

DATA ARTICLE

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A glance at one decade of water pollution research in Iranian environmental health journals

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Abstract

Background: Due to the importance of water, the negative effects of water pollution on human health and the lack of proper knowledge of the state of research in this regard, the purpose of this study was to analyse scientific publications on water pollution in Iranian journals of environmental health.

Methods: This cross-sectional study was conducted using a scientometric method over a ten-year period (2008–2017) on articles published in five specialised environmental health journals emphasising the issue of water pollution. Data were collected through a researcher-based checklist using the International Committee of Medical Journal Editors (ICMJE) and the World Association of Medical Editors (WAME) recommendations. Data processing was done using descriptive statistics and VOSviewer software.

Results: A review of 1276 articles in specialised environmental health journals revealed that 33.7% of the articles were in the field of water. Physical and chemical factors in water were the main subjects of 21.4% of studies, and temperature and turbidity were the most important physical factors. Microbial agents in groundwater and surface water were the main subjects of 14.1% of the articles. The findings show that 55 of 430 articles related to water were written with contributions from 20 countries (including Iran), with the most contributions from researchers from Asia.

Conclusions: Good conditions do not exist to investigate the status of articles on water pollution in specialised environmental health journals in Iran over a ten-year period. Health policymakers should therefore provide mechanisms to encourage national researchers, especially environmental health professionals, by setting national research priorities on quality and water pollution to conduct studies in this regard.

Keywords: Water pollution, Environmental health, Articles, Journals, Scientometrics

Introduction

Water accounts for two-thirds of human body weight. This indicates that water is a vital ingredient for human survival and attention to water pollution is important (Aghalari and Jafarian 2017; Dai et al. 2016). In contrast, contaminated water, in addition to compromising human health, has a

detrimental effect on the various aspects of human life, including social, economic and cultural (Satterthwaite 2016; Behailu et al. 2016). According to a report by the United States Environmental Protection Agency (EPA), about one-third of the world's water is polluted. In this report, pollution is a factor damaging the chemical, physical and aesthetic properties of water (Komasi and Sharghi 2017). Since 2004, the World Health Organization (WHO) has been recommending the Water Safety Plan (WSP) to reduce the pollution of drinking water,

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Table 1 Specifications of Iranian environmental health specialist journals (2008–2017)

Journal name	The first year of publication	Language	Journal abbreviation	Kind of publication	Publisher	Website Address
Journal of Environmental Health Science and Engineering	2004	English	JEHSE	Published Quarterly	Tehran University of Medical Sciences	https://www.springer.com/environment/environmental+health++public+health/journal/40201
Environmental Health Engineering and Management Journal	2014	English	EHEMU	Published Quarterly	Kerman University of Medical Sciences	http://ehemj.com/
Iranian Journal of Health and Environment	2008	Persian	IJHE	Published Quarterly	Tehran University of Medical Sciences	http://ijhe.tums.ac.ir/index.php?&slct_pg_id=10&sid=1&slc_lang=en
Journal of Environmental Health Engineering	2013	Persian	JEHE	Published Quarterly	Alborz University of Medical Sciences	http://jehe.abzums.ac.ir/index.php?slc_lang=en&slc_sid=1
Journal of Research in Environmental Health	2015	Persian	JRHE	Published Quarterly	Mashhad University of Medical Sciences	http://jreh.mums.ac.ir/journal/about?lang=en

but there are still contaminants in water resources that, in addition to serious damage to human and environmental health, lead to death in different parts of the world (WHO 2008). In the United Nations World Water Development Report (2015), 1.1 billion people in the world do not have access to safe drinking water, 90% of whom live in continental Asia and Africa (The United Nations world water development report 2015).

According to the above, conducting water-related research and its contaminating agents are necessary measures to protect water resources (Ikonen et al. 2013; Fisher et al. 2015). Continuous assessment of water quality and the publication of findings on water pollution in the form of articles and scientific reports have led to the production of a set of information that, at the time of the occurrence of epidemics and acute environmental problems, gives a detailed picture of water quality, and the identification and elimination of factors causing pathogenic agents in water (Yan et al. 2015).

Scientometrics or citation analysis is one of the new scientific approaches that can be used to monitor scientific activities and manage research (Tirgar and Aghalari 2018; Aghalari and Tirgar 2017), so scientometrics is one of the research methods used for quantitative research on scientific production, scientific policy and a scientific plan (Sajjadi et al., 2018) for protecting water resources and preventing their pollution. Considering the importance of water, the negative effects of water pollution on human health and the lack of accurate information on the state of research in this regard, the purpose of this study was to analyse scientific publications on water pollution in the Iranian journals of environmental health.

Materials and methods

This descriptive study was carried out retrospectively for a period of ten years on all articles published in the Iranian Journal of Environmental Health focusing on water pollution, from the beginning of 2008 to the last issue published in 2017. The inclusion criteria were the existence of the phrase 'environmental health' in the title of the journal, the publication of at least four issues of journals per year and the publication of articles in three consecutive years. According to the aforementioned criteria, three Persian-language journals and two English-language journals were selected (Table 1).

Data collection was done by logging into the dedicated site of each journal and downloading all the articles. The related articles, their titles, abstracts and keywords were then reviewed individually and the articles related to water were eventually enrolled in the study (Fig. 1).

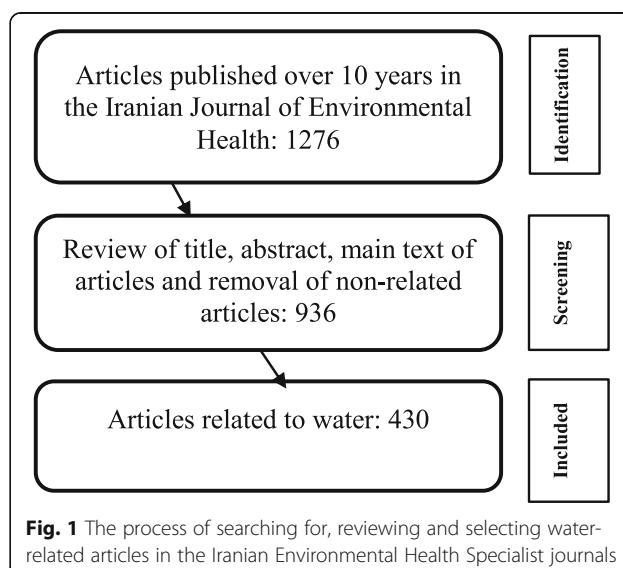


Fig. 1 The process of searching for, reviewing and selecting water-related articles in the Iranian Environmental Health Specialist journals

Table 2 Variables studied about water in specialised environmental health journals (2008–2017)

Variables	Levels
Water-related articles by journals	Number / percent
Water-related articles by year of publication	Number / percent
Sources of water	1- Surface 2- Groundwater
Types of pollutants by origin	1- Primary pollutants 2- Secondary pollutants
Physical variables	Classification by type
Microbial agents	Classification by type
Heavy metals	Classification by type
Chemical pollutants	Classification by type
Collaboration of researchers by country	Name of countries
Collaborative research by continent	Name of continent

Data collection was done by a researcher-made checklist about which there was previous experiences (Tirgar et al., 2019; Aghalari et al., 2020). To select the most important and common variables, recommendations for articles in the formulation of articles by the International Committee of Medical Journal Editors (ICMJE 2019) and the World Association of Medical Editors (World Association of Medical Editors (WAME) and Editorial Policy and Publication Ethics Committees, 2019) were the criteria of choice. The research encompassed the variables studied for analysing the articles, the number of articles by journals and the year of publication, type of pollutant, sources of water surveyed and the geographical distribution of the researchers (Table 2).

Data analysis

After collecting the data, the information about the articles studied was encoded and entered into Excel software. The data were processed statistically using descriptive statistics. VOSviewer software was also used to visualise the data and show the level of collaboration of continents and authors from different countries with Iran. This software helped to visualise the collaborative network of authors from different countries in different ways. For example, it made it possible to display data aggregate by different colours, clustering them at different geographic locations (Van Eck and Waltman 2009).

Results

Articles according to journals

A review of 1276 articles in 102 issues over the past decade (2008–2017) were published in five Iranian Journal of Environmental Health, with 430 articles (33.7%) related to water. The highest and lowest proportion of water-related articles belonged to JEHSE and JRHE, contributing 36% and 7%, respectively. The shares of IJHE, JEHE and EHEMJ in the publication of papers were 34%, 15% and 8%, respectively.

Trend of articles publications

According to the findings, a survey of the trend of published articles in the field of water during the past decade shows that, despite the fluctuations, the number and proportion of water-related articles grew in environmental health publications. As shown in Fig. 2, in total, over a decade, there has been an uptrend in the publication of water articles (Fig. 2).

Type of water resources

In the present study, in terms of type of water resources, surface water was classified into eight categories and

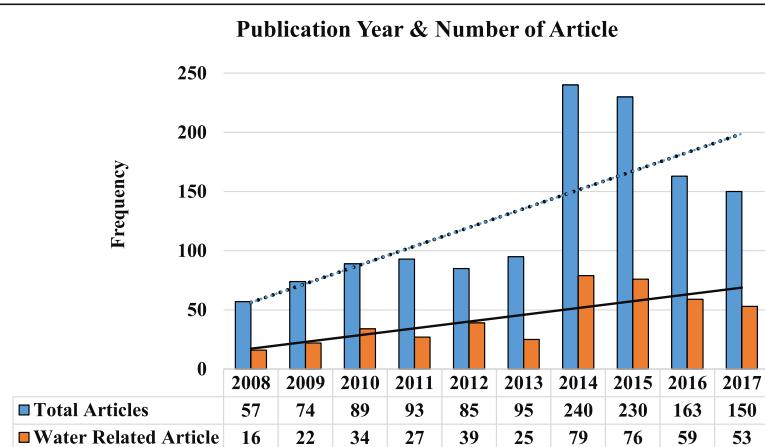
**Fig. 2** Comparison of the trends of the publication of all articles and water-related articles in specialised environmental health journals (2008–2017)

Table 3 Frequency of water resources in water studies in Iranian environmental health journals (2008–2017)

Water resources	Types	Number	Percentage
Surface water	Drinking water	211	49.1
	*Surface water	63	14.6
	River, lake and sea	55	12.8
	Swimming pools	13	3.1
	Surface runoffs	10	2.3
	Haemodialysis water	5	1.2
	Wetland	4	1
Groundwater	* Ground water	37	8.6
	Spring water	16	3.7
	Wells water	9	2.1
Total		430	100

* In a number of articles, the type of water resources was not explicitly mentioned, and only the authors cited examples of surface water and groundwater, so two separate categories for surface water and groundwater were mentioned

groundwater into three (Table 3). Most of the water resources belonged to surface water (368 articles (85.5%)). Drinking water had the highest abundance of surface water (Table 3).

Type of water pollutants

The classification of articles based on the type of water pollutants into primary and secondary categories (according to EPA classification) showed that most pollutants in 280 articles (65.1%) fall in the category of primary contaminants (such as microbial, chemical, organic, mineral, disinfection products, radionuclides, antibiotics), and 93 articles (21.7%) in the category of secondary pollutants (physical pollutants, heat, cold, turbidity, aesthetic (taste, odor, and colour) (Table 4).

According to the findings, among 430 articles related to water, in 92 articles (21%) the physical and chemical factors were the main subject of the study. Temperature and turbidity are very important physical factors, which were examined in 58 and 57 articles. Among the chemical properties of water, corrosion was studied with the least frequency in just two articles (Table 5).

According to the findings, 52 articles (12%) were devoted to the determination of the amount and environmental effects of 15 heavy metals in water resources,

with the highest frequency for chromium (30 articles), cadmium (29 articles) and lead (27 articles) (Fig. 3).

According to the findings, in 212 articles (49%), chemical compounds in water were the main subjects of the research. Among the various chemical compounds, the most frequent were nitrates (45 articles), and phenol (36 articles) (Fig. 4).

According to findings from 430 articles, in 61 (14.1%) about microbial agents in surface and ground water, the highest number of microbial agents studied was related to different types of bacteria, and the numbers of published articles on the study of fungus, parasites and viruses in water were 5, 2 and 1 (Table 6).

Collaboration in research

The findings show that there was international research participation in 55 articles (12.7%). In Fig. 5, researchers' collaborative network was drawn to continents and countries using VOSviewer software (Fig. 5). According to this figure, there were 25 nodes (mutual cooperation) and 199 authors from 20 countries participating in the research. In this network, the size of each node represents the total number of articles from each country and continent with Iran, and the diameter of the link between the two nodes is proportional to the number of joint writings. Since the collaboration of countries with Iran was targeted in this study, Iran was located at the centre of the nodes with 55 articles. In this map, countries with more contributions by Iranian authors were located closer to Iran and less contributing countries more distantly. According to the findings, the top continents based on the number of articles shared with Iran were Asia, Europe and Africa with 37, 9, and 7 articles, respectively. From the perspective of countries, India had the highest level of cooperation with Iranian researchers with 8 articles (Fig. 5).

Discussion

The findings of the present study showed that more than 30% of the 1276 articles published over the last decade in environmental health journals were devoted to water issues. In a study by the WHO in 2012, with the collaboration of 14 research institutes around the world, the burden of water-borne diseases was higher in 145 countries with a low-to-moderate income level. According to

Table 4 Types of primary and secondary pollutants in water studies in Iranian environmental health journals (2008–2017), by EPA classification

Type of water pollutants	Pollutant	Number	Percentage
Primary pollutants	Microbial, Chemical, Organic, Mineral, Disinfection, Radionuclides, Antibiotics	280	65.1
Secondary pollutants	Physical pollutants, Heat, Cold, Turbidity, Aesthetic (taste and odor), colour	93	21.7
Both types	Primary and secondary pollutants	57	13.2
Total		430	100

Table 5 The frequency of physical and chemical variables in water studies in Iranian environmental health journals (2008–2017)

Variables	Types	Number*	Percentage
Physical properties of water	Temperature	58	13.4
	Turbidity	57	13.2
	Aesthetic (taste and odor)	2	0.46
Chemical properties of water	Acidity	44	10.2
	Hardness	34	7.9
	Electrical conductivity	21	4.8
	Oxygen	8	1.8
	Corrosive	2	0.46

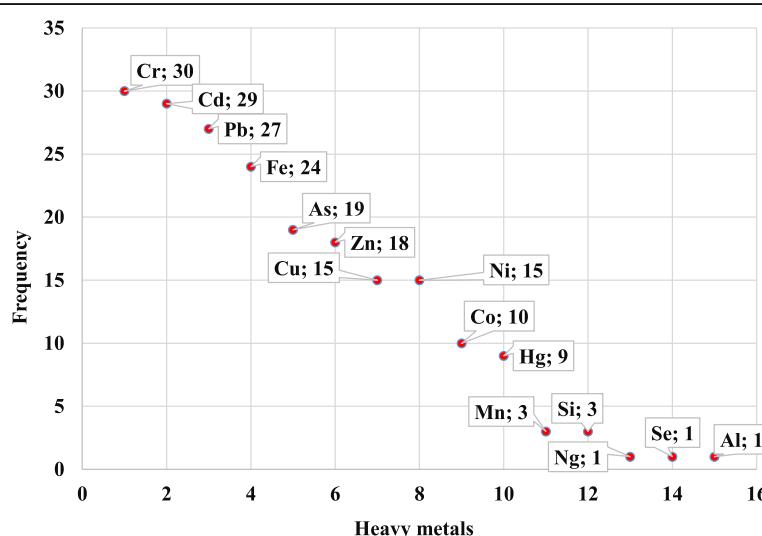
* Due to the two or multiple themes of some articles, each of the research topics is more than the full range of articles related to the physical and chemical properties of water

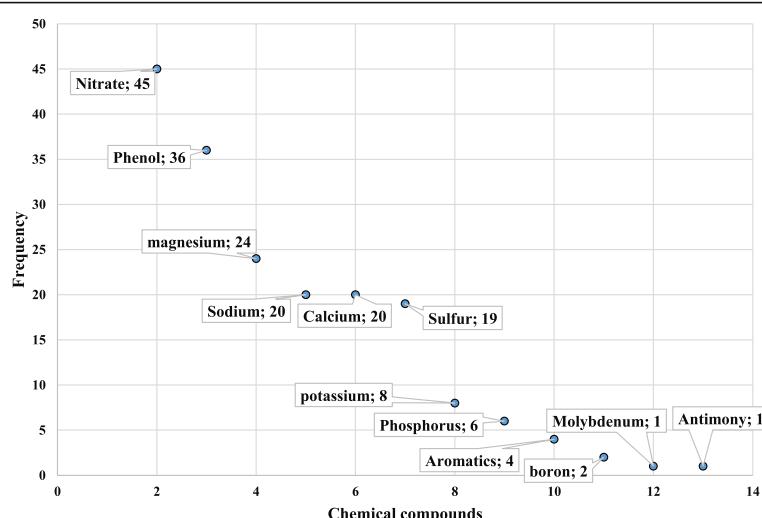
the WHO report, 502,000 deaths due to water pollution occurred in the Southeast Asian and African countries. In the Mediterranean countries including Iran, 50,400 deaths were registered, with 432 deaths due to water pollution in Iran (WHO 2014). Obviously, water pollution, causing diseases and related deaths are highlighted by environmental health professionals by conducting more and more research into the identification of water contamination factors, thus providing effective and diverse water contamination prevention strategies.

In the present study, in 21.4% of the articles physical and chemical factors were the main subject of the water studies, and the most important physical factors were temperature and turbidity. Studies in drinking water in Philadelphia, Atlanta and Vancouver showed a positive relationship between turbidity and endemic digestive diseases (Hsieh et al. 2015). The study by Yao et al. (2016) showed that turbidity in the Taihu River of China was directly related to the concentration of heavy metals. Turbidity is one of the symptoms of microbial

contamination in water, which requires further research to identify its association with other chemical and mineral pollutants.

In this study, 52 articles were devoted to the determination of the amount and environmental effects of heavy metals in water resources, which of 52 articles are listed in attached 1.(Attach1(Ref.1–52)). Because this study showed that most of articles were about dangerous pollutants such as chromium (30 articles), cadmium (29 articles) and lead (27 articles), it is suggested that in future research, these articles be studied to serve the pollutants in water resources. One of the highest heavy metals in the articles were cadmium and lead respectively. In a study by Fu et al. (2013), a survey of drinking water research published in the ISI database from 1992 to 2011 showed that most heavy metals were arsenic, lead and cadmium, which are similar to the findings of this study. Heavy metals are persistent and non-degradable pollutants (Ab Razak et al., 2015). Although some heavy metals are essential for biosynthesis in humans, however,

**Fig. 3** Frequency of heavy metals in water studies in Iranian environmental health journals (2008–2017)

**Fig. 4** Frequency of chemical compounds in water studies in Iranian environmental health journals (2008–2017)

some metals such as lead and chromium, even at very low concentrations, have negative effects on human health (Abraham and Susan 2017; Li et al. 2012; Adesyan et al. 2018). Therefore, conducting extensive research, identifying contaminated resources and providing control strategies from the missions of environmental health professionals are very important.

In the present study, the main topic in 14.1% of the articles was the study of microbial agents in surface water and ground water, and the highest number of microbial agents studied was related to different types of bacteria. A study by Chen et al. (2016) showed that contaminants

in the surface water of the Liao River included faecal contamination, oil and organic pesticides. A study by Kirschner et al. (2017) on the pollution of the River Danube showed that a major contamination was faecal. A study by Glińska-Lewczuk et al. (2016) showed that the highest contamination of the Łyna River in Poland was bacterial, so the findings of this study, like our research, indicate that microbial testing should be carried out continuously in drinking water to solve this problem.

In this study, the classification of the 55 articles written with the contribution of 199 researchers from 20

Table 6 Frequency of microbial agents in water studies in Iranian environmental health journals (2008–2017)

Microbial contamination	Types	Number	Percentage
Bacteria	Faecal coliforms	37	8.6
	Heterotrophic plate counts	11	2.5
	<i>Staphylococcus aureus</i>	5	1.6
	<i>Escherichia coli</i>	5	1.6
	<i>Pseudomonas aeruginosa</i>	5	1.6
	<i>Bacillus subtilis</i>	3	0.7
	<i>Streptococcus faecalis</i>	3	0.7
	Acinetobacter	2	0.5
	<i>Klebsiella pneumoniae</i>	2	0.5
	Aeromonas	1	0.2
	Achromobacter	1	0.2
Mycological flora	Aspergillus	3	0.7
	Mycotic flora	1	0.2
	Candida	1	0.2
Parasite	Giardia	1	0.2
	Legionella	1	0.2
Virus	Norwalk virus	1	0.2

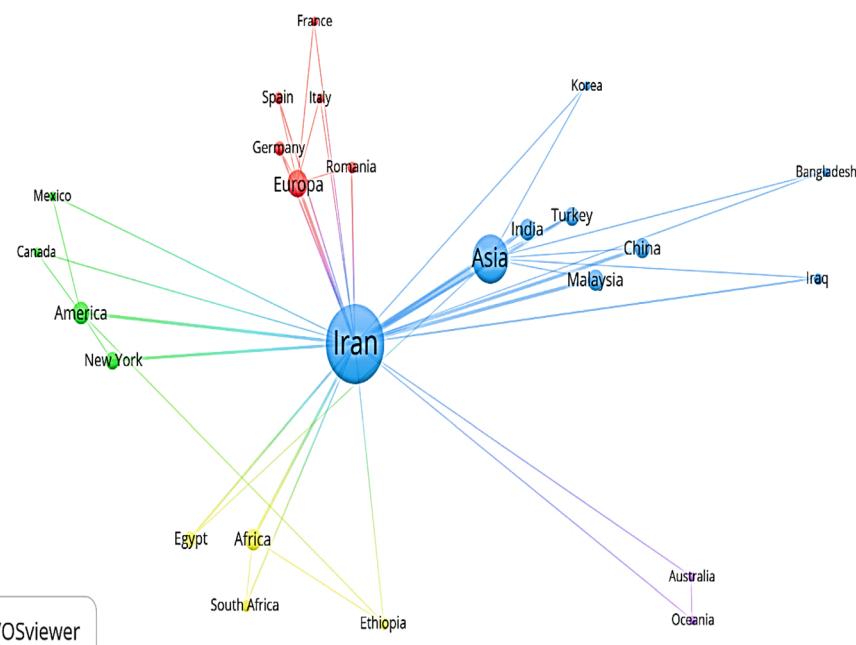


Fig. 5 Collaborative network of authors of joint water studies in Iranian environmental health journals based on continents and countries (2008–2017)

countries (including Iran) showed that the highest number of articles published in Iran was shared by Asian scholars. The study by Sweileh on the study of scientific publications on water-borne diseases at the Scopus showed that most countries that had scientific cooperation in the field of water diseases were European, North American, Asian and Australasian (Sweileh et al. 2016). Given the research facilities and funding available for health projects in European and American countries, their contribution to scientific publications on water quality is higher, but Asian countries are getting active in this area as well.

The strengths of this study are its relatively extended (over a decade) and broad scope of scientific contributions to public health research. One of the limitations of this study is the lack of review of published articles about water in other Iranian journals. However, most studies in this area appear to be published in specialised environmental health journals.

Conclusion

Despite the presence of water pollution and its adverse effects on human health, the health and economic system of the country, the number of papers published on the issue of water pollution was low. Health policy-makers should therefore provide mechanisms for encouraging national researchers, especially environmental health professionals, by prioritising national research into water quality and pollution to encourage professionals to conduct studies in this regard.

Supplementary information

Supplementary information accompanies this paper at <https://doi.org/10.1186/s40550-020-00080-9>.

Additional file 1 Attach 1. In the reviewed journals 52 articles were devoted to the determination of the amount and environmental effects of heavy metals in water resources, which are listed below for future research. (Ref.1–52).

Additional file 2.

Abbreviations

EHEMJ: Environmental Health Engineering and Management Journal; IJHE: Iranian Journal of Health and Environment; JEHE: Journal of Environmental Health Engineering; JEHSE: Journal of Environmental Health Science and Engineering; JREH: Journal of Research in Environmental Health; ICMJE: International Committee of Medical Journal Editors; EPA: Environmental Protection Agency; WHO: World Health Organization; WSP: Water Safety Plan

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Authors' contributions

AT designed the study, made final decisions on the inclusion of journal articles and extracted data from them, and wrote and revised the manuscript. ZA conceived the study, made final decisions on the inclusion of journal articles and extracted data from them, and wrote and revised the manuscript. MS and HUD wrote and revised the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on request.

Ethics approval and consent to participate

This study was approved and registered by the Code of Ethics (IR.GMU.REC.1396.110).

Consent for publication.

All authors agree to submit the above MS to the intended journal.

Competing interests

The authors declare that they have no competing interests.

Permission to collect data.

We have a permission to collect the data from the source.

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