Parameters to increase the quality of iridology studies: A scoping review

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Systematic review

Parameters to increase the quality of iridology studies: A scoping review

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A R T I C L E I N F O

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A B S T R A C T

Introduction: Iridology is an applied health practice whose overall aim is to better understand the constitution of an individual. There are a range of new methods which can be used to acquire and interpret images but these have not as yet been reviewed. This scoping review aims to build on previous reviews and explore publications from 2014 to 2019.

Methods: This scoping review focuses on advances in iridological research methods and equipment. It followed the PRISMA-ScR guidelines and the Joanna Briggs Institute framework. The search strategy was designed in collaboration with the health sciences librarian, the principal investigator, and the researcher's supervisors. Six relevant databases were identified. The form created prior to data extraction was used to review each article.

Results: Twenty-three publications out of a total of ninety-three publications identified were included. Four main themes emerged: (1) five different types of equipment are currently used to capture iris images in humans, (2) three different iridology-related theoretical frameworks were incorporated into the various research designs, (3) two major software-based techniques were employed to evaluate iridological signs, and, (4) sixteen of the reviewed articles linked a specific pathology or syndromic health condition of the human body represented to the reflex iris map of the eyes.

Conclusions: Computerized technological advancements in the field of iridology have helped to improve the clarity and detail of iris images and the ability to relate iridological signs to human health. The findings of this review can guide the design and methodological choices for future iridology studies.

1. Introduction

Technological advancements often lead to health research improvements, allowing greater precision and clarity in data collection and interpretation. Nonetheless, such advancements are not always met with unequivocal support, including health research [1,2]. In the field of integrative health research, knowledge uptake has been challenged by public opinion, low levels of knowledge among health professionals, updated equipment costs, policies that exclude integrative health practices, and significant differences in research methods across studies [3,3–5].

Iridology is a science that studies the structural and pigmentation patterns and other parameters related to the iris of the eye to analyze the constitution of an individual [6–8]. In the history of iridology' the Hungarian Ignatz von Peczely, in 1881, published a book "Discoveries in the field of Natural Science and Medicine: Instruction in the Study of Diagnosis from the Eye" [8,8], which presented a topographical map of the iris that reflects areas of the body. The author became known as the father of iridology [3,6]. There are over 80 areas identified on topographic charts of the iris, which vary due to the existence of different theoretical frameworks [10,10]. The body of knowledge regarding iridology is applied in the practice of complementary and integrative medicine, mainly through holistic therapists' practices [4,9]. Training and certification for iridologists vary worldwide and are offered by educational institutions that are linked to different associations of specialists who advocate the practice of iridology [11,12].

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There are multiple methodological choices regarding the equipment used to capture the image of the iris [digital cameras, integrated and/or adapted iridoscopes (specific cameras to photograph the iris)], various types of illumination and image recording, techniques of image creation for later analysis and regular image editing software (e.g., Corel Draw, Photoshop or specific ones for iris images, such as Iris 3D) [13–15]. Details regarding the decisions about lenses or magnifying glasses, type of light for iris observation, and how the data is recorded and analyzed should be included in the methods section in published research studies; however, this is not always the case.

Three systematic reviews on applied iridology in health have been published [16–18]. Although there was little consensus among the three reviews, each contributed to the field in their synthesis of relevant scientific evidence. The differences among the reviews are likely related to different methodological frameworks adopted to conduct literature review studies, the temporal span (1999-2010), the evolving body of knowledge and the technology available at the time of the review. Over the last decade, newer tools and further knowledge have created new opportunities to address consistency and generalizability across studies [19–21]. An updated synthesis of the current literature can be considered an important first step in achieving consensus and developing guidelines to help researchers make informed decisions regarding research designs and methods used in iridology.

This scoping review aimed to build on previous analyses, identifying, describing, and synthesizing the published literature on types of equipment and techniques used in research that assesses iridological signs in the field of human health. In reviewing papers published in the last five years (2014-2019), we sought to understand how these technological advances were applied to human health research, to relating to iridological findings to specific health conditions and to more general well-being. This review also aims to contribute to building consensus regarding best research practices in the field of iridology.

2. Methods

A scoping review provides an effective and systematic method to conduct an overview of poorly researched topics, allowing the academic community to explore published material more flexibly than systematic and integrative reviews [22–24]. This scoping review focuses on advances in iridological research methods and equipment. It followed the PRISMA-ScR guidelines and the Joanna Briggs Institute's stepwise approach, which includes: 1.Defining and aligning the objectives and question, 2.Developing and aligning the inclusion criteria with the objectives and question, 3.Describing the planned approach for evidence searching, selection, extraction, and charting, 4.Searching for the evidence, 5.Selecting the evidence, 6. Extracting the evidence, 7.Charting the evidence, 8. Summarizing the evidence linked to the objectives and question, 9.Consultation of information scientists, librarians, and experts [25]. Two research questions, structured from the Population, Concept, and Context (PCC) mnemonic acronym, were posed: *What are the types of equipment and techniques employed in research that evaluates iridological signs in the area of human health? How have these technological advances been applied to human health research regarding specific health conditions and more general well-being?*

2.1. Search strategy

A health sciences librarian (L. S.) helped to identify relevant search terms and databases that would best address our research questions. Six relevant electronic databases were identified: Cumulative Index to Nursing and Allied Health Literature-CINAHL Plus with Full Text, Web of Sciences from All Databases, Scopus, Cochrane Library, Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily 1946 to February 01, 2019 (EBSCOhost) and Excerpta Medica Database-EMBASE 1974 to 2019 February 01 (EBSCOhost). The main descriptors, keywords, and synonyms were Iridology, Iridiagnosis, Complementary Therapies, Iris. Added filters included: English language and year of publication from 2014 to 2019. From the initial search, 93 publications were identified. Database searches were completed at the beginning and repeated at the end of 2109. Table 1 below summarizes the search strategy carried out for each electronic database and the number of selected studies. Appendix A. Search strategies with details for each database can be accessed and available online as Supplementary Material [64].

2.2. Data extraction and analysis

The authors (R. B. E. and S. S. P.) extracted the information from the included studies using a standardized extraction form based on Joanna Briggs Institute (JBI) Template adapted to the particular characteristics of this scoping review [25]. Extracted information included: authors; year; country; equipment (the type of equipment for image capture, equipment features); theoretical framework; software, methods, and techniques to capture and interpret iridological signals (software, automated methods, and manual techniques). The first version of the extraction protocol for this scoping review was developed by (R. B. E.), being reviewed by the authors (K. M. H. and L. C.) independently. The last version was validated through a meeting between the reviewers and is available as Supplementary Material; Appendix B [65].

2.3. Study designs

A broad range of study designs (quantitative, qualitative, mixed methods, experimental and non-experimental studies, descriptive and analytical observational studies, literature reviews, including primary and secondary data) was included. Publications types, conference proceedings, articles with/without peer-review, theses, dissertations, editorials, guidelines, and other textual modalities were considered. Studies conducted in humans, male and female, without details related to age and design or methodological approaches were also considered. Exclusion criteria for publications were non-English, not available in full text, animal studies, publications that did not report sample size (this criterion was justified to address potential bias problems and bioethical issues), and publications that did not directly address the theme of the present study.

3. Results

3.1. Search results

The initial database search retrieved 93 publications. These articles were exported to ProQuest RefWorks, and duplicates were removed (N=37). The selection process was supported by Rayyan QCRI [26]. In phase one of the selection process, two independent and blinded researchers read the title, abstract, and keywords of the remaining 56 articles, with post-completion conflict resolution through a meeting between the reviewers. From this initial review, 11 publications were excluded. The full text of the remaining 45 publications was then reviewed for eligibility. From this full text, 24 publications were excluded. Two (2) additional publications were identified through a hand search of reference lists. Twenty-three (23) publications were included in the full review. Fig. 1 summarizes the review process using a flow diagram adapted from the PRISMA statement [27,28].

3.2. Characteristics of the studies

Published material spanned all 5 years of the review period, with two-thirds of the articles from 2015 and 2016. The majority of the articles were conference proceedings (55%) or peer-reviewed academic journals (45%). One article was related to a patent application. Articles were identified from 11 different countries, with the majority from

Table 1
Search strategies performed in databases and selected studies, Edmonton, Alberta - Canada on January 4th, 2019.

Database	Search strategies	Selected studies
CINAHL	iridolog* OR iridodiagnos*	04
Web of Sciences	iridolog* OR iridodiagnos*	41
Scopus	iridolog* OR iridodiagnos*	36
Cochrane Library	iridolog* OR iridodiagnos*	0
MEDLINE	iridology.mp. OR iridodiagnos*.mp. OR (Iris/ AND Complementary Therapies/)	04
Embase	exp iridology/ OR (iridology OR iridodiagnos*).mp	08

Asterisk (*) = Truncation Symbol
Forward Slash (/) = means that the term is a valid controlled vocabulary term which has been searched in the Subject Headings field of the database.
Parenthesis (()) = Combine modifiers to create a more complex search.
Abbreviation (mp) = Field tag searching as a keyword in an OvidSP database
Explode (exp) = The Explode function searches for an index term (subject heading) and automatically ORs it with all of its narrower terms.

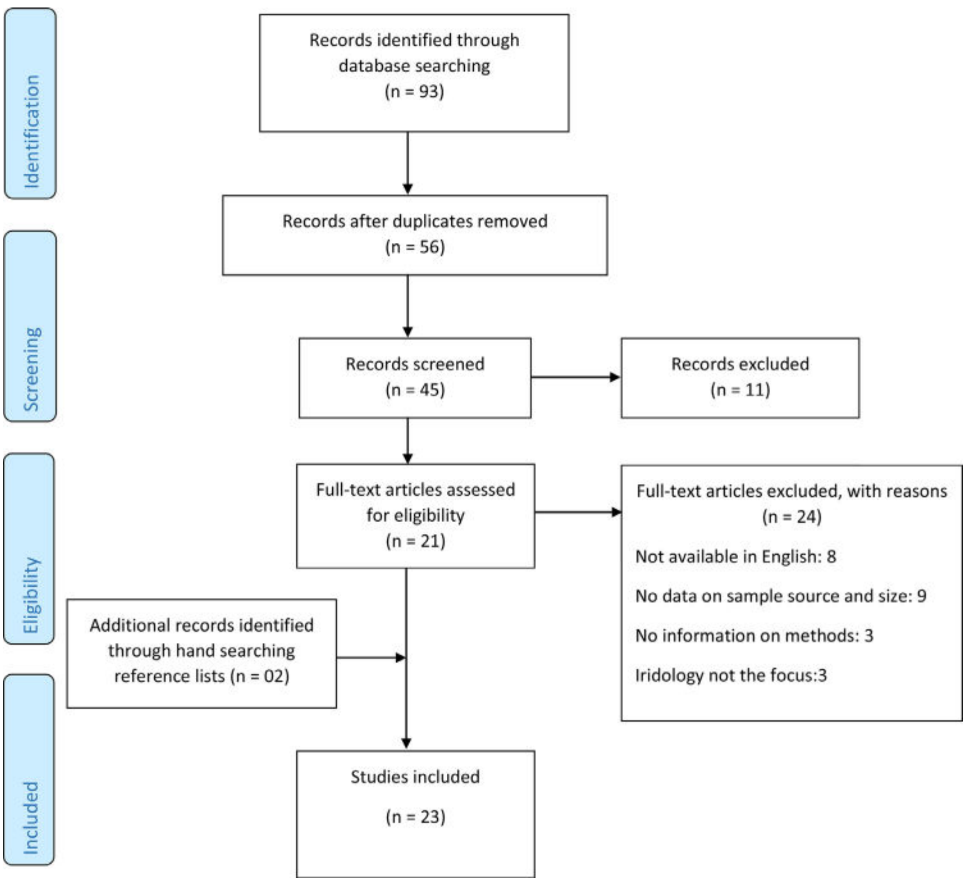

Fig. 1. Flow Diagram for scoping review process adapted from the PRISMA statement by Moher and colleagues (2009).

South and Southeast Asia (70%). Two studies were published in Germany. There were five articles from Iran, Mexico, Ecuador, the United States of America, and Brazil. Table 2 details each of the studies. There were five articles from Iran, Mexico, Ecuador, the United States of America, and Brazil. The data extracted were categorized into three main topic areas: equipment used to collect iridology data, theoretical frameworks, techniques, and software employed to analyze iridological data. Monographs from manufacturers were used to supplement data not reported or partially reported when the equipment brands were in the material and methods section in the reviewed publications.

3.3. Equipment for iridological data collection

The first objective was to identify the types of equipment used to capture the iris image. We identified five different types of equipment: seven (30.4%) studies used iridology cameras [33,36,40,43,46,50], four (17.4%) studies used the iris scanner camera [30,31,39,47], four (17.4%) studies used digital camera [34,38,45,49], two (8.7%) studies used a smartphone as a camera but did not provide the manufacturer's name [32,51], two (8.7%) studies used the Ophthalmologist microscope [35,48]. Three (13.0%) studies did not provide any information on which image capture equipment was used [29,41,42], and one (4.3%) was a literature review that synthesized data on iridology and ophthalmology. However, details regarding the equipment were not the main focus [37]. Although the latter four studies did not provide details on equipment, they were relevant to other dimensions of our review.

The second objective was to identify which theoretical frameworks were used. We identified three different frameworks, based on topographic charts that reflect the relationship between irises' representations and specific organs and areas of the human body. Three different topographic maps were identified across the 23 studies. The most common map (N=16; 70%) was developed by Bernard Jensen [29–

Table 2
Description of data extracted from the sample of publications included in the study.

	Equipment		Theoretical framework	Software, methods, and techniques to captured and interpret the iridological signal	
Authors; year; country	Type of equipment for image capture	Equipment Features	Map	Software	Automated methods / Manual techniques
Amerifar et al. 2015, Iran [29]	*NR*	N/A	B. J.	*NR*	CAS Based on MLA
Bansal et al. 2015, India [30]	*Iris scanner camera*: I-SCAN-2 dual iris scanner (Crossmatch Technologies, Inc.)	Magnification: NR Sensor: 1.3 Megapixel Resolution: 480x480 Pixel Save format: Bitmap Illumination: 1 Led Safety certificate: Approval	B. J.	Matlab[2]	CAS Based on MLA
Bansal et al. 2019, India [31]	*Iris scanner camera:* I-SCAN-2 dual iris scanner (Crossmatch Technologies, Inc.)	Magnification: NR Sensor: 1.3 Megapixel Resolution: 480x480 Pixel Save format: Bitmap Illumination: 1 Led Safety certificate: Approval	B. J.	Matlab[2]	CAS Based on MLA
Rosales-Banderas et al. 2016, Mexico [32]	*Smartphone* *	*NR*	*NR*	OpenCV[1]	CAS Based on MLA
Carrera & Maya 2019, Ecuador [33]	*Iridology camera*: IRISO Camera	Magnification: 28X – 55X Sensor: 2.0 Megapixel Resolution: 480x480 Pixel Save format: ISO Illumination: 4 Led Safety certificate: Approval	B. J.	Python[1] with OpenCV[1] And Sklearn[1]	CAS Based on MLA
Dewi et al. 2016, Indonesia [34]	*Digital camera**	*NR*	B. J.	Photoshop[4] or Photoscape[1]	CAS Based on MLA
Perner 2015, Germany [35]	*Ophthalmologist microscope* *	Magnification: 400X Sensor: NR Resolution: NR Save format: NR Illumination: 4 Lamps Safety certificate: Approval	P. J-M.	*NR*	CAS Based on MLA
Lim et al. 2016, South Korea [36]	*Iridology camera*: Dr Camscope Pro LED (Sometech, Seoul, Korea)	Magnification: 30x-60x Sensor: 1080i 60 Frames Resolution: 1920x1080 Pixel Save format: JPG/FULL-HD Illumination: 1 Led Safety certificate: Approval	*NR*	Photoshop[4]	Three MD (Iridologists) examined iridological signs in iris images.
Ramlee et al. 2015, Malaysia [37]	N/A	N/A	N/A	N/A	CAS Based on MLA
Kusumaningtyas et al. 2016a, Indonesia [38]	*Digital camera* *	Magnification: 4x -10x Sensor: 12.8 Megapixel Resolution: NR Save format: NR Illumination: Back-illuminated. Safety certificate: NR	B. J.	C# in Visual Studio[3]	CAS Based on MLA
Samant & Agarwal 2018b, India [39]	*Iris scanner camera:* I-SCAN-2 dual iris scanner (Crossmatch Technologies, Inc.)	Magnification: NR Sensor: 1.3 Megapixel Resolution: 480x480 Pixel Save format: Bitmap Illumination: 1 Led Safety certificate: Approval	B. J.	*NR*	CAS Based on MLA
Wibawa et al. 2016, Indonesia [40]	*Iridology camera*: Camera Dino-Lite	Magnification: 10x ~20x Sensor: 1.3 Megapixel Resolution: 1280x1024 Pixel Save format: BMP/JPG/AVI Illumination: 2 Led Safety certificate: Approval	B. J.	*NR*	CAS Based on MLA
Herlambang et al. 2015, Indonesia [41]	*NR*	N/A	B. J.	Matlab[2]	CAS Based on MLA
Salles & Silva 2015, Brazil [42]	*NR*	N/A	C. A.	*NR*	*NR*
Sitorus et al. 2015, Indonesia [43]	*Iridology camera*: Camera Dino-Lite	Magnification: 10x ~20x Sensor: 1.3 Megapixel Resolution: 1280x1024 Pixel Save format: BMP/JPG/AVI Illumination: 2 Led Safety certificate: Approval	B. J.	*NR*	CAS Based on MLA
Prayitno et al. 2016, Indonesia [44]	*Iridology camera:* Camera Dino-Lite	Magnification: 10x ~20x Sensor: 1.3 Megapixel Resolution: 1280x1024 Pixel Save format: BMP/JPG/AVI Illumination: 2 Led Safety certificate: Approval	B. J.	Avidemux [1]	ROI analysis used image editing software

(*continued on next page*)

Table 2 (*continued*)

	Equipment		Theoretical framework	Software, methods, and techniques to captured and interpret the iridological signal	
Nguchu & Li 2017, China [45]	*Digital camera:* Professional Logitech video	Magnification: 10x Sensor: NR Resolution: NR Save format: NR Illumination: 1 Led Safety certificate: NR	B. J.	Matlab[2]	CAS Based on MLA
Abdul Jalil et al. 2015, Malaysia [46]	*Iridology camera* *	*NR*	B. J.	*NR*	CAS Based on MLA
Samant & Agarwal 2018a, India [47]	*Iris scanner camera:* I-SCAN-2 dual iris scanner (Crossmatch Technologies, Inc.)	Magnification: None Sensor: 1.3 Megapixel Resolution: 480x480 Pixel Save format: Bitmap Illumination: 1 Led Safety certificate: Approval	B. J.	*NR*	CAS Based on MLA
Perner 2017, Germany [48]	*Ophthalmologist microscope* *	Magnification: 400X Sensor: NR Resolution: NR Save format: NR Illumination: 4 Lamps Safety certificate: Approval	P. J-M.	*NR*	CAS Based on MLA.
Triwijayanti et al. 2016, Indonesia [49]	*Digital camera:* Casio QV-8000SX	Magnification: 8x - 4x Sensor: 1.31 Megapixel Resolution: 1280x940 Pixel Save format: JPG/AVI Illumination: 1 Lamp Safety certificate: Approval	B. J..	FotoCanvas[4], Photoshop[4], and Corel Photo-Paint[4]	CAS Based on MLA
Lim et al. 2014, South Korea [50]	*Iridology camera*: Dr Camscope Pro LED (Sometech, Seoul, Korea)	Magnification: 30x-60x Sensor: 1080i 60 Frames Resolution: 1920x1080 Pixel Save format: JPG/FULL-HD Illumination: 1 Led Safety certificate: Approval	*NR*	Photoshop[4]	Three MD (Iridologists) examined iridological signs in iris images.
Myr 2016, USA [51]	*Smartphone* *	N/A	B. J.	*NR*	CAS Based on MLA

N/A = not applicable; NR = not reported; CAS = Computer Automatic System; MLA = Machine learning algorithms; B. J. = Bernard Jensen; P. J-M. = Peter Jackson-Main; C. A. = Cross of Andreas (Germany iridology)

[1] It is free software

[2] It is free for academic use

[3] there is a free version

[4] It is not free

* No brand of equipment informed

31,33,34,38–41,43–47,49,51]. Others included the map developed by Peter Jackson-Main (N=2; 9%) [35,48], while one study (4%) used the topographic map of the Cross of Andreas (a topographic representation with four signals in each iris) [42]. Three (13%) studies [32,36,50] and a literature review [37] did not provide information related to a topographical map.

The third objective was to identify techniques employed to evaluate the iridological signs in the captured images through manual techniques, software, and other techniques to maximize accuracy in delineating the region of interest in the iris images. Most studies had developed computer systems applying mathematical models of artificial intelligence called “Machine learning algorithms” to identify the region of interest in the iris. Specifically, the studies have developed automated systems for locating areas of interest in iris images guided by topographic iris maps representing the human body’s organs that may be associated with some disease or health condition.

The data analytic techniques were categorized into two different subgroups (A and B) and represented 21 out of the 23 articles. The remaining two articles did not provide sufficient information to discern the analytic processes [37,42]. Subgroup A included automated methods with artificial intelligence techniques and accounted for 19 of the reviewed articles. These articles described automated systems that extracted and classified digital iris images based on the chosen topographic map of iridology with the human body organs’ representations as parameters to predict a disease or health condition. Nine of the 19 studies did not report the name of the software used for the analysis [29,35,39–41,43,46,48,51]. Four studies used MATLAB, the programming software for numerical and matrix calculation, signal, and graphic processing [30,31,41,45]. Three studies used different programming software, and two studies used OpenCV. Between of those studies, one used Python, and Sklearn and the last one studies used C# in Visual Studio [32,33,38]. Moreover, the last three studies used different software for editing a digital iris image. Three studies used Photoshop and PhotoScape, another used two other software programs (Corel Photo-Paint and FotoCanvas), and one study used only Photoshop [34,44,49].

Subgroup B included manual techniques [36,50]. There were two studies in this subgroup. Both studies used six identical iridological signs that were extracted from the digital iris images. The process of extracting the iridological signs was performed by three different Medical Doctors (Iridologists) in each publication. The six signs included data on iris density, pigment dots, nerve ring, toxic radii, pupil area ratio, and autonomic nerve wreath ratio. The signs were related to temperament traits determined by a psychometric scale. The studies used Adobe Photoshop software to crop the iris region, excluding the other eye areas. The studies did not provide any information on whether topographic maps of the iris were used.

3.4. Iridology finds and clinical practice

The fourth objective was to summarize how the various advances have been applied to health research. The data presented here were grouped according to specific pathology or health condition and the same studied iridological sign. Thus, the results are described considering (1) the specific pathology or syndromic health condition; (2) topographic signal equivalent to a human body organ or system represented in a reflex map of the eyes' iris.

Sixteen (16) articles related a specific pathology or syndromic health condition and a topographic signal equivalent to an organ or system of the human body represented on a reflex map of the eyes' iris, called an iridological chart. Five studies focused on diabetes mellitus, three of which were related to a sign in the pancreas region [30,39], one study to a signal in the kidney region [44], and one study to a signal of the Cross of Andreas [42]. Three other studies were related to chronic renal failure and the signal in the kidney region [29,40,43].

Two studies were related to heart disease and signs in the heart region [38,45]. Two studies were related to lung diseases and signs in the lung region [31,49]. Two studies were related to stomach and gastrointestinal disorders and signs in the gastrointestinal region [33,34]. One study was related to liver disease and a signal in the liver region [41]. One study was related to the vagina and pelvic diseases and signals in the vagina and/or pelvic regions [46]. Seven articles did not link any disease or syndromic condition to signs or regions in eyes' iris, instead more generally referring to possible topographic representations in connection to organs or systems in the human body [32,35–37,48,51].

4. Discussion

The present scoping review was driven by the need to update information about recent technological advances in the field of iridology. This review aimed to identify the equipment, materials, and techniques employed in research and practices relating iridological signs to human health. No consensus was reached in previous reviews [16–18] regarding best research methods or guidelines to support research design decisions. However, this latest review which described the newest techniques for improving the image quality and locating the iridological signs could be used as parameters to consider in future research in the field of iridology.

The results of our review may encourage further research and guide the design of research protocols. A significant proportion of the reviewed publications showed gaps or lack of precision regarding the description of the equipment used for data collection and data analysis. This lack of detailed information about the research methods highlights one of the ongoing limitations of the collective body of knowledge regarding research in iridology. [52–54].

Of the three identified theoretical frameworks, the one proposed by Bernard Jensen was the most common. This might reflect his stature as "the Father of American iridology" and the international recognition for his contributions to the field [55,56]. Bernard Jensen analyzed the iris's structures to explain how the iridological chart presented details about reflex topography of human organs in the iris, which can then demonstrate different stages of diseases [57]. The second theoretical framework was that proposed by Peter Jackson-Main, who linked the evaluation of the individual's unique to health promotion and as a strategy to avoid health problems ng health. The main difference between these frameworks is the iridological maps of the organs [58]. The third framework is based on the signal Cross of Andreas, which is a topographic and reflex representation of the irises, composed of four openings in the iris' fibers. It is used to study hereditary weaknesses related to the predisposition to diabetes mellitus. The Cross of Andreas refers to the pancreas' iridological points, found in the region close to the pupil. The right iris indicates a predisposition to disorders of exocrine function and the left iris to disorders of the pancreas' endocrine function [42,59–61].

Most of the publications arose out of research completed in Asian countries. Most studies from this continent had developed computerized artificial intelligence systems to identify iridological signals automatically. This may be related to the fact that Asian universities have recognized educational and research institutions focused on "Computer Science & Artificial Intelligence" and "Integrative & Complementary Medicine". Asian universities rank among the top 10 universities in these two subjects, according to the Center for World University Ranking [62,63].

Another notable aspect in terms of equipment and data analysis techniques is that the majority of studies used iris-imaging equipment not specifically designed for iridology and automated computer systems not specifically designed to interpret iris topographic data. This might suggest that although previous equipment and data analytic techniques were more specific to iridology, they had inherent limitations that served as a barrier to further developments in terms of clarity of the signal and the interpretation of results.

5. Limitations

The present scoping review has several noteworthy limitations. The selected time from 2014 - 2019 can be limiting factor. Another issue is to the decision to include six databases most frequently used in academic settings and not to carry out a search strategy on "Google" or "Google Scholar". However, we were confident that using the databases, as well as a search of references from the identified papers and including conference proceedings and patent registrations gave us the full range of published works on our topic of interest. As was stated previously, another limitation was the low level of details provided in the methods sections of many of the reviewed articles.

6. Conclusion

This scoping review provided summaries of the research work over the past five years (2014-2019) in the field of iridology and the technological advances that have occurred across four main areas (equipment used to collect iridological data, potential evolutionary development of theoretical frameworks, data analyses equipment and techniques and further application of iridological data to human health). Despite significant differences across studies, there is evidence that advances have been made.

This review serves as a guide for the development of future research projects, in terms of choices of equipment to collect data, to analyze data and the most appropriate theoretical framework to answer the research questions posed. Further improvements in research designs and methods can benefit iridology practitioners in accurately analyzing iris data and in turn can benefit their patients by linking these data to general health and wellbeing, as well as early detection of health problems.

CRediT authorship contribution statement

Rafael Braga Esteves: Writing – original draft, Conceptualization, Methodology, Data curtion, Writing – review & editing, Visualization, Funding acquisition. **Juceli Andrade Paiva Morero:** Data curtion, Writing – original draft, Writing – review & editing, Visualization. **Sandra de Souza Pereira:** Data curtion, Writing – original draft, Writing – review & editing, Visualization. **Karina Dal Sasso Mendes:** Writing – original draft, Methodology, Writing – review & editing, Visualization. **Kathleen Mary Hegadoren:** Conceptualization, Methodology, Validation, Writing – review & editing, Supervision, Visualization. **Lucilene Cardoso:** Conceptualization, Methodology, Validation, Writing – review & editing, Supervision, Visualization.

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Declaration of competing interests

The authors have no competing interests to declare.

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Data availability

The authors state that all information provided in this article can be obtained from the author on request. Supplementary Material already presented: [64,65].

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.eujim.2021.101311.

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[65] R. Esteves, J. Morero, S. Pereira, K. Mendes, K. Hegadoren, L. Cardoso, Appendix B. Form for extracting details, data and characteristics of the study, template adapted for the present study, according to the Joanna Briggs institute reviewer's manual: chapter 11: scoping reviews., Mendeley Data, V1 (2020), doi:10.17632/87k64ztsf9.1.