

## History of Contemporary Medicine in Iran

## History of Medical Parasitology and Parasitic Infections in Iran

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**Abstract**

Parasites and parasitic diseases have been prevalent in Iran according to Iranian ancient scholars and physicians' inscriptions dating back to 865–1496. Some protozoan diseases such as malaria and cutaneous leishmaniasis have been introduced by clinical manifestations and helminthic infections by size and morphology of the worms. Scientific studies of Parasitology started in Iran from 1833, first by foreign physicians and continued from 1909 by Iranian researchers. The pioneer medical parasitologists of Iran were Dr N. Ansari and Dr. Sh. Mofidi who established the Department of Medical Parasitology in the School of Medicine, University of Tehran, 1939. Afterward, a considerable number of researchers and professors of parasitology have been active in training and research works in the fields of medical parasitology throughout the entire nation. At present, some significant parasitic diseases such as bilharsiasis and dracunculiasis are more or less eradicated and malaria is in the elimination phase. The prevalence of most helminthic infections has considerably decreased. Most of the departments of medical Parasitology in Iran are active in training MD, MSPH and PhD students. The Iranian Society of Parasitology established in 1994 is active with many eligible members and its creditable publication, the *Iranian Journal of Parasitology*, published seasonally since 2006. From 1833, when the scientific studies of Parasitology have started in Iran up to 2013, many researchers have been done on various fields of medical Parasitology and parasitic diseases in Iran and 2517 papers in English and 1890 papers in Persian have been published in national and international scientific journals. In addition, more than 420 books related in the field of medical parasitology field have been published in Persian language.

**Keywords:** Helminthes, history, Iran, parasite, protozoa,

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**Introduction**

Over the years, human life on earth has been affected by a large number of parasitic infections. About 300 species of parasitic helminthes and more than 70 species of parasitic protozoa have been reported in humans. Nearly 90 species of parasites in humans are rather common and a small portion of them cause important parasitic diseases.<sup>1</sup> *Plasmodium falciparum*-specific genes have been found using PCR on Egyptian mummies from the sixteenth to eleventh century BC.<sup>2</sup>

From the study of protein eggs, worms and protozoan cysts in the stool or dry, natural, or artificial fossilized corpses, a new field of science has emerged as Palaeoparasitology that encompasses the useful information on the history of Parasitology.<sup>1</sup>

In Avesta, centuries BC a disease with fever and chill symptom has been referenced that is probably the clinical sign of malaria.<sup>3</sup>

Abu Ali Sina (Avicenna), the Iranian physician and philosopher about ten centuries ago in the book of Canon of Medicine (the Law of Medicine) mentioned the pure and impure fever, which is similar to two types of malaria fever.<sup>4</sup> In this book, *Khayronieh* or long live ulcer is also mentioned which means after a long duration,<sup>5</sup> probably referring to cutaneous leishmaniasis. Abu Ali

Sina has also reported the worm's infections and their treatment in details.<sup>6</sup>

Another group of Iranian scientists and physicians of the ancient times have released information on parasitic diseases in Iran. Approximately 20 species of more or less pathogenic protozoa and more than 32 kinds of worms have been reported in human body in Iran.<sup>7,8</sup> In 1949, from Iran's population of 13 million people, annually 4–5 million were suffering malaria with considerable mortality rate<sup>3</sup> and about half the population had *Ascaris* infection.<sup>8</sup>

Now, the most common intestinal protozoan parasite in Iran is *Giardia*. Among blood and tissue protozoan diseases, cutaneous leishmaniasis (oriental sore) and visceral leishmaniasis (kala-azar) are prevalent in some foci, and cases of cutaneous leishmaniasis are more or less increasing.<sup>7</sup> Helminthic infections such as ascariasis and hookworm diseases are very uncommon. Urinary schistosomiasis and dracunculiasis have reached the brink of eradication.<sup>7-10</sup>

**Knowledge and comments of Iranian ancients' scholar and physicians about parasitic infections**

Parasitic infections have been the most important disorders that were under consideration by Iranian ancient scholars and physicians. Among the parasitic infections, helminthes were considered more due to their macroscopic appearance. Among protozoan infections, cutaneous leishmaniasis which has a typical sore (Volcano shaped) with rather long duration has also been considered. Malaria was diagnosed based on its clinical signs

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and symptoms, particularly the frequency of fever and trembling called *Tab-e-nobeh* (renewer or paludal fever). Amoebiasis, the infection with the dysentery syndrome was usually classified in diarrheal categories.

Some helminthes and clinical symptoms of a few protozoan infections have been considered by ancient Iranian physicians as follows:

Muhammad ibn-Zakariya al-Razi (c.865–935 C.E.), famous Persian, physician, philosopher and chemist in two informative and comprehensive ancient medical books: *Manlayahzarah-o-Tabib* (i.e., when physician is not available) and *mansouri-fi-teb* (i.e., Mansouri in medicine) has explained some cutaneous sores (probably cutaneous leishmaniasis), a number of renewed fevers particularly quartan fevers, intestinal and non-intestinal worms specially *Filarial medinensis* (Guinea worm) and a few ectoparasitosis such as phthiasis and their treatment.<sup>11,12</sup>

Abu Ali Sina (Avicenna) (c.980–1037 C.E.) composed the most informative and comprehensive ancient medical book (*Canon*) which has different chapters including etiology, symptoms and treatment of prevalent diseases in that era, such as some intestinal and non-intestinal worms infections with their relevant treatments. A long duration skin sore (probably cutaneous leishmaniasis), a few renewed pure and non-pure fevers that have been described are clinically comparable with benign and malignant malaria.<sup>4-6</sup>

One of the Iranian ancient medical textbook in the field of medicine by Zeinoddin Esmaeil Jorjani (c.1013–1110) is *Zakhireh Kharazmshahi* (i.e., *Treasure of Kharazmshahi*). The book explains the etiology and treatment of many diseases including helminthic infections and some fever diseases such as renewed fevers.<sup>13</sup>

Abokaker Rabbi-ibn-Ahmad al-Akhavainy Bokhary (1057 C.E.) has divided the worms into two kinds including small intestinal worms and large intestinal worms such as *Taenia saginata* and pinworms, respectively. The author also introduces some herbal remedies for treatment of the infections.<sup>14</sup>

Abolfazl ibn-Ebrahim Teflisi (1129 C.E.) has described clinical signs, morphology and treatment of a number of intestinal worms. He also gives an extensive explanation about different kinds of fevers including tertian renewed fevers in his textbook *Kefayaytoteb* (i.e., adequate in medicine).<sup>15</sup>

Zakkaria-ibn-Mahmoud Ghazvini (1184–1261 C.E.), has well described *madineh worm* (Guinea worm) in his book entitled: *Asarolbelad-va-Akhbarolebad* (i.e., monuments of cities and community news).<sup>16</sup>

Allaeddin Ghorashi (ibn-Nafis) (1286–1366 C.E.) believed that four kinds of worms can cause helminthic infections, which live in human's small and large intestines. According to his description of the worms, morphologically and clinically, they look like *Taenia saginata* and *Ascaris*.<sup>17</sup>

Mohammad-ibn-Mahmoud Kharazmi (1330 C.E.) has mentioned some considerable subjects in the field of helminthic infection in a medical book entitled *Ghanonche fi-teb* (i.e., principles in medicine).<sup>18</sup>

Hakim Nafis ibn Avaz-e-Kermani (1420 C.E.) in *Sharh ol Asbab Va Alalamat* (i.e., description of causes and symptoms), a notable ancient medical book described some different intestinal worms such as squash seed (tape worm) and small worm which cause rectal itching (Oxyure). He also described about 25 types of fevers such as mild and severe tertian renewed fevers.<sup>19</sup>

Bahaodole Razi (1486 C.E.) in his book, *Kholasatotajareb* (i.e.,

summary of experiences) describes (ed) a kind of sore, which mends after one year without treatment (cutaneous leishmaniasis). The author also characterized some intestinal worms that can be treated with artemisia plant.<sup>20</sup>

## Scientific studies of parasitology and parasitic infections in Iran

The scientific studies of some of the most common parasitic diseases began about 150 to 200 years ago started by a few foreign physicians who came to Iran. For example, cutaneous leishmaniasis was studied, uniformly by French physician Guilhou in 1833,<sup>21</sup> Polak, a German researcher who was one of the professors of Dar al-Fonoun in 1865<sup>22</sup> and Neligan.<sup>23</sup> More studies on leishmaniasis were continued by Iranian researchers and professors such as Lughman-al-dowlah in 1909,<sup>24</sup> Zanganeh in 1335,<sup>25</sup> Habibi and Sabeti, 1942,<sup>26</sup> Ansari in 1946 and 1947.<sup>27,28</sup>

The first case of human and canine visceral leishmaniasis or Kala-azar in Iran was reported by Professor Yahya Pouya in the Caspian area in 1949.<sup>29</sup> More sporadic cases of Kala-azar were reported by others mainly by Nadim.<sup>30</sup>

Studying the status of malaria in northern Iran started in 1921 by Russian researcher Latychev<sup>31</sup> and continued by Iranian investigators such as Mashouf in 1956<sup>32</sup> and Mofidi in 1956.<sup>33</sup> From 13 million Iran's population in 1949, annually 4–5 million were suffering malaria with considerable mortality rate.

For the first time, the presence of *Toxoplasma* in smear of human eye conjunctiva in Iran was reported by Ansari and Minou in 1948.<sup>34</sup> Ghorbani and Samii (1973) reported human toxoplasmic lymphadenitis in Iran.<sup>35</sup>

Although, information about helminthic infections have been given by old Iranian physicians such as Ibn Sina<sup>6</sup> nevertheless, scientific studies on the field of helminthology were started in Iran by Ansari and Faghih on bilharziasis in 1953.<sup>36</sup> Kostanian and Melik-Gulnazarian studied human trichostrongyloidosis in Iran in 1956,<sup>37</sup> (and) Arfaa F, and Mahdavi M reported the importance of helminthes parasites in Iran in 1969.<sup>38</sup>

With the establishment of laboratory and Department of Parasitology in the School of Medicine, Tehran University in 1939, and the establishment of scientific institutions of Razi and Pasteur in Iran, research was encouraged on Parasitology and parasitic diseases and followed by huge activities conducted by Iranian researchers, mostly from the School of Public Health and Institute of Public Health Research on epidemiology, diagnosis, symptoms, treatment and control of parasitic diseases, throughout the country. The training and research activities lowered the prevalence of parasitic diseases and in a few cases, eradication of infections such as Guinea worm and more or less schistosomiasis was achieved.

The results obtained from these studies are published or have been written in old grey literature, and to some extent are released in hard journals or e-journals usually searchable via internet.

Some of these reports are often cited in Medical Parasitology books<sup>7-10,39</sup> and review articles on important endemic parasitic diseases such as malaria,<sup>40,41</sup> kala-azar and oriental sore,<sup>42-45</sup> hydatidosis,<sup>46</sup> fascioliasis,<sup>47</sup> which provide enough information about the past and present situation of parasitic diseases in Iran.

A comprehensive project supported by the Iranian Academy of Medical Sciences and conducted by the Iranian Society of Parasitology embraces the complete output of Medical

Parasitology in Iran from 1833 to 2013, including 2517 papers mostly in English and 1890 papers in Persian, published in national and international scientific journals, 421 Parasitology books in Persian and 1224 theses in the fields of Parasitology and parasitic diseases performed by MD, MSPH, PhD and some other students under supervision of scientific members of Parasitology departments.<sup>48</sup>

### Iranian Society of Parasitology (ISP)

The initiative to establish ISP was putted forth by Dr. Mohammad Anwar, Professor of Dept. of Parasitology, School of Veterinary, Tehran University and Professor Shamsedin Mofidi, Dean of the School of Public Health and Institute of Public Health Researches, Tehran University of Medical Sciences in 1974. The Society, then headed by Dr. S. Mofidi, was formally accredited by the Interior Ministry in 1977 for two years.

After the Islamic revolution, all medical societies were required to get the permission of inauguration from the Ministry of Health, so the first formal session of the board of founders of the society was held in 1992 and it was approved in the 26<sup>th</sup> session of the Commission of Scientific Societies of Medical groups of the Ministry of Health and Medical Sciences in 1994.

The Society has an internal publication entitled *Iranian Journal of Parasitology* (IJP), launched in 2006. IJP is supported and published by the Tehran University of Medical Sciences and Health Services. Now it is released quarterly on line. This Journal is indexed and abstracted in Science Citation Index Expanded (SCIE) by Thompson/ISI, PubMed Central (PMC), SCOPUS, EMBASE and many other authentic databases.

### Departments of Medical Parasitology in Iran

Department of Medical Parasitology and Mycology, School of Public Health and Institute of Public Health Researches, Tehran University of Medical Sciences

Modern medical education in Iran was started by Mirza Taghi Kahn Amirkabir in 1891 with inauguration of Dar al-Fonoun School. In 1927, the field of Medicine was separated from Dar al-Fonoun School to establish an independent medical school. Finally, in 1934, simultaneous with installation of Tehran University, joined it under the name of the School of Medicine.

The Laboratory of Medical Parasitology of the School of Medicine was established under the supervision of Dr. A. Shaybani in 1938. Dr. Delpi (French), the principal of Razi Vaccine and Serum Research Institute was commissioned for six months to teach Medical Parasitology in the School. Then, Dr. Naser Ansari was appointed as the chair of laboratory of Parasitology and teaching section. In 1940, chair of Parasitology and Research section was established and afterwards two sections of educational and experimental activities as well as researches on parasitic diseases and their epidemiology and control were started. Initially, the most prevalent diseases, malaria and schistosomiasis, were considered.

Professor Naser Ansari was the head of Department of Medical Parasitology and director of research section of the School of Medicine and associate Professor Dr. Shamsedin Mofidi was the vice dean of the Department. In 1955, when Professor Ansari became Director of Parasitology Section of the World Health Organization in Geneva, Dr. Mofidi was promoted as the

professor of the Department of Parasitology and director of the research section.

Considering the importance of parasitic diseases especially malaria, which involved about 40% of the population, as well as the mortality caused by it, according to an agreement held between the Ministry of Health and the University of Tehran, in June 4, 1952, the Institute of Malariology was approved to be established affiliated to Parasitology Department and Research Section of the School of Medicine. Then, it changed to "Institute of Parasitology and Malariology" in 1956. After incorporation with Tropical Health Section of the School of Medicine in 1963, it was changed to "Institute of Parasitology and Tropical Health"; afterwards, it continued its activities as "Institute of Public Health Research".

Following the sincere collaboration of the academic staff and the efficiently administration directed by Professor S. Mofidi, the Institute was promoted as the School of Public Health, approved in the 115<sup>th</sup> session of Central Council of Iranian Universities in 1966. At that time, Dr. N. Ansari was engaged as the head of the Parasitic Diseases Section of WHO in Geneva and Dr. S. Mofidi was appointed as the President of the School of Public Health and Institute of Health Research.

Now, the School of Public Health has 13 departments and the main one is Department of Medical Parasitology and Mycology, which is the oldest and largest department of medical Parasitology in Iran.

### Center for Research of Endemic Parasites of Iran (CREPI):

Due to the necessity of establishment of the *Center for Research of Endemic Parasites of Iran*, and remarkable potential on related fields in the country and especially in the Department of Medical Parasitology and Mycology, it was decided to launch this center in 2008. Eventually, in 2010, after the approval of the Minister of Health (in 2010), the center was established in 2011.

### Research stations of Parasitology of the School of Public Health and Institute of Public Health Research:

Following the establishment of Tehran University concurrent with inauguration of the School of Medicine in 1934, medical research officially started in the country. Considering the importance of parasitic diseases, especially malaria, the main goal was control of malaria and other endemic parasitic diseases throughout the country.

Therefore, the Institute of Parasitology and Malariology expanded the scope of its activities in the malaria endemic areas of Iran by establishing permanent or temporary field research stations in some cities such as: Bandar Abbas, Abadan, Shoosh, Kazeroun, Birjand, Jiroft and Iranshahr. In 1959, the Institute had the plan of fight against bilharziasis. Accordingly, extensive related research started in Khuzestan Province, in the Research Center of Ahvaz. More research field stations were gradually established by the School of Public Health and Institute of Public Health researches in other cities such as Babol, Ramsar, Isfahan, Meshkin Shahr for other parasitic diseases such as intestinal parasitic diseases, leishmaniases, etc.

The brilliant history of the School of Public Health and Institute of public Health Research in field activities and its role in cooperation with operational health system has been remarkable in

controlling major parasitic diseases such as malaria, bilharziasis, leishmaniases, dracunculiasis, as well as fungal, bacterial and viral diseases.

#### Department of Medical Parasitology of Shahid Besheshti University of Medical Sciences

The Shahid Besheshti University of Medical Sciences, before revolution was active as Melli University (National University).

In this university, in 1966 to 1975, the units of Bacteriology and Parasitology were in the Department of Microbiology. In 1975, the late Professor Hussein Bijan, separated the unit as two different groups and was designated as the principal of the Department of Parasitology.

Professor Bijan selected several faculty members for the Department of Parasitology as follows: Dr. A. Eghbali (associate professor), Dr. H. Bashiribod, Mrs. Dr. Esfandyari, Dr. M. Nazari-pouya (assistant professors). Now the Department of Medical Parasitology of Shahid Beheshti University of Medical Sciences is quite expansive and active in training undergraduates and MSPH & PhD national and international students as well as in Parasitology research.

#### Department of Parasitology and Mycology, Iran University of Medical Sciences and Health Services

Iran University of medical Sciences was first established in 1973 as the Imperial Medical Center founded by Dr. A. Samiee.

Based on the decisions of the Elite Commission of the 103<sup>rd</sup> meeting of the Council of Higher Education dated Aug.27,1975, it was allowed to establish the School of Medicine and School of Medical Sciences in various fields of Basic medical sciences, and the School of Nursing and Allied Health Sciences and Management at medical institutions, respectively.

Before 1975, medical Parasitology was taught in Microbiology Department of Medical School by: Dr. H. Hourmazdi and Mrs. Dr. Soliemani. In 1989–1990, with some other parasitologists and mycologists, Department of Medical Parasitology and Mycology was established in Iran University of Medical Sciences and now the Department is active in training MD, MSc and PhD students as well as in research on Parasitology and Mycology.

#### Department of Parasitology and Mycology of Shiraz University of Medical Sciences

The Parasitology and Mycology Department (formerly Parasitology section of Microbiology Department for 30 years) was established at Shiraz University of Medical Sciences in 1996.

Dr. Tahmoore Jalayer, was trained under the supervision of Dr. Haaeri-Dana. He was employed as an instructor of Parasitology after his return from London, where he received a diploma in medical Parasitology. He conducted the Parasitology Section from 1954 to 1968 during which Dr. Nasser Hoghooghi-Rad was admitted as a resident of Shiraz Medical School and stayed there until 1967. The main research projects were based on the epidemiological aspects of echinococcosis in Shiraz, (delete) in particular, as well as visceral leishmaniasis, digestive tract parasitic infections and ectoparasites of schoolchildren in Fars province.

Immunological aspects of experimental leishmaniasis and development of immunodiagnostic tools for visceral leishmaniasis, toxoplasmosis and echinococcosis had been the main line of research in the Dept. of Microbiology through studies carried

out by the late Professor H. R. Rezaei, the late Professor S. M. Ardehali and Professor M. Kabiri.

The curriculum of the department is updated and designed to meet the demands of post-graduate teaching and research on present problems of the region.

In 1996, the Department of Microbiology was divided into three independent disciplines, namely Department of Parasitology and Mycology, Department of Bacteriology and Virology and Department of Immunology. The principal research of the Department of Parasitology and Mycology is centered on the applied aspects of comprising epidemiologic, experimental, biochemical and molecular investigations as well as diagnosis, control and chemotherapy of endemic parasitic diseases in Iran.

#### Department of Medical Parasitology of Isfahan University of Medical Sciences

Medical Parasitology teaching and launching was started in 1965 by Professor Attar from the Dept. of Pediatrics and Tropical Diseases in Isfahan University of Medical Sciences. Simultaneously, Dr. H. Farid Moayer cooperated with him on teaching the course, later boosted by Dr. M. Maleki Entric Diseases specialist Gastroenterologist who learned Parasitology in USA. In the meantime, Dr. Motamedi, the President of the university established a department entitled Pathobiology as a combination of Mycology, Microbiology, Immunology, Biology and Parasitology. In 1971s, the late Dr. T. Jalayer and Dr. Hoghooghi parasitologists and Dr. Shayban mycologist joined the Department of Parasitology and Mycology became a separate department and Dr. M. Baghayee, a graduate from England, joined this department.

#### Department of Medical Parasitology of Mashhad University of Medical Sciences

The Department of Medical Parasitology, Mashhad University of Medical Sciences was launched in 2002 after separating from the Dept. of Laboratory Sciences. The late professors Mirdamadi and A. Eskoian were the pioneers of establishing the departments who were experts in Laboratory Sciences and taught Medical Parasitology, as well. Two active professors in Parasitology and Mycology in the department were Dr. M. Moatakef and Dr. H. Rezvani. In addition, Professor H. Foad Nejati, from Egypt should be mentioned who was very active in the department and many of his products on Parasitology are now used.

In 2002, the Department of Laboratory Sciences was separated to three departments of Parasitology and Mycology, Virology and Hematology and Blood Bank. Dr. Sayed Reza Elahi was the head of the department. After his retirement, Dr. M. Mohajeri succeeded him for three consecutive periods until 2010, when he retired and Dr. AM Fata was appointed as the head of department.

#### Department of Medical Parasitology of Tabriz University of Medical Sciences

In 1953, the Department of Health Education involved the Departments of Immunology, Mycology, Parasitology and Medical Entomology. The department changed the name to Pathobiology until 1998 when the Department of Parasitology and Immunology was launched. In 2007, two sections separated to two independent departments: departments of Parasitology and Mycology as well as department of Immunology.

Among professors who had key roles in the evolution of the

department, Dr. Rafieezadeh and Dr. Majidi, Immunologist, Dr. Ahmadi, Microbiologist, and Dr. Jamali parasitologist should be mentioned.

Department of Medical Parasitology and Mycology of Ahvaz Jundisapur University of Medical Sciences

The School of Medicine was launched in this university in 1956. Two years later, Dr. Behin, a graduate from the University of Johns Hopkins USA, was employed in the university and started to teach parasitology until 1968. After him, Dr. A. Ebrahimzadeh was appointed as the head of the Dept. of Parasitology and Mycology until 1978. Later on, teaching continued by Mrs. Guilani and Mr. Ghahari, then in 1980–1984 Dr. N. Hoghooghi took the position of the head of the department while simultaneously teaching Parasitology. Then, Dr. Sharif Maraghi was head of the department up to 2009 when he retired.

### Department of Medical Parasitology in other universities of medical sciences in Iran

Now, there are Departments of Medical Parasitology in most universities of medical sciences and some other universities and scientific organizations such as Tarbiat-modares University and Pasteur Institute in Iran, which are active in training and research in the field of Parasitology.

### Board of Medical Parasitology

One of the main boards of medical sciences in the Ministry of Health and Medical Education is Board of Medical Parasitology, which established before 1990. The Board has about 11 members who are experienced professors and associate professors from different universities of medical sciences of Iran.

### Iranian scholars and pioneers of Parasitology

The recent 75 years history of Medical Parasitology in Iran has been indebted to educational and researches activities of scholars and pioneers of Parasitology in this country. They have been active in training many parasitologists and the results of their research studies in the fields of Parasitology, diagnosis, clinical syndrome, treatment, epidemiology and control of parasitic diseases in rural and urban areas of Iran eliminated a few and considerably decreased the prevalence of the most parasitic diseases. Their activities in Public health systems nationally in Iran and internationally through WHO in other countries, have been effective and helpful for the human being.

A brief biography of some of 42 scholar parasitologists has been given before. The two late pioneers of Parasitology in Iran were Professors N. Ansari and Professor Sh. Mofidi.<sup>48</sup>

### Recent studies on parasitic diseases and their present status in Iran

Preliminary studies in the field of paleoparasitology in Iran, by Mowlavi *et al.*, 1915 confirm existence of two helminthes parasites belonging to several centuries BC. First, egg of *Dicrocoelium dendriticum* in western Iran around Yasuj City, belong to pre-Persepolis period (2600 to 2200 BC).<sup>49</sup> Another finding, egg of

*Macracanthorhynchus hirudinaceus* that is an acanthocephalan species belonging to Sasanian period, 4<sup>th</sup>/ 5<sup>th</sup> centuries BC, found in Chehrabad salt mine's archeological site in northwestern Iran.<sup>50</sup>

There are considerable number of cutaneous leishmaniasis foci in Iran and several foci of visceral leishmaniasis mostly in northwest and south parts of country.<sup>42–45</sup>

The prevalence of malaria, after a long various campaigns that have been done by Ministry of Health and Provincial Health Centers in malaria endemic areas, School of Public Health and Institute of Public Health Research and cooperation's of WHO and UNISEF gradually decreased and limited to a low level in southeast parts of Iran. Now, malaria cases that have been reported in Iran in 2014 were about 1,200 cases of which 625 cases were imported from neighboring malarious countries.<sup>51</sup> Now, the antimalarial program is in the elimination phase.

Helminthic infections such as ascariasis and hookworm diseases are very low. Despite important advances in the control of helminthic diseases, and this fact that some of them like schistosomiasis and guinea worm disease have reached to the limit of eradication in Iran, hydatidosis and oxyurias are prevalent, *Fasciola* infection<sup>47</sup> and strongyloidiasis<sup>52</sup> are potentially important. Leishmaniasis and hydatidosis are public health problems in the country. Emergent and re-emergent parasitic disease such as cryptosporidiosis,<sup>53</sup> microsporiosis,<sup>54</sup> and strongyloidosis<sup>52</sup> and visceral leishmaniasis<sup>55</sup> in immunocompromised patients like AIDS patients, might be more problematic in the future. Amoebic keratitis causes by keratitis caused by *Acanthamoeba* spp., (T4 genotype) is more or less prevalent in Iran.<sup>56</sup>

The progress of parasitology in Iran are partly due to enthusiastic activity of considerable number of pioneers and investigators of parasitology who served their most active life in order to study and control parasitic diseases, and partly due to the activities of investigators who are studying parasitology and parasitic diseases and their findings have been reported as large number of scientific papers in the field of parasitology and parasitic diseases.<sup>48</sup>

In recent years, new biotechnology methods such as: nanotechnology<sup>57,58</sup> genomics and proteomics<sup>59,60</sup>, agglutination rapid diagnostic test<sup>61</sup> and geographical information system (GIS)<sup>62</sup> in leishmaniasis; production of recombinant antigens for malaria<sup>63</sup> and toxoplasmosis<sup>64,65</sup> have been applied by scientific members and young scientists of parasitology in the departments of medical parasitology and other research organizations of Iran.

In conclusion, over the span of thousand years, concepts of sciences have changed due to the multilateral progress of technology. While looking for the cause of parasitic diseases, the earliest physicians were relying only on clinical signs and symptoms of parasitic diseases. With the invention of the microscope as a scientific tool, concepts were re-focused on morphology and structure of parasites as primary causes of all parasitic diseases as well as all changes caused by parasites on cells, tissues and fluid materials of definitive and intermediate hosts. Now, with advent of new powerful technologies such as biotechnology, nanotechnology, genomics and proteomics, great changes have happened in all biosciences branches particularly in Parasitology and parasitologists accosted with various branches of modern Parasitology. The outcome of medical Parasitology in Iran has been impressed greatly in the light of these modifications and comparison the present and past situation of the rate of parasitic diseases and released outputs supports this claim.

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