b>Washing (females)</b>				
No	5,152	172 (3.3%)		
Yes	818	57 (7.0%)	2.17	1.59–2.95
<b>Playing (children &lt;15 years old)</b>				
No	3,429	149 (4.3%)		
Yes	1,175	148 (12.6%)	3.17	2.50–4.02
<b>Clinical findings</b>				
<b>History of schistosomiasis</b>				
No	7,723	305 (3.9%)		
Yes	2,696	262 (9.7%)	2.62	2.01–3.11
<b>Prior treatment of schistosomiasis</b>				
No	8,205	340 (4.1%)		
Yes	2,615	252 (9.6%)	2.47	2.08–2.92
<b>History of burning micturition</b>				
No	1,337	53 (4.0%)		
Yes (total)	642	39 (6.1%)	1.57	1.02–2.40
<15 years	188	16 (8.5%)	2.25	1.26–4.03
$\geq 15$ years	454	23 (5.1%)	1.29	0.78–2.13
<b>History of blood in urine</b>				
No	1,668	58 (3.5%)		
Yes	295	34 (11.5%)	3.62	2.32–5.63
<15 years	124	21 (16.9%)	5.66	3.31–9.69
$\geq 15$ years	171	13 (7.6%)	2.28	1.22–4.26
<b>Hepatomegaly in MCL (by PE)</b>				
No	1,556	63 (4.0%)		
Yes	388	26 (6.7%)	1.70	1.06–2.73
<15 years	122	13 (10.7%)	2.83	1.51–5.30
$\geq 15$ years	266	13 (4.9%)	1.22	0.66–2.25
<b>Splenomegaly (by PE)</b>				
No	1,920	88 (4.6%)		
Yes	59	4 (6.8%)	1.51	0.54–4.27
<15 years	20	2 (10.0%)	2.31	0.53–10.13
$\geq 15$ years	39	2 (5.1%)	1.23	0.27–4.74
<b>Laboratory findings</b>				
<b>Hematuria</b>				
No	9,391	257 (2.7%)		
Yes	2,935	409 (13.9%)	5.75	4.89–6.77
<15 years	1,056	215 (20.4%)	9.09	7.48–11.04
$\geq 15$ years	1,879	194 (10.3%)	4.09	3.37–4.97

TABLE 1  
Continued

Risk factor	Total in group	Infected No. (%)	Odds ratio	Confidence limits
<b>Proteinuria</b>				
No	10,856	369 (3.4%)		
Yes	1,471	297 (20.2%)	7.19	6.10–8.47
<15 years	628	170 (27.1%)	10.55	8.60–12.94
≥15 years	843	127 (15.1%)	5.04	4.06–6.25
<b>Ultrasonography</b>				
<b>Hepatomegaly in MCL</b>				
No	1,362	65 (4.8%)		
Yes	516	22 (4.3%)	0.89	0.54–1.46
<15 years	228	15 (6.6%)	1.41	0.79–2.51
≥15 years	288	7 (2.4%)	0.50	0.23–1.10
<b>Hepatomegaly in MSL</b>				
No	1,510	75 (5.0%)	0.64	0.35–1.20
Yes	368	12 (3.3%)	0.64	0.35–1.20
<15 years	66	5 (7.6%)	1.57	0.61–4.02
≥15 years	302	7 (2.3%)	0.45	0.21–1.00
<b>Splenomegaly</b>				
No	1,764	83 (4.7%)		
Yes	196	9 (4.6%)	0.97	0.48–1.97
<15 years	72	2 (2.8%)	0.58	0.14–2.40
≥15 years	124	7 (5.6%)	1.21	0.55–2.68
<b>Periportal fibrosis</b>				
No	1,784	80 (4.5%)		
Yes (≥3 mm)	172	12 (7.0%)	1.60	0.85–2.99
<15 years	86	5 (5.8%)	1.31	0.52–3.33
≥15 years	86	7 (8.1%)	1.89	0.84–4.22
Grade I (3–<5 mm)	170	12 (7.1%)	1.62	0.86–3.03
Grade II (5–<7 mm)	0			
Grade III (≥7 mm)	2	0 (0.0%)		
<b>Bladder wall lesions</b>				
No	1,927	81 (4.2%)		
Yes	39	11 (28.2%)	8.95	4.31–18.62
<15 years	28	10 (35.7%)	12.66	5.66–28.30
≥15 years	11	1 (9.1%)	2.28	0.29–18.02
<b>Obstructive uropathy</b>				
No	1,924	87 (4.5%)		
Yes	43	5 (11.6%)	2.78	1.07–7.23
<15 years	8	2 (25.0%)	7.04	1.40–35.38
≥15 years	35	3 (8.6%)	1.98	0.59–6.59

\* MCL = midclavicular line; PE = physical examination; MSL = midsternal line.

burden of schistosomiasis, i.e., GMEC ( $x + 1$ ). Graphic presentations were prepared using Harvard Graph3.0 (Software Publishing Corp., Mountain View, CA).

#### RESULTS

The overall prevalence of *S. haematobium* was  $4.8\% \pm 0.7$  (+ SE) in the 43 surveyed communities and ranged from 0% to 20.6% (Figure 1). The average intensity of infection in the surveyed villages was 7.0 GMEC/10 ml of urine and ranged from 0 to 20.0/10 ml of urine. The prevalence of infection was slightly more in ezbas than in their mother villages. The OR of having a *S. haematobium* infection in inhabitants of ezbas in comparison with village dwellers was 1.49 with a 95% CI of 1.23–1.81 (Table 1).

Prevalence followed the classical community pattern for *S. haematobium*, being maximum (10–11%) in those 10–20

years of age, decreasing to 7.5% in those in the 20–25-year old age bracket and lower in those younger than 10 years of age and those ≥25 years of age (Figure 2). Intensity of infection followed the same pattern, being higher, i.e., 7–10 ova/10 ml of urine, in those between the ages of 5 and 25 and usually lower in the very young and in those more than 25 years of age. Prevalence and intensity of infection was usually higher at all ages in males than in females.

Risk factors in Qena for *S. haematobium* infection are shown in Table 1. Those significantly associated with infection were male gender, living in smaller communities, males bathing, women washing clothing or utensils and children swimming or playing in canals, and a history of and/or treatment for schistosomiasis. *Schistosoma haematobium*-infected individuals were slightly more likely (OR = 1.57, 95% CI = 1.02–2.40) to have a history of burning micturition, while infection was much more common (OR = 3.62, 95%

TABLE 2

Odds ratio and confidence limits for risk factors for urinary tract morbidity (obstructive uropathy and/or bladder wall lesion) with *Schistosoma haematobium* in Qena Governorate\*

Risk factor	Total in group	Morbidity No. (%)	Odds ratio	Confidence limits
<b>Demographics</b>				
<b>Age groups (years)</b>				
0-10	880	21 (2.4%)		
11-20	572	33 (5.8%)	2.50	1.43-4.37
21-35	467	10 (2.1%)	0.90	0.42-1.92
36-55	366	16 (4.4%)	1.87	0.96-3.63
>55	169	10 (5.9%)	2.57	1.19-5.57
<b>Gender</b>				
Female	1,266	23 (1.8%)		
Male	1,188	67 (5.6%)	3.23	2.00-5.22
<b>Domicile</b>				
Village ( $\geq 500$ houses)	625	15 (2.4%)		
Ezba (<500 houses)	1,829	75 (4.1%)	1.74	0.99-3.05
<b>Exposure to canal water</b>				
<b>Bathing (males)</b>				
No	681	25 (3.7%)		
Yes	357	36 (10.1%)	2.94	1.74-4.99
<b>Washing (females)</b>				
No	1,005	16 (1.6%)		
Yes	162	4 (2.5%)	1.56	0.52-4.74
<b>Playing (children &lt;15 years old)</b>				
No	699	15 (2.1%)		
Yes	243	19 (7.8%)	3.87	1.93-7.74
<b>Parasitologic findings</b>				
<i>S. haematobium</i> infection				
No	1,874	64 (3.4%)		
Yes	92	14 (15.2%)	5.08	2.73-9.45
<20 ova/10 ml of urine	78	11 (14.1%)	4.64	2.34-9.21
$\geq 20$ ova/10 ml of urine	14	3 (21.4%)	7.71	2.10-28.32
<b>Clinical findings</b>				
<b>History of schistosomiasis</b>				
No	1,523	40 (2.6%)		
Yes	536	35 (6.5%)	2.59	1.63-4.12
<b>Prior treatment of schistosomiasis</b>				
No	1,612	45 (2.8%)		
Yes	518	33 (6.4%)	2.37	1.49-3.76
<b>History of burning micturition</b>				
No	1,608	38 (2.4%)		
Yes (total)	763	48 (6.3%)	2.77	1.80-4.28
<15 years	218	20 (9.2%)	4.17	2.38-7.32
$\geq 15$ years	545	28 (5.1%)	2.24	1.36-3.68
<b>History of blood in urine</b>				
No	1,984	54 (2.7%)		
Yes	367	31 (8.4%)	3.30	2.09-5.21
<15 years	143	16 (11.2%)	4.50	2.51-8.09
$\geq 15$ years	224	15 (6.7%)	2.57	1.42-4.63
<b>Hepatomegaly in MCL (by PE)</b>				
No	1,863	71 (3.8%)		
Yes	463	12 (2.6%)	0.67	0.36-1.25
<15 years	157	4 (2.5%)	0.66	0.24-1.83
$\geq 15$ years	306	8 (2.6%)	0.68	0.32-1.42
<b>Splenomegaly (by PE)</b>				
No	2,295	76 (3.3%)		
Yes	73	9 (12.3%)	4.11	1.97-8.56
<15 years	26	4 (15.4%)	5.31	1.79-15.78
$\geq 15$ years	47	5 (10.6%)	3.48	1.34-9.03

TABLE 2  
Continued

Risk factor	Total in group	Morbidity No. (%)	Odds ratio	Confidence limits
<b>Laboratory findings</b>				
<b>Hematuria</b>				
No	1,472	44 (3.0%)		
Yes	494	34 (6.9%)	2.40	1.51–3.80
<15 years	180	16 (8.9%)	3.17	1.75–5.74
≥15 years	314	18 (5.7%)	1.97	1.12–3.46
<b>Proteinuria</b>				
No	1,721	56 (3.3%)		
Yes	245	22 (9.0%)	2.93	1.76–4.90
<15 years	111	12 (10.8%)	3.60	1.87–6.94
≥15 years	134	10 (7.5%)	2.40	1.19–4.81
<b>Ultrasonography</b>				
<b>Hepatomegaly in MCL</b>				
No	1,734	64 (3.7%)		
Yes	600	21 (3.5%)	0.95	0.57–1.56
<15 years	270	9 (3.3%)	0.89	0.44–1.83
≥15 years	330	12 (3.6%)	0.98	0.53–1.85
<b>Hepatomegaly in MSL</b>				
No	1,907	69 (3.6%)		
Yes	427	16 (3.7%)	1.04	0.60–1.81
<15 years	76	4 (5.3%)	1.48	0.53–4.17
≥15 years	351	12 (3.4%)	0.94	0.51–1.76
<b>Splenomegaly</b>				
No	2,214	76 (3.4%)		
Yes	232	14 (6.0%)	1.81	1.00–3.25
<15 years	91	6 (6.6%)	1.99	0.84–4.69
≥15 years	141	8 (5.7%)	1.69	0.80–3.58
<b>Periportal fibrosis</b>				
No	2,220	75 (3.4%)		
Yes (≥3 mm)	218	14 (6.4%)	1.96	1.09–3.54
<15 years	110	3 (2.7%)	0.80	0.25–2.58
≥15 years	108	11 (10.2%)	3.24	1.67–6.30
Grade I (3–<5 mm)	216	14 (6.5%)	1.98	1.10–3.57
Grade II (5–<7 mm)	0			
Grade III (≥7 mm)	2	0 (0.0%)		

\* MCL = midclavicular line; PE = physical examination; MSL = midsternal line.

CI = 2.32–5.63) than no infection in subjects with a history of blood in the urine. Hematuria and proteinuria were highly associated, particularly in children, with *S. haematobium* infection.

Infection with *S. haematobium* was not associated with hepatomegaly or splenomegaly detected by physical examination (Table 1). *Schistosoma haematobium* was not more common in subjects with hepatomegaly, as measured by ultrasonography in the mid-clavicular line (MCL) or mid-sternal line (MSL) or in those with ultrasonography-splenomegaly. A total of 153 (7.9%) of 1,944 had hepatomegaly detected by physical examination and 59 (3.0%) of 1,979 had splenomegaly detected by physical examination. Hepatomegaly of the left lobe of the liver (measured in the MSL) was detected by ultrasonography in 189 (10.1%) of 1,878 subjects. Ova in the urine was statistically associated with periportal fibrosis (PPF) in adults (OR = 2.95, 95% CI = 1.25–6.95) but not in children. Only 2 of the 172 (9.0%) of 1,956 with PPF detected by ultrasonography had grade III lesions and none had grade II changes.

Bladder wall lesions were rare, being present in only 39

(2.0%) subjects. However, *S. haematobium* infection was highly associated (OR = 8.95, 95% CI = 4.3–18.6) with these abnormalities detected by ultrasonography, particularly in children. Obstructive uropathy was detected in 43 (2.2%) subjects; the majority (81.4%) with these lesions were adults having *S. haematobium* ova in the urine. The presence of obstructive uropathy was associated with ova positivity (OR = 2.78, 95% CI = 1.07–7.23).

Morbidity defined as bladder wall lesions or obstructive uropathy detected by ultrasonography was low, occurring in only 90 (3.7%) of 2,454 subjects, and it had the highest prevalence in those 11–20 years old and those >55 years old (Table 2). Males were more likely to have urinary tract morbidity than females. Males bathing in canal water and children playing or swimming in canals had associated morbidity, but females washing utensils and clothes in canal water were not more likely to have morbidity than women who did not. Urinary tract morbidity was highly associated (OR = 5.08, 95% CI = 2.73–9.45) with *S. haematobium* ova in the urine, particularly in those with >20 ova/10 ml of urine. Also, hematuria and proteinuria correlated with morbidity

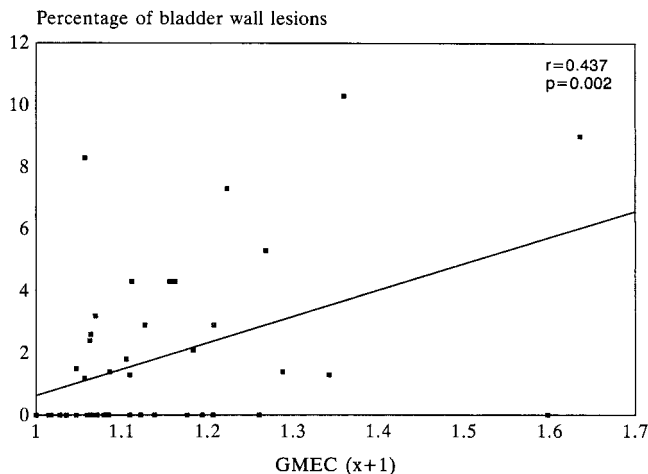


FIGURE 5. Urinary bladder morbidity in relation to *Schistosoma haematobium* infection in Qena governorate. GMEC = geometric mean egg count.

detected by ultrasonography. A history of and/or treatment for schistosomiasis were also risk factors for morbidity. Living in ezbas, as opposed to larger communities, was a marginally significant (OR = 1.74, 95% CI = 0.99–3.05) risk factor for urinary tract morbidity. A present and/or past history of burning micturition or blood in urine was associated with morbidity, particularly in children.

Hepatomegaly detected by physical examination was not associated (OR = 0.58, 95% CI = 0.21–1.61) with bladder wall and obstructive lesions, but was associated with splenic enlargement detected by physical examination (OR = 4.11, 95% CI = 1.97–8.56). There was no association between hepatomegaly, as detected by ultrasonography in either the MCL or MSL, and urinary tract morbidity. However, splenomegaly detected by ultrasonography (OR = 1.81, 95% CI = 1.00–3.25) and PPF (OR = 1.96, 95% CI = 1.09–3.54) were both marginally associated with urinary tract morbidity. The latter relationship was present only in adults.

The community prevalence of hepatomegaly and splenomegaly, as detected by physical examination, increased with age in the case of hepatic enlargement from 5% to 7% in children and young adults to 10–15% in most older age groups. The community prevalence of hepatomegaly ( $r = 0.42$ ,  $P = 0.002$ ) and splenomegaly ( $r = 0.42$ ,  $P = 0.002$ ) detected by physical examination increased with the community burden of schistosomiasis. Hepatomegaly detected by ultrasonography in both the MCL and MSL increased in prevalence from about 5% in children to 15–20% in adults (Figure 3). The prevalence of ultrasonography-detected splenomegaly increased slightly with age and the low prevalence of PPF (5–10%) changed minimally with age. Ultrasonography-detected right ( $r = -0.15$ ,  $P = 0.17$ ) or left ( $r = -0.09$ ,  $P = 0.28$ ) lobe hepatic enlargement or splenomegaly ( $r = 0.20$ ,  $P = 0.10$ ) were not related to the community burden of schistosomiasis haematobia. There was an increase ( $r = 0.35$ ,  $P = 0.01$ ) in PPF as the community burden of infection increased. Urinary bladder morbidity was more frequent in the young while obstructive uropathy had a higher prevalence in older adults (Figure 4). Both bladder wall lesions ( $r = 0.44$ ,  $P = 0.002$ ) and urinary tract

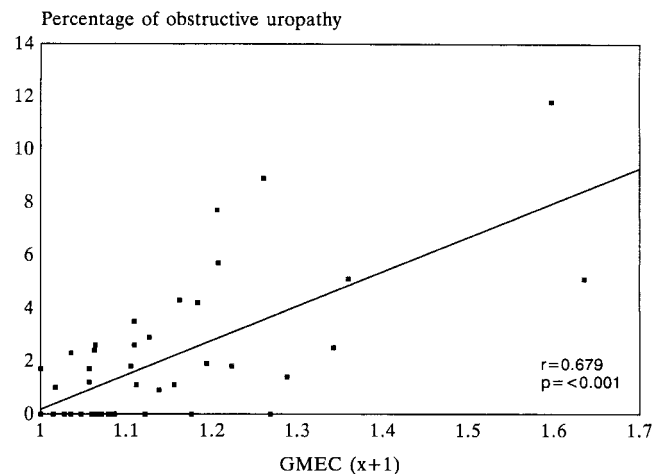


FIGURE 6. Obstructive uropathy in relation to *Schistosoma haematobium* infection in Qena governorate. GMEC = geometric mean egg count.

obstruction ( $r = 0.68$ ,  $P < 0.0001$ ) were highly associated with the community burden of schistosomiasis haematobia (Figures 5 and 6).

Overall, *S. mansoni* prevalence was less than 1% ( $0.4 \pm 0.2\%$ ). The GMEC was  $47.7 \pm 6.5$  eggs per gram of feces, indicative of a low intensity of infection. Most villages and ezbas had a prevalence of less than 1%, with the exception of Nag'a El-Sheikh Hamad, where the prevalence was  $10.3 \pm 0.5\%$  (GMEC =  $57.4 \pm 2.6$ ). Two other communities (Ezbet Sahran and Kom Heitin) also had prevalences in excess of 1%.

#### DISCUSSION

The overall estimated prevalence of *S. haematobium* infection as determined by ova in the urine was low ( $4.8 \pm 0.7\%$ ). The intensity of infection (GMEC) was also low ( $7.0 \pm 0.55$ ). Although there was significant variation in prevalence of *S. haematobium* between the villages and hamlets (from 0 to  $20.6 \pm 0.3$ ), even the highest prevalence was lower than figures reported by independent researchers as recently as 1982.<sup>6</sup> At that time, some villages had prevalence estimates in excess of 60%. Kitron and Higashi<sup>4</sup> noted that among the most intensely infected male school age children, infection rates were decreasing sharply at every 6-month follow-up of their cohort. Kessler and others<sup>7</sup> and Webbe and El Hak<sup>8</sup> have documented trends *S. haematobium* infection, using Ministry of Health surveillance data, as an evaluation of the Upper Egypt National Schistosomiasis Control Program. Their reports, as mentioned above, suggest that by 1988, the prevalence had decreased to 10.3%. Our results, based on sample estimates, suggest that the prevalence has continued to decrease to less than half of the 1988 level. Of those infected, intensity of infection was low. Webbe and El Hak<sup>8</sup> reported that the GMEC in school children was 8.3/10 ml of urine. Comparison of the GMEC with males in the 10–14-year-old age group ( $12 \pm 2.6$ ) from our sample, the age and sex group with the highest GMEC, shows that intensity of infection was roughly similar.

Measurement of morbidity, data not available before and

for which comparisons with historical data cannot be made, also show a low level of morbidity regardless of the specific measurement. Bladder lesions and liver periportal fibrosis, which can be determined only by ultrasonography, were very infrequent. Grade III periportal fibrosis was found only in 2 individuals. Obstructive uropathy was also rare.

This was the first report to show that cases of *S. mansoni* are occurring throughout rural Qena. The prevalence in most villages and hamlets was very low. It is not clear if transmission foci exist in these low prevalence communities or if the cases are imported from outside. However, the prevalence of 10.3% in Nag'a El-Sheikh Hamad and in the other 2 communities with prevalences greater than 1% suggest active transmission of *S. mansoni*.

These data further document and establish important benchmarks for the continued evaluation of control activities or other natural changes of schistosomiasis patterns in the governorate of Qena. The identification of *S. mansoni* foci warrant rapid intervention and justify investigation of factors that may give insight into why *S. mansoni* is being established in these communities and what other communities may be affected. More importantly, the results infer that there are other villages or ezbas with established infection foci of *S. mansoni* villages in Qena.

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