

## Original Article

# Arthropod Borne Diseases in Imposed War during 1980-88

\*M Khoobdel<sup>1</sup>, A Mehrabi Tavana<sup>1</sup>, H Vatandoost<sup>2</sup>, MR Abaei<sup>2</sup>

<sup>1</sup>Health Research Center, Baqiyatallah University of Medical Sciences, Iran

<sup>2</sup>Department of Medical Entomology and Vector Control, School of Public Health, Tehran University of Medical Sciences, Iran

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## Abstract

**Background:** Personnel of military forces have close contact with natural habitat and usually encounter with bite of arthropods and prone to be infected with arthropod borne diseases. The imposed war against Iran was one of the most important and the longest war in the Middle East and even in the world and military people faced various diseases. The aim of this study was to review prevalence of arthropod borne diseases and to collect relevant information and valuable experiences during the imposed war.

**Methods:** The present survey is a historical research and cross-sectional study, focused on arthropod fauna, situation of different arthropod borne diseases and also the ways which military personnel used to protect themselves against them. The information was adopted from valid military health files and also interviewing people who participated in the war.

**Results:** Scabies, cutaneous leishmaniasis, sandfly fever and pediculosis were more prevalent among other arthropod –borne diseases in Iran-Iraq war. Measures to control arthropods and diseases at wartime mainly included: scheduled spraying of pesticides, leishmanization and treatment of patients.

**Conclusion:** Although measures used during the war to control arthropods were proper, however, due to needs and importance of military forces to new equipment and technologies, it is recommended to use deltamethrin-impregnated bed net, permethrin treated military uniforms and various insect repellents in future.

**Keywords:** Arthropods, Iran, Iraq, War, Insects, *Leishmania*, Scabies

## Introduction

Military forces face to arthropod borne diseases all over the world because of their missions, type of activities and their frequent contact with insects in comparison with other people (Debboun et al. 2001, Faulde and Uedelhoven 2006).

All of the armies in the world face to some species of insects and related diseases (Deparis et al. 2004), dependent on zoogeographical regions and also arthropods fauna there, thus they have different strategies to protect their military forces from damage of arthropods (Barnard 2000).

For example, in French army, diseases such as malaria, dengue fever and cutaneous leishmaniasis are important (Deparis et al. 2000, Meynard et al. 2001) but African, American and European army forces which serve in African region, in addition to malaria and leishmaniasis also involve yellow fever, trypanosomiasis and onchocerciasis (Fall et al. 2001). Incidence rate of leishmaniasis among French military forces that were resident in New Guinea was 3.2% in 1999 (Lightburn et al. 2002).

In South American countries also malaria, leishmaniasis, yellow fever, and lymphatic filariasis are important (Souza-Santos and Car-

valho 2000). Foreign militaries that enter to these regions face to such diseases, for example Australian soldiers that were in East Timor, introduced dengue fever to Australia after return back (Kitchener and Leggat 2002).

In Iran, several arthropod borne diseases are endemic, because it is located at two zoogeographic regions, i.e. oriental and palearctic (Service 1996). Among arthropod borne diseases, malaria, cutaneous and visceral leishmaniasis, scabies, pediculosis, papatasi fever and scorpion sting are significant in Iran (Khoobdel et al. 2003).

Armies have strategies to recognize arthropod borne diseases that exist specially in their regions and in addition to identifying species and fauna of arthropods, they study about ecology of arthropods to have better control (Guessan et al. 2001, Faulde et al. 2003, 2006). For instance, French armies have developed some procedures to protect military forces from arthropod borne diseases including: use of military clothes (uniforms) which are permethrin-impregnated and using insect repellents on exposed skin and utilization of deltamethrin-impregnated tents (Deparis et al. 2004).

During the imposed war against Iran, soldiers faced with several arthropod borne diseases. Lack of facilities and occurring some problem, it was not feasible to provide such a perfect study in that time. This study aimed at reviewing of the state of arthropod borne diseases and control methods during imposed war using available documentary information and interviews with health personnel, to retrieve useful information and highlight the problems and future needs of Iranian military forces to keep away from arthropod borne diseases.

## Materials and Methods

In this descriptive cross-sectional and historical study, information of wartime from

several sources was accumulated. Furthermore, we interviewed health personnel that combated at northwest and west of Iran about our research subject. West battle field comprised of war regions of 4 west provinces of Iran including Ilam, Kermanshah, Kurdistan and West Azerbaijan.

At first, we developed a questionnaire including 70 questions about several aspects of arthropods and related diseases as vectors. Then we used from documentary sources and verbal history for completion of questionnaires. Finally information accumulated from these two sources, classified separately and compared with each other.

$\chi^2$  test was used for data analysis.

### Documentary Sources

Sources used in this research included the reports and files about several aspects of arthropods and to assess quality of health personnel action in west war regions. These documents have remained since wartime. The other documentary sources included letter reports of health revenue. There is one transcript at army files now. Others included student thesis and scientific articles printed in Iranian journals and articles presented in seminars. In addition, study pictures and films existed in several file-keeping units were used.

### Verbal history sources

In interview section, statistical and target society included all of health personnel that were active during the war especially at last 3-4 yr of war. We interviewed with all 80 possible members of the population mentioned above and we did census.

## Results

During Iran-Iraq war, the most important problems or diseases due to arthropods were included: Scabies (30%), cutaneous leishmaniasis (24%), sandfly fever (15%), mosquito bites (10%), pediculosis (9%), malaria (8%) and others (4%).

As a whole, 87 active persons at war time were found through introduction of health personnel. Among them we interviewed with 46 persons (88%) of west war region health personnel. The average of their attendance in health affairs of west war regions was 4.5 yr.

Their academic degrees were mostly diploma and junior college (75% of cases) at wartime.

With assessment of files or articles and other documents, only 53 questions (%76) were replied in interviews.

According to various evidences arthropods were serious problems to soldiers and diseases such as malaria, leishmaniasis, scabies, sandfly fever and scorpion sting were prevalent. Furthermore, prevalence of infestation to flea, louse, bug and other insects, especially at warm seasons has occurred. During the war, identification of medically important arthropods was not perfected completely.

## Discussion

### Malaria

Malaria is endemic in Iran and local endemic regions of that exist at east regions of Iraq with common boundary along with Iran. Despite of that, during the war fortunately, only 100 cases of malaria have reported among Iranian soldiers (Mehrabi Tavana and Purtagi 2000). In west and south west war regions, 9 species of *Anopheles* mosquitoes have been identified comprising 5 known vector species of malaria in Iran as follows (Maleki 1985):

*Anopheles stephensi*

*An. superpictus*

*An. sacharovi*

*An. maculipennis*

*An. dthali*

### Leishmaniasis

According to the information in the files and data obtained from interviews, cutaneous leishmaniasis at west war regions especially

Mehran, Dehloran, Sumar and Marivan was prevalent. In 1989, 80% of soldiers that fought in Dehloran region had cutaneous leishmaniasis (Ranjbar Kermani 1989).

After war, studies showed that incidence of leishmaniasis in Mehran region was 220 per 1000 (Dehestani 1994). The type of cutaneous leishmaniasis at west war regions was probably zoonotic cutaneous leishmaniasis (ZCL) (Ranjbar Kermani 1989, Dehestani 1994). Several species of sandflies in Kermanshah, Javan Rood, Paveh, Dehloran and Marivan regions have been identified (Vahabi 1998). *Leishmania* parasites have been isolated from two species, *Phlebotomus papatasi* and *P. alexanderi*. The reservoirs of cutaneous leishmaniasis in west war regions were rodents such as *Nesokia* and *Tatera*. In Mehran region, *Tatera indica* is reservoir of cutaneous leishmaniasis and parasite species at this region is *Leishmania major* (Dehestani 1994). During the war at south west regions such as Mucian, Fakkeh, Sumar, Eine Khosh, Dasht abbas, Abu Gharib, Shoosh, Bostan, Dasht-e-Azadeghan and Sharhani, 11 species of sandflies have been captured and furthermore 4 other species of sandflies have been identified at other cities of Khoozestan Province. Natural promastigote infections have seen in *P. papatasi*, *P. alexanderi* and *Sergentomyia sintoni* species.

*P. papatasi* is known as vector of diseases between human and animals (reservoirs). Natural contamination to *Leishmania* have been seen among reservoirs at rodents such as *Tetera indica*, *Nesokia*, *Meriones libycus* and some of dogs, at this region (Javadian and Nadim 1989).

During that time, researches showed that at Khoosestan region, ZCL have been dominant and the most important reservoir of cutaneous leishmaniasis was *Tetera indica* (Husainidoost and Javadian 1989).

### Sandfly fever

Sand fly or Papatasi fever is one of the arboviral diseases which are endemic in Iran

and transmitted by sandfly (*P. papatasi*). During the war, the disease was prevalent among soldiers in west and southwest regions.

During the last years of war, isoenzymes assess in Mehran and Gilanharb regions resulted in detecting of two serotypes that cause sandfly fever include Cessil and Naple serotypes (Mehrabi Tavana et al. 2000). In 1988, an epidemic disease was seen among 1000 soldiers with clinical manifestation of fever, chills, painful joints, thus physicians were suspected to dengue fever and sandfly fever (Rezaeimoghadam 1989). In Spite of existence of vectors of dengue fever in Iran (some species of *Culex* and *Aedes*), we did not have any reports of that during and after the war.

#### **Scabies**

Scabies has been the most important illness after intestinal disease (like diarrhea) among soldiers during the Iran-Iraq war (Heidarpur 1996). According to evidences in documentary sources during the war, scabies also was prevalent among Iraqi soldiers. In addition to its prevalence in all seasons, sometimes it was epidemic among soldiers in Ilam, Mahabad, Sardasht and Kermanshah regions.

*Sarcoptes scabiei*, hominis variety, was isolated from soldiers infected with scabies during the war. This mite is known as causative agent of scabies in Iran.

#### **Pediculosis**

Infestation to louse was prevalent during the war especially in Kurdistan and Kermanshah regions but there is no report of typhus at that time (Mehrabi Tavana et al. 1998). All of three species of human louse (*Pediculus capitis*, *P.humanus* and *Phthirus pubis*) had been prevalent among soldiers in west regions.

#### **Plague**

Kurdistan is potentially the most important focal regions for plague in Iran. Among 7 rodent species of *Meriones* exist in Iran, 4 species have been found in Kurdistan and

among them, *Meriones persicus* is very effective in persistence of plague in that region (Asmar and Nekuei 1996a). According to the studies of Pasteur Institute in Iran, during the war there were no *Yersinia pestis* in 1800 rodents and 36000 fleas (Asmar and Nekuei 1996b). Despite that fact, according to the wartime documents and expression of health personnel, outbreak of fleas has been reported in some operations among soldiers.

#### **Myiasis**

Myiasis is the infestation of live human and vertebrate animals with fly (dipterous) larvae, which, at least for a certain period, feed on dead or living tissue or ingested food of the host (Zumpt 1965). During the war because of bullet injuries and wounds on soldier's bodies, traumatic myiasis was prevalent, especially when they were unconscious and could not repel flies. *Wohlfahrtia magnificica*, *Lucilia sericata* and other *Calliphora* species invaded wounded soldiers. According to documents, some of the war martyrs had been infested with *Calliphora* and *Sarcophaga* species (Ghasemi 1988).

In addition to insects that have discussed above, other insects also were harmful to soldiers including *Musca domestica*, *Stomoxys calcitrans* and *Cimex lectularius*.

Mosquitoes and scorpions have been harmful during war, but unfortunately they have not been identified.

According to the reports, sometimes soldiers had such an entomophobia that could not sleep at all.

#### **Arthropod control methods in imposed war Chemical control**

This has been done in military regions periodically during epidemics and outbreaks of insects. For example, in Kurdistan war regions, rifle pits of soldiers received insecticide spray in winter. Insecticides that were used included DDT, lindane, permethrin, malathion, ficam, propoxur, temephos. In outbreak of pediculosis, DDT and later permethrin powder was used on the head of

soldiers in middle years of the war. Methyl bromide ampoule was used for sterilization of clothes that were contaminated to lice, fleas and scabies. The contaminated clothes were put in plastic bags and then a methyl bromide ampoule was broken on them, inside the bags, to kill insects and other arthropods that mentioned above (interviews and documents).

### Repellents

During the 8 yr of war, repellent ointments such as Indian "Odimus" and German "Autan" ointments were used (topical application on face and hand), to protect soldiers from insects bites. At that time a kind of insect repellent, called "Trench pomade" (a mixture of DEET+DMP) was widely used to protect military personnel, which had a satisfactory result (Mehrabi Tavana et al. 2000). On the basis of interviews, Trench pomade was useful and its protection time was about 3-4 h, but it did not protect completely, especially against mosquitoes which bite overnight. On the other hand, this pomade had some undesirable effects including: oily hand and face. Also, sometimes soldiers used other substances such as: Iraqi repellents, smoky agents, gas oil and lemon juice on skin to repel insects (interviews).

### Physical control

A number of various physical methods have been used during the war, mosquito net at low rates, clearance of environment, during of stagnant waters around residence of military forces, covering of sewage sources and using of disinfectants such as kerolin to sterilize sewages and using of metal-nets for buildings windows are examples of health care affairs during the war (interviews and documents).

### Biological control

Health personnel have used "*Gambusia affinis*" for biological control of *Anopheles* larvae in Sanandaj, Marivan, Javanrood and Gilan Gharb regions (interviews and documents).

*Gambusia* fish were released into the pools and stagnant waters to control *Anopheles* and *Culex* larvae by hunting them.

According to interviews this method worked successfully in the region applied.

### Chemoprophylaxis

Most of military personnel in the regions where malaria was prevalent were given chemoprophylaxis. Also soldiers who were came from high-risk regions such as Sistan and Baluchestan Province consumed anti malaria drugs for precaution (Razeghifam 2002). For this purpose they took daraprime tablet (25 mg weekly, for 4 weeks) and chloroquine. In the case of malaria infected patients, they were transferred backward for treatment. At wartime 1,483,760 daraprime and chloroquine tablets have been distributed among soldiers (Razeghifam 2002).

### Leishmanization

Leishmanization is intradermal inoculation of *L. major* promastigotes into covered sites of body (often thigh or arm). This is applied on healthy soldiers. Wounds were found on the inoculated regions and were recovered spontaneously because of stimulation of immune system.

During the war because of high prevalence of cutaneous leishmaniasis and failure in control procedures of sandflies, more than 200,000 soldiers were under leishmanization from 1982 to 1989. Assessment of this procedure demonstrated that about 87% of them did not suffer from leishmaniasis. In affected persons, duration of the disease was short and wounds were smaller (Mahmodzadeh 2002). Unfortunately this procedure had some side effects such as large wounds in 2-3% of inoculated persons and treatment course was long (Nadim et al. 1991).

Glucantim and pentostam were used to treat persons affected by leishmaniasis.

### Scorpion sting

To prevent scorpion sting tobacco solved in water and used around military tents and trenches, although they believed this method

was effective against scorpions but we did not find any scientific document.

During imposed war treatment of scorpion stings was done by injection of polyvalent serum that was composed of antitoxin of 5` important species of scorpions in Iran (except for *Hemiscorpius lepturus*). Now polyvalent serum has been reevaluated and includes 6 antitoxins of scorpion species which covers *H. lepturus* too.

### Scabies

$\gamma$ -Benzene and benzyl benzoate ointment have been used to treat scabies. To achieve this purpose, centers to spend convalescence have been prepared in Kermanshah, Mehran, Orumieh and Sanandaj regions in back lines of war regions and soldiers received treatment there (for 4-5 d). Also their clothes were disinfected with methyl bromide ampoule or exposed to sun or cold rooms to kill mites that caused scabies (interviews and documents).

Assessment of health files (documentary sources) and interview (verbal history) showed that during the war, less scientific studies were conducted about arthropod species of medical importance. Thus, most of studies have been performed after finishing of the war at regions. It seems that it is necessary to study the fauna of medically important arthropods in each region separately.

Results show that most problems caused for soldiers by arthropods were cutaneous leishmaniasis, scabies, sandfly fever and pediculosis, respectively. However, above mentioned diseases decreased the combat ability of the forces but had not caused heavy casualties for soldiers.

In some cases they were exposed to severe epidemics because of being weakened and affected with unknown disease in Iraq region.

By war prolongation and increment in the intensity of army combat which weakened the military health system and also by Iranian troops progress and their entrance to some parts of Iraq and encountering to prob-

able diseases; there was this concern that Iranian troops face new problems and severe epidemics of arthropod borne diseases; in authorities opinion by efforts of health personnel of war these problems have been controlled. But today we do not know that they were really successful in their control or not, because there is no valid evidence to prove their success.

On the other hand, continuous military operations and heavy casualties makes it impossible to exactly estimate the success of health personnel in control of diseases.

According to official reports, in addition to arthropod borne diseases, in most of cases only insect biting (especially mosquito biting) causes problems for soldiers. To prevent mosquito biting Trench pomade widely have been used.

According to a recent laboratory study, protection time (PT) of Trench pomade is about 4.5 h (Khoobdel et al. 2007). This shows that soldiers to prevent mosquito bites need more effective repellents with longer PT and higher quality.

Usually in each region, there are some specific diseases. Diseases such as malaria, leishmaniasis, scabies and sandfly fever are specific diseases which are endemic in Iran and adjacent countries. Because of prevalence of pediculosis and bed bugs and other insects among military forces, education of individuals about personal protection technique against medically important arthropods is essential.

Finally the results indicated that scabies, cutaneous leishmaniasis, sandfly fever and pediculosis were more prevalent in the imposed war.

During imposed war various methods of vector control have not been used completely (Khoobdel et al. 2003, 2005), therefore it is recommended to use personal protection methods such as deltamethrin-impregnation bed net, various insect repellents, permethrin

treated military uniforms and tents for Iranian military forces.

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