Iran J Public Health, Vol. 52, No.7, Jul 2023, pp.1334-1345

Review Article

The Development Trend of Medical Animals in the Last Ten Years: A Review

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(Received 23 Apr 2022; accepted 15 Jul 2022)

Abstract

Background: There are many kinds of medicinal animal resources, which are an important part of traditional Chinese medicine resources (TCM). However, the use of medicinal animals in TCM, especially wild animals, has become a sensitive problem at home and abroad. Systematic analysis on the research status and direction of medical animals in the last 10 years which for promoting the sustainable development of Chinese medicine.

Methods: PubMed, Web of Science, Embase, CINAHL, CNKI, VIP database and WanFang Database were selected, and SPSS 25.0 software was used to analyze annual publications, journals, global distribution, authors, coauthors and co-authors rate, author institutions and high-frequency keywords.

Results: Chinese Journal of modern Chinese medicine occupies the majority articles with a high co-authorship rate, but low impact factors. The development of medical animals around the world is not balanced. The top three countries are China, United Kingdom and United States. However, these countries have less exchanges and cooperation with each other. The Institute of TCM of Chinese Academy owns the most research achievements. At present, the hot spots involve the identification and quality of medical animals, applied basic research.

Conclusion: The identification, quality and applied basic research of medical animals are still worthy of increasing research investment. In addition, it is necessary to strengthen exchanges and international cooperation among different countries in TCM, and promote the high-quality development in medical animals.

Keywords: Medical animals; Traditional Chinese medicine; Bibliometric analysis

Introduction

Traditional Chinese Medicine resources are the foundation for the survival and development of global TCM, while the medical animals are important parts of TCM resources. Promoting the sustainable development of TCM and protecting medical animal resources are the hot topics of global discussion (1,2).

In 1979 and 1983, Chin-a published the first volume (3) (332 species), the second volume (4) (380 species) (referred to as "original records"), and revised the second volume (5) (2341 species) (referred to as "new records") in 2013 to supplement and improve the medical animal resources. Some large pharmaceutical companies in the world began to pay attention to the development

potential of TCM products and invested a lot of money in the research of animal and plant resources, such as setting up natural medicine departments, seeking cooperation with China to develop TCM products, and developing TCM compound preparations(6).

At present, the research on quality and technology is not enough. How to more efficiently extract active ingredients from medical animals and quality test become a barrier for these countries who want to develop the medical animals resources (7, 8). We study analyzed and summarized the results of clinical experience and research in the field of medical animals in the past 10 years, in order to explore the research trend, which contribute to the healthy development of TCM.

Materials and Methods

We systematically searched for the literature and used other systematic methods within the papers.

Data Sources and Searches

We retrieved the major clinical articles published in PubMed, Web of Science, Embase, CINAHL, CNKI (China National Knowledge Infrastructure), VIP (Chinese Scientific Journal Database), and WanFang Database from Jan 2010 to Dec 2020. These arch term included "medical animal*" or "animal medicine" or "animal drug" or "animal medical material*" or "Animal-based medicine*" or "animal-derived medicine*" or "Animal-Based Medicinal Product*" or "animal-derived medicinal product*". Literature type including systematic reviews of clinical studies randomized clinical trials, non-randomized controlled clinical studies, and case reports. No language restriction was applied. As an example on one specific strategy, the search terms for Web of Science database were as follows: TI=(medical animal* OR animal medicine*OR animal drug*OR animal medical material*OR Animal-based medicine*OR animal-derived medicine* OR Animal-Based Medicinal Product*OR animal-derived medicinal product*). Filters: Humans. Data were analyzed by SPSS25.0 software (IBM Corp., Armonk, NY, USA), retrieval time: Dec 2020.

Inclusion criteria

1) Literatures related to experimental research and pharmacological action of medical animals, 2) It is related to the TCM treatment of medicinal animals, 3) Literature related to the quality standards of medical animals, 4) Theoretical and comprehensive literatures related to medical animals.

Exclusion criteria

1) Literature is unrelated to medical animals. 2) Literatures related how medical animals breed. 3) Literature on the price of medical animals. 4) Conference and newspaper literature. 5) Repeated published literature. 6) The full text of the literature could not be found.

Quality control

The three researchers read the titles and abstracts of articles one by one in CNKI, Wan Fang, VIP, Web of Science, PubMed, EMBASE and CINAHL, and screen the articles that meet the inclusion criteria. In case of uncertain literature, a fourth person will participate in the discussion and reach an agreement after reading the full text.

Data statistics and analysis

The researchers were in CNKI, Wan Fang database, VIP, Web of Science, PubMed, EMBASE and CINAHL, 105, 357, 85, 46, 40, 37 and 20 articles were screened out according to the requirements of quality control, and then literature management software endnote was used to check duplicate articles according to the title and the first author name. Overall, 139 repetitive articles were excluded. Four articles were excluded after reading the full text, and 9 articles could not be found. After filtering raw literature, 538 documents met the inclusion criteria, as shown in Fig. 1. Microsoft Excel 2019 software was used to make data statistics and descriptive analysis on the information characteristics (annual number of papers, institutions, authors, keywords, etc.).

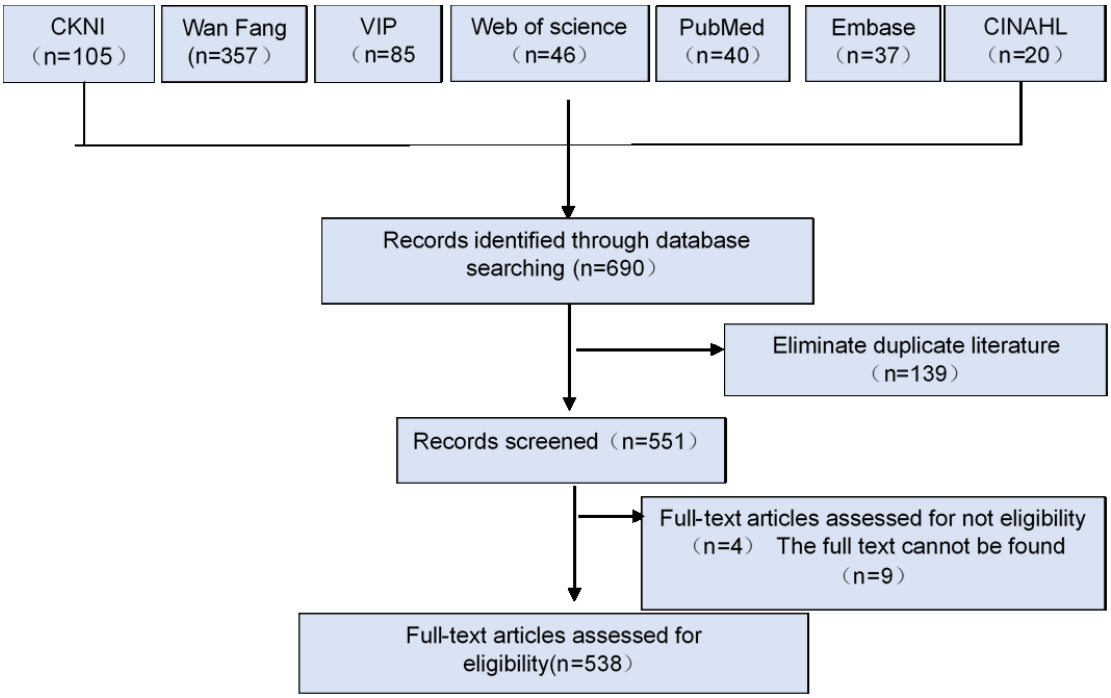

Fig. 1: Presentation of procedure of study searching and selection with numbers of articles at each stage

Results

The publishing trends of literatures

According to the statistics of 538 papers, average number of articles published annually is 53.8. According to the annual published literature curve, there are two peaks in the research of medical animals in the past 10 years. The first peak is from 2010 to 2012, which were published 144 papers (26.77%). Then, there were 28 papers (5.20%) in 2013, and the second peak is from 2014 to 2018, which were published 273 papers (50.74%). However, there were decline signs from 2019, and in 2020. There were only 34 papers in the world (Fig. 2).

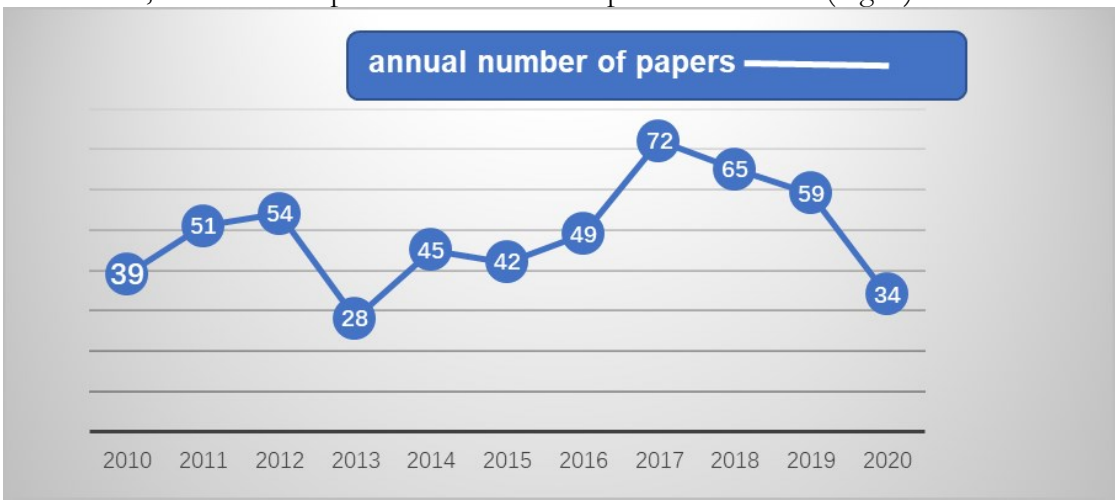

Fig. 2: Annual number of papers published in the field of medical animals from 2010 to 2020

Distribution of literature and periodical

From the statistic results of 538 papers, 59 dissertations and 479 journal papers were published in 238 different journals. According to articles published by the journal with seven or more articles, the 10 journals were selected, and 120 papers (25.05%) were published, the average impact factor of the 10 journals is 1.15. On the one hand, The10 journals have become the core journals in the field of medical animals; on the other hand, they also have a high output in the field of medical animals' research (Table 1).

Table 1: Distribution of top 10 published journals

Journal Name	*TP*	*TPR%*	*IF(2020)*
Modern Chinese Medicine	22	4.59	0.64
Jilin Tradition Chinese Medicine	16	3.34	0.84
Tradition Chinese Medicine Journal of China	16	3.34	1.71
Chinese Herb Medicine	14	2.92	1.63
Shizhen Traditional Chinese Medicine	11	2.30	0.88
World Science and Technology Modernization of TCM	10	2.09	1.17
Chinese Journal of Ethnic Medicine	9	1.88	0.28
Chinese Journal of Experimental Prescriptions	8	1.67	1.62
Mitochondrial DNA. Part A, DNA Mapping	7	1.46	1.80
Traditional Chinese Medicine	7	1.46	0.91

IF(2020), impact factor; TP, total paper; TPR%, the percentage of articles of journals in total publications; TCM, Traditional Chinese Medicine

Author organization

According to the statistics of 538 literatures, there are 343 research units in the field of medicinal animals around the world, the unit with the largest literature output was China Academy of Chinese Medical Sciences and accounts for 5.76% (Table 2).

Table 2: Distribution of authors in the top 9 paper

Number	*Author organization (city)*	*Number of papers*
1	China Academy of Chinese Medical Sciences (Beijing)	31
2	Changchun University of Chinese Medicine (Changchun)	21
3	Chengdu University of Chinese Medicine (Chengdu)	17
4	Beijing University of Chinese Medicine (Beijing)	11
5	China Institute for Food and Drug Control (Beijing)	10
6	China Medical University (Shenyang)	9
7	Hunan University of Chinese Medicine (Changsha)	9
8	Chinese Academy of Medical Sciences (Beijing)	8
9	Shandong University of Chinese Medicine	7

Distribution of authors

According to the statistics of 538 literatures, 12 highly productive authors published more than 8 articles, all of them are Chinese scholars, and the average number of articles per author is 9.92. One person published 22 articles, one person published 12 articles, five persons published 9 articles, and five persons published 8 articles (Table 3).

Table 3: The top three authors of medicinal animal research

Author	*TP*	*FCA*
Hui Zhang (9-30)	22	3
LUqi Huang(31-42)	12	3
Shilin Chen(24,43-50)	9	2
Jingyuan Song (18-20,51-56)	9	0
Hongyu Jin(57-65)	9	0
Shuangcheng Ma(64,66-73)	9	0
Junde Li(74-81)	9	2

TP, total articles; FCA, the number of articles published as the first author or the corresponding author

Co-authorship and co-authorship rate

According to the statistics of 538 literatures, there are 467 first authors and 1644 authors in total, excluding 59 dissertations. There were 426 literatures with two or more collaborators. The maximum number of authors was 9, and the co-author rate is 79.18 (426/538), which indicates that the degree of cooperation among scholars in the field is high.

Global distribution of literature

According to the analysis of the number of papers published on animal medicinal materials in the world, only 17 countries in the world have conducted research on medicinal animals. China is the country with the largest number of papers, followed by the United Kingdom and the United States (Table 4).

Table 4: Number of studies on animal medicinal materials in different countries

Country	*Study design (number of study)*				*Total n(%)*
	RCT	CCS	SR	CR	
England	7	8	10	0	25(4.65)
USA	1	7	8	0	16(2.97)
Germany	2	2	1	0	5(0.93)
Switzerland	0	4	1	0	5(0.93)
Ireland	0	4	0	0	4(0.74)
Japan	0	0	2	0	2(0.37)
Netherlands	0	0	2	0	2(0.37)
Brazil	0	5	2	0	7(1.30)
Canada	0	2	0	0	2(0.37)
China	10	291	155	1	457(84.94)
Egypt	0	0	1	0	1(0.19)
India	0	3	2	1	6(1.12)
Korea (South)	0	1	0	0	1(0.19)
Spain	0	2	0	0	2(0.37)
Italy	0	1	0	0	1(0.19)
Tunisia	1	0	0	0	1(0.19)
Bhutan	0	1	0	0	1(0.19)

SR, systematic review; RCT, randomized clinical trial; CCS, non-randomized controlled clinical studies (quasi-randomized clinical trial or observational studies such as cohort or case-control studies); CR, case report; USA, United States of America

High frequency keywords in literature

According to the statistics of 538 articles, 1341 keywords were listed, 2.49 keywords per article, 1069 keywords that appeared only once, accounting for 79.72%. Eighteen keywords appeared 10 times, accounting for 1.34% (Table 5).

Table 5: Statistical table of high frequency keywords of medical animal research literature from 2010 to 2020 (frequency≥10 times)

Serial Number	*Themes*	*Article Number*
1	Medicinal animal	84
2	Traditional Chinese Medicine	54
3	DNA barcoding	45
4	identification	35
5	Animal medicinal materials	28
6	molecular identification	22
7	COI sequences	18
8	Chemical composition	18
9	High-performance liquid chromatography	14
10	Quality standard	13
11	Quality control	13
12	The musk	13
13	The Leech	13
14	Pharmacological effects	12
15	Specific polymerase chain reaction (PCR)	12
16	DNA authentication	11
17	The earthworm	10
18	Quality evaluation	10

Discussion

This systematic study reflects the most comprehensive analysis to date of the study condition on medicinal animals, including narrative syntheses of systematic reviews, randomized controlled trials, non-randomized clinical controlled trials, and case reports, and with no language exclusions.

Papers growth analysis

On the whole, the number of literatures on medicinal animals in the world during 2010-2020 is on the rise, which not only shows that the scientific and technological workers of Traditional Chinese Medicine have done a lot of scientific research work in the field of animal medicinal materials, but also shows that animal medicinal materials are concerned by the scientific and technological workers.

Journal source analysis

The research in the field of medicinal animals involves 238 journals. On the one hand, it can guide scientific researchers to pay attention to relevant journals in the field of medicinal animals, and help to grasp the research trends and research hotspots of medicinal animals all over the world in real time; on the other hand, the authors have diverse choices in the field of medicinal animals. In addition, Chinese journal "Modern Chinese Medicine" is the first choice for submission in Chinese, while journal "Mitochondrial DNA. Part A and DNA Mapping" is in English. The average impact factor of 9 journals with more than 7 articles is 1.15, which indirectly indicates that the global research quality in the field of medicinal animals needs to be strengthened.

Research strength analysis

At present, 17 countries around the world focus on the field o-f medicinal animals. On the one hand, it shows that Traditional Chinese Medicine is stepping into the stage of globalization. On the other hand, there are fewer researches in the field

of medicinal animals. It is worth noting that the most active country in the field of medical animals is China, which is related to the 13thfive-year plan of Traditional Chinese Medicine and the white paper of Traditional Chinese Medicine (1,82). From the perspective of the number of papers published by scientific research institutions, the research level of Institute of Traditional Chinese Medicine of Chinese Academy is in the primary position in field. Only 9 Institutions (2.62%) have more than 7 articles, indicating the imbalance of international and regional distribution in the field of medicinal animals. From the analysis of literature co-authorship rate and its "core journals", the co-authorship rate of papers is high but the influence factor is low, which indicates that the academic research authors in this field have completed the transformation from independent to co authorship, However, the scientific research construction of animal medicinal materials is not perfect.

Subject topic Analysis

From the research hotspots of high-frequency keyword analysis, the current researches mainly focus on the following areas: 1) identification and quality: molecular identification, COI sequences, high performance liquid chromatography, DNA barcoding, quality standard, quality control, DNA authentication of animal medicinal materials, etc. Sequences, high performance liquid chromatography, DNA barcoding and it is important methods for quality identification of medicinal animals. Meanwhile, DNA barcoding of animal medicinal materials is the keyword with the highest word frequency. On the one hand, DNA barcoding of animal medicinal materials has the advantages of high accuracy and rapid detection, and on the other hand, it is related to the establishment of COI sequence database of DNA barcoding at home and abroad, so there are more researches on its application (83,84). 2) Applied basic research: chemical composition, content determination, pharmacological action, and biological activity, etc. 3) Animal medicinal materials: the musk, the leech, and the earthworm are the medicinal animals with high research frequency in China at the present stage. 4) Clinical application: preparation and processing technology of Chinese herbal medicine. The processing of Chinese herbal pieces is the core content of the modernization of Chinese medicine, and it is the essence of Chinese medicine (85-86). According to the analysis of key high-frequency words, the identification and quality of medicinal animals and the basic research of application are the research directions worthy of paying great attention to TCM researchers in the future.

Conclusion

In the past 10 years, with the global attention and support to the of TCM, the relevant research institutions headed by the Institute of TCM, Chinese Academy of Traditional Chinese Medicine made great contributions to the scientific research and construction in the field of medicinal animals, However, the global imbalance of research is still an important issue. In order to further promoting the globalization, and standardization of Traditional Chinese Medicine, it is necessary to strengthen the research on the identification and quality, application basis, biotechnology and product development of medical animals. It is helpful for the sustainable industry to build an innovation platform, strengthen the research on the standardization of TCM, and promote the innovation on TCM products; it will achieve the effective protection and get the utmost out of medical animals' resources.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

Acknowledgements

The study was self-funded.

Conflict of interest

The authors declare that there is no conflict of interests.

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