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PREVALENCE OF SCHISTOSOMIASIS IN AL-BAHA PROVINCE, SAUDI ARABIA IN YEARS 2012 AND 2013 (PROSPECTIVE AND COMPARATIVE STUDY)

By

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Abstract

The rate of human schistosomiasis increased in Al- Baha Province, Saudi Arabia in the last few years. So, it was necessary to study the prevalence of human schistosomiasis in Al-Baha Province over the period of the two years (2012-2013).

In general, there was a decline in the prevalence of schistosomiasis in Al- Baha over the study period and it was significantly less in 2013 than it was in 2012. Schistosomiasis infection rate was affected by host sex as males had higher infection rate than females. Age group of 15-44 showed the highest infection rate. Prevalence of schistosomiasis in Saudi people was significantly higher than it was in non-Saudi or immigrant ones. Thus, more attention should be paid to Al-Baha area in the future schistosome control programmes.

Key words: Saudi Arabia, Al-Baha, Schistosomiasis, Prospective study.

Introduction

Schistosomiasis is an endemic parasitic disease in 74 countries and is estimated to infect 200 million infected in Africa and about 700 million at risk otherwise (You *et al*, 2014). It is one of the ten leading causes of morbidity among travelers (Hotez *et al*, 2012). It is among the most important parasitic diseases worldwide, with a significant socio economic impact (Steinmann *et al*, 2006). Schistosomiasis, also known as bilharziasis is caused by snail transmitted parasites of the genus *Schistosoma* that inhabit the human vasculature (Lier *et al*, 2009; WHO, 2011). Schistosomiasis remains a serious health problem worldwide, mostly in tropical regions, and endemic developing nations (Othman, 2013).The Kingdom of Saudi Arabia, commonly known as Saudi Arabia is one of the largest Arabian countries which cover four-fifths of the Arabian Peninsula. It is surrounded by countries with a well-documented history of human schistosomiasis: Egypt, Iraq and Yemen (Youssef *et al*, 1998, Arfaa, 1972, Arfaa 1976). Schistosomiasis or bilharzias is a primary tropical parasitic disease that was first described in 1851 by Theodor Bilharz. It is caused by blood-dwelling fluke worms of the genus *Schistosoma* that reside in the abdominal veins of their vertebrate definitive hosts (Chitsulo *et al*, 2000). Autochthonous human cases of schistosomiasis have been found in all provinces except the Eastern Province, Qassim, and Empty Quarter Provinces (Al-Madani 1990). Two species of schistosomes are endemic in Saudi Arabia, *Schistosoma mansoni* and *S. haematobium* (Arfaa 1976; Ghandour *et al*, 1997; Morsy and El Dasouqi, 1979; Shati, 2009).

Infection with S. mansoni was reported mainly in the highlands of the western areas and some parts of the Central and Northern Regions, whereas *S. haematobium* was reported mainly in Tihama-Assier and the lowland coastal plain in the southern areas (Ghandour *et al*, 1999).

Prevalence of schistosomiasis in Saudi Arabia: Saudi Arabia is the largest Arab countries in Eastern Mediterranean Region in which the status of schistosomiasis was determined for planning and implementation purposes (WHO 2013). Abdel-Azim and Gismann (1950; 1951) carried out a schistosomiasis limited survey and its snail hosts in some countries of Southwestern Asia including Saudi Arabia. Lack of time and facilities prevented the survey from being compre-

hensive and systematic, but enough data were obtained to provide a general estimation of the situation. Infection with *S. haematobium* was endemic in small foci, while *S. mansoni* was widespread in the fertile areas of Saudi Arabia. They alarmed that industrialization of Saudi Arabia and its inevitable concentration of population may result in spread of the disease**.**

Farooq (1961) studied the distribution of urinary and intestinal schistosomiasis and recorded the disease in the Kingdom Central Region (Kharj and Daraiya), the Midwest Region (Taif and Wadi Fatimah), and the Northwest Region (Tayma and Tabuk). Probably the first comprehensive epidemiological study on schistosomiasis snail intermediate hosts was that carried out by **Alio (1967)**. He proved the occurrence of *S. mansoni* infection among the inhabitants of areas in the north and south-central parts, and both *S. mansoni* and *S. haematobium* in the Northwest, Midwest, Southwest, and north-central but none in the Eastern part with an overall prevalence of 17%.

Arfaa (1976) carried out a schistosomiasis survey, and concluded that the prevalence of 17% of **Alio (1967)** might be an overestimation as infection was rarely found among the inhabitants of large cities such as Makkah Al-Mokarama, Riyadh, Taif, Jeddah, Abha, and Tabuk where a significant proportion of the population of the country lives. In addition, the disease was almost absent from the Eastern Region (Shargieh and Hassa). He added that in most rural areas the infection was in limited foci in a few villages, but, exceptions were found in few areas such as Jizan (Southwest Region), where the infection was highly prevalent in most of the villages. He concluded that the focal nature of transmission offers a good opportunity to reduce the transmission of schistosomiasis by snail control operations. On the contrary to what Arfaa (1976), Ghandour *et al*. (1986; 1990) noted that the agricultural developmental schemes and the establishment of many new dams in various regions of the country have led to the creation of many ideal permanent habitats suitable for the snail intermediate hosts. Later on, this resulted in an all-year transmission of schistosomiasis in large foci instead of seasonal transmission in small foci (Jordan, 1993; Shati 2009).

Habib et al. (1977) reported schistosomiasis infection among school-children and gave the clinical pattern of infection. Ashi (1989) declared that human infection with both intestinal and urinary schistosomiasis has a wide distribution in the kingdom of Saudi Arabia

According to the Statistical Year Book of Ministry of Health in Saudi Arabia (2002), the mean prevalence of schistosomiasis in the Saudi Kingdom from 1990-2000 was 2.2/100,000. The highest schistosomiasis rates were recorded in Aseer (39%), Jazan (27.6%), Bishah (16.3%), and Al-Bahah (9.8%). The least rate was recorded in Riyadh (0.2%) and Tabouk (0.2%), but none in Najran and Al-Jouf. There was still active infection transmission in Jazan, Aseer and Al-Baha with new cases among the children and middle-aged individuals.

Regarding snail vectors four species were encountered, *Biomphalaria arabica* for *S. mansoni*, and *Bulinus truncates*, *B. wright*, and *B. beccarii* for *S.haematobium* with very high susceptibility (Arfaa *et al*, 1989).

The prevalence of schistosomiasis clustered in the Eastern and Southwestern provinces, due to the preferable environmental conditions (Arfaa, 1976). Both abiotic and biotic factors contribute to the schistosomiasis transmission cycle and these determine the spatial distribution of the disease (Cox, 1993;Satayathum *et al*, 2006; Zhou et al, 2008).

Other factors contributed to the increase in infection prevalence includied the large number of expatriates, many from countries with higher prevalence of schistosomiasis, and hence the possibility of parasitic infection among them (Abahussain, 2005).

Wallace (1979) studied the distribution, etiol-

ogy and pathology of clinical aspects of urinary schistosomiasis in Saudi population. He observed that mortality from the disease among Saudi population was not due to parasitic ova passed in urine and feces but due to the complications caused by fibrotic immunological reactions to the retained ova. He recommended application of hygienic, educational and snail control for the complete eradication of the disease in this country.

Transmission occurs when people suffering from schistosomiasis contaminate freshwater sources with their excreta containing parasite eggs which hatch in water. People become infected when larval forms of the parasite – released by freshwater snails – penetrate the skin during contact with infested water. In the body, the larvae develop into adult schistosomes. Adult worms live in the blood vessels where the females release eggs. Some of the eggs are passed out of the body in the faces or urine to continue the parasite's life-cycle. Others become trapped in body tissues, causing immune reactions and progressive damage to organs (WHO 2014).

Subjects, Material and Methods

The study was carried out in representative areas in Al-Baha Province. Al-Baha has a mean altitude of 2200 meters above the sea level. It is relatively a small province in the southern part of Saudi Arabia characterized by moderate annual rainfall and a mean annual temperature of 22^{o}C.

Data collection and analysis**:** A written permission was obtained from the Town Administrative Officials prior to the study. Verbal consent was obtained from each individual before conducting interview and sample collection.

This study were done on a total of 234255 people (113115 and 121140 cases in 2012 and 2013 respectively) attending the primary health care centers of Al-Baha Province, Saudi Ministry of Health during the period from January 2012 to December 2013. Sheet were filled out on each patient including name, age (three groups; 0-14.15-44 and >45), sex (male & female) and nationality (Saudi & non-Saudi), any history of dysentery, hematuria, frequency of micturition and abdominal pain. All the subjects were subjects to clinical examination with stress on the size of the liver and/or spleen and lymph nodes. Urine and stool samples were collected in labeled plastic containers stool. The urine samples analyzed by sedimentation method and by Nucleopore technique which is a filtration technique which consists of a microscopic examination of a filter used to collect the eggs of *S. haematobium* from 10 ml of urine to determine intensity of infection (Abou-Madyan *et al*, 2004).

The stool samples were examined microscopically for *S. mansoni* eggs by direct thin smears and by Kato-thick smear (Katz *et al*, 1972). Patients were given a prescription order of appropriate anti-parasitic drugs in the form of Mirazid®, an extract from *Commiphora molmol* (Family: Burseraceae) common name Myrrh, Gum-Myrrh/ Myrrha or Mur Makkah or El-Murrah (Al-Mathal, 2007; Tonkal and Morsy, 2008). *C. molmol* was successfully used to control *B. arabica* under laboratory conditions (Al-Mathal and Fouad, 2006) and to treat human infected with *Bertiella studeri*; Cestode: Anoplocephalidae (Al-Mathal *et al*, 2010)

Statistical analysis: Data were computerized and analyzed using SPSS windows version 11.5.

Results

The results are shown in tables (1, 2, 3, 4, 5, 6, 7, 8 & 8) and figures (1, 2, 3 & 4).

Table 1: Total No of cases according to type of specimens examined

Examined sample	No. of cases 2012	No. of cases 2103
Urine	40078	47716
Stool	34490	34808
Both	38547	38616
Total cases	113115	121140

Table 2: Schitosomiasis nationality

Schistosomiasis patients	No. of cases 2012		No. of cases 2013	
	Saudi	Non Saudi	Saudi	Non Saudi
Urinary	39790	288	47359	357
Intestinal	34212	278	34602	206
Mixed infection	38149	398	38252	364
Total cases	112151	964	120213	927

Table 3: No of cases according to patients sex (234255)

Schistosomiasis patients	No. of cases 2012		No. of cases 2103	
	Male	Female	Male	Female
Urinary	17074	23004	20844	26872
Intestinal	17013	17477	16936	17872
Mixed infection	18357	20190	18585	20030
Total cases	52444	60671	56366	64774

Table 4: Schitosomiasis in years 2012 and 2103 according to type

Patients No.	Urinary	Intestinal	Mixed infection	Total
2012	1	19	0	20
2103	0	13	0	13
Total cases	1	32	0	33

Table 5: Prevalence in years 2012 and 2103 according sex.

Schistosomiasis patients	No. of cases 2012		No. of cases 2013	
	Male	Female	Male	Female
Urinary	1	0	0	0
Intestinal	15	4	8	5
Mixed infection	0	0	0	0
Total cases	16	4	8	5

Table 6: Prevalence in years 2012 and 2103 according to nationality.

Schistosomiasis patients	No. of cases 2012		No. of cases 2013	
	Saudi	Non Saudi	Saudi	Non Saudi
Urinary	1	0	0	0
Intestinal	16	3	12	1
Mixed infection	0	0	0	0
Total cases	17	3	12	1

Table 7: Prevalence in years 2012 and 2103 according to age group

Age group	No. of cases 2012	No. of cases 2013
0-14 years	3	2
15-44	12	6
>45	5	5
Total	20	13

Table 8: Prevalence in Al –Baha province according to sex

Sex / Year	Male	Female
No. of cases 2012	16	4
No. of cases 2013	8	5

Table 9: Prevalence in Al–Baha province according to nationality.

Nationality / Year	Saudi	Non Saudi
No. of cases 2012	17	3
No. of cases 2013	12	1

Discussion

Analysis of the prevalence of human schistosomiasis in Al-Baha Province showed that there was a decline in the prevalence of schistosomiasis over the study period and the prevalence of infection in year of 2013 was lower and significantly differed from the prevalence in year of 2012. There was a special variation in the prevalence of schistosomiasis in Al Baha province as it was significantly higher in year 2012 than it was in year 2013.

The prevalence of schistosomiasis was found to be affected by human sex, males had significant higher infection rate than females in both years. Although, it was higher in year 2102 than in year 2103.The infection rate in year 2102 was 80% among males and 20% among females while rate in year 2103 was 61.5% among males and 38.5% among females. Sex was one of the factors affected the prevalence of schistosomiasis in Al-Baha region as the rate of infection in males was higher than in females. The present results agreed with many other studies (Talaat *et al*, 1999; Khoby *et al*, 2000; Hammam *et al*, 2000; Brooker, 2007). However, the present results might be due to cultural and behavioral practices, as males were associated more with farms' working, dealing with animals at the water ranks and did out-door swimming and being in contact the intermediate hosts of schistosomes. On the other hand, females contact with water was less as they were mainly in-doors concerned with home duties.

In the present study, there was a significant association between the human age and prevalence of schistosomiasis, age group of 15-44 showed the highest infection rate in both years 2012 and 2013. This might be due to behavioral and professional factors (Gryseels *et al*, 2006) as this age group usually were farmers and have more contact with water in their daily practices. A significant difference for the prevalence of schistosomiasis among different nationalities showed that 85% of infection rate were among Saudi patients followed by 15% among non-Saudi patients in year 2012, while 92.3% of infection rate among Saudi patients followed by 7.7 % among non-Saudi ones in year 2013. This might be due to the fact that most of them were farmers and do other activities required contact with water bodies.

The present results disagreed with that of Shati (2009) who found that schistosomiasis was higher among Non-Saudi people in comparison to Saudi people. Although, Al-Baha Province had the higher rate of human schistosomiasis in comparison with other Saudi Arabian Provinces in the past years, the results of the present study showed that there was a decline in the prevalence of infection in this region during the study period. This may due to the increase of applying schistosome control programmes run by the Saudi Ministry of Health as well as the increase of people awareness about schistosomiasis. Also, the conditions in Al Baha province, however, are not suitable for schistosome transmission especially in winter as the temperature drops to lower degrees. Such low temperature has been found in other studies to affect schistosome transmission (Appleton, 1978; Martens, 1995; Gryseels *et al*, 2006; Brooker, 2007).

Al-Baha Province is a tourist area, as the summer time has a good weather and the rate of rainfalls becomes higher making people contact with water increase. Thus, people coming from different areas and countries during the summer time may have brought infection with them to the area at that season.so that schistosomiasis did not eradicated completely from it. This is in line with other studies which have reported that prevalence of schistosomiasis usually peak in wet seasons where the contact with water sources (Scott *et al*, 2003; Spear *et al*, 2004).

Conclusion

Each year schistosomiasis afflicts millions people particularly in in tropical and subtropical countries, predominantly in the developing world. There is no vaccine availa-

ble but one is urgently needed especially since praziquantel-resistant schistosomiasis emerged in the near future. However, in Saudi Arabia *Commiphora molmol* proved its efficacy in treating human schistosomiasis and control its snail intermediate hosts.

This study showed that many factors have contributed to human schistosomiasis in Al-Baha Province.

No doubt, the focus on schistosomiasis surveillance and improving surveillance system after the achievement of transmission control of schistosomiasis, also the hygienic education by the TV and Broad casts and even in mosques are a must.

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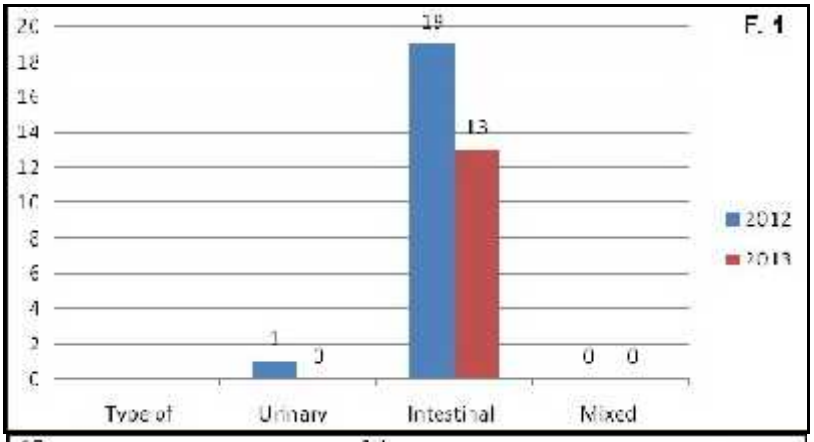
Explanation of figures

Figure 1: Prevalence of schitosomiasis in Al-Baha Province.
Figure 2: Infection rate among Saudi than non-Saudi patients in both years2012 and 2013.
Figure 3: Infection rate among age groups in both years 2012 and 2013.
Figure 4: Infection rate among sexes in both years 2012 and 2013.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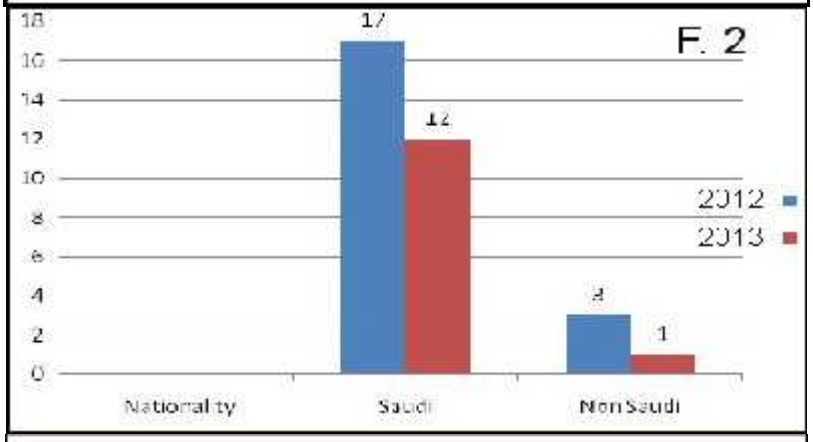
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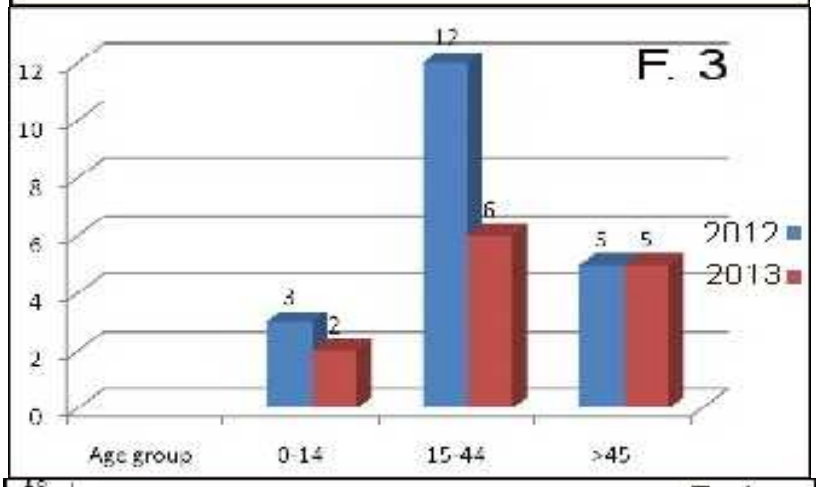
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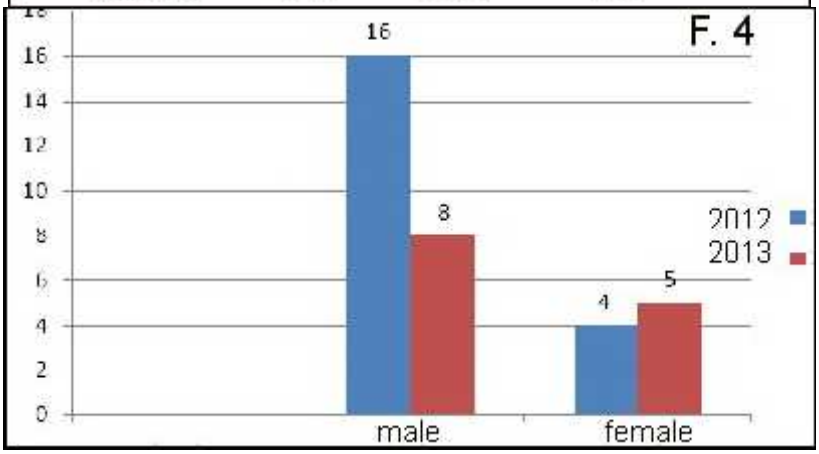
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