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Examination of Scientific Production on Badminton: A Content Analysis

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ABSTRACT

The aim of this research is the examination of scientific production on badminton. The data were obtained from studies published in the British Medical Journal, Eric, ULAKBIM National Databases, WOS, Google Scholar, ProQuest, and YÖK National Theses Center databases between 1939 and 2020. A total of 856 publications, including 624 articles, 134 proceedings papers, 71 M.Sc. theses, and 27 Ph.D. dissertations, were included in the research. The data obtained from these studies was analyzed using content analysis. Most publications were produced between 2016 and 2020. 751 publications in English and 105 in Turkish. It was observed that the distribution of the number of productions and the number of authors were close to each other. 134 proceedings papers (90 full-texts, 44 abstracts) were identified. Of the studies, 670 were quantitative, 105 were qualitative, 54 were mixed design, and 27 were reviews. Experimental design was used the most, and historical design was used the least. Stratified and simple random sampling methods were mainly used. Most studies were conducted with athletes, and the least with instructors (coaches and teachers). Most studies were conducted on exercise and sports physiology and the least on physical education, games, and recreation. The studies focused on physiological, anthropometric, and motoric measurements as the main themes. As a result; it has been determined that scientific productions on badminton are mostly studies on exercise and sports physiology in which physiological, anthropometric and motoric measurements are taken by conducting experimental studies on athletes selected by simple random sampling.

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INTRODUCTION

Badminton is one of the most popular sports nowadays. Badminton is an Olympic sport that can be played at any age and in any environment, giving pleasure to those who play and watch, and that stands out with its technique and aesthetics. Playing the ball without touching the ground, requiring good reflex and conditioning, and providing positive physical, mental, social, health, and psychological development to the person also increase interest in this sport (Bebetos & Antoniou, 2003; Callow et al., 2001; Grice, 2003).

According to data from the Badminton World Federation (BWF), approximately 220 million people play badminton worldwide (Wörner & Safran, 2022). Bringing badminton to the service of more people, which appeals to so many people and makes positive contributions to the lives of individuals of all ages, is essential in terms of raising healthy individuals and accordingly, creating healthy societies. In addition, the fact that badminton is an Olympic sport appealing to people of all ages and being played by more and more people every day has revealed the need for more extensive studies.

In the literature, it is seen that the first scientific studies on badminton were mainly conducted on training sciences, physical education, and sports pedagogy (French & Stalter, 1949; Lockhart & McPherson, 1949; Phillips, 1943, 1946; Rutledge, 1955; Scott, 1941). These studies, mostly published in scientific articles, proceedings papers or theses, have developed a multidisciplinary structure and have become widespread. This situation necessitates the classification and in-depth analysis of the studies on the subject. In particular, classifying and dividing the research into themes helps to determine the structure and evolution of the field and increase its effectiveness. Furthermore, this information is essential in giving ideas for new scientific studies to be carried out by determining the subjects and areas of research (Atılgan, 2020).

When the literature was examined, two content analyses on badminton came across (Blanca-Torres et al., 2020; Doğar et al., 2021). Blanca-Torres et al. (2020) analyzed 122 articles on badminton published in the Web of Science (WOS) database between 2007-2017. The articles were evaluated according to years, author countries, institutions, number of authors, journals, number of citations, sample sizes, disciplines, topics, and methodological aspects. Doğar et al. (2021) examined the articles and theses published on badminton sport in Türkiye. The general status, number of authors, journals, publication languages, distribution by years, research models, sample sizes, sample characteristics, topics, and main themes of these productions were examined.

It is seen that the scope of research on badminton is limited to Turkey and WOS database. For this reason, it is thought that there is a need to conduct research in different databases and by seeking answers to different research questions. Therefore, this study aims to scan and systematically analyze the scientific production on badminton.

To achieve this aim, answers to the following research questions were sought:

RQ-1: What is their distribution according to the type of publication?

RQ-2: How is the distribution by years?

RQ-3: How is their distribution according to the language of writing?

RQ-4: What is the distribution of articles and proceedings papers according to the number of authors?

RQ-5: What is the distribution of the proceedings papers according to the text type?

RQ-6: What is their distribution according to their method?

RQ-7: How is their distribution according to the pattern?

RQ-8: What is their distribution according to the sampling method?

RQ-9: What is their distribution according to the data collection tool?

RQ-10: What is their distribution according to the number of samples?

RQ-11: What is their distribution according to sample characteristics?

RQ-12: How is the distribution according to the subjects?

RQ-13: What is their distribution according to their main themes?

METHODS

Research Scope

The scope of the research consists of scientific studies published on badminton between 1939 and 2020. In the databases examined, it was determined that the first production was published in 1939. Therefore, the beginning of the period is taken as 1939. Accordingly, the criteria for inclusion in the study are as follows:

- the studies were published between 1939 and 2020
- published in British Medical Journal, Eric, Ulakbim National Databases, WOS, Google Scholar, YÖK National Theses Center and ProQuest databases
- having scientific articles, proceedings papers and postgraduate theses
- answering research questions
- writing languages are Turkish or English.

The exclusion criteria are:

- studies published before 1939 or after 2020

- not responding to at least one of the research questions
- writing languages other than Turkish or English.

Searching Strategy

In this study, the search process was carried out between September 2020 and December 2020. This study examined British Medical Journal, Eric, Ulakbim National Databases, WOS, Google Scholar, YÖK National Theses Center, and ProQuest databases. These databases were searched using the keyword "badminton." In the search, in order to identify articles and proceedings papers, the databases were limited to articles and proceedings papers. The searches were limited to studies with the word "badminton" in the entire text.

Data Entry Form

In content analysis, no system in which categories are suitable for every research. For this reason, researchers may need to create and standardize the categories in which they will seek answers to the questions. Therefore, in this study, the categories were created by the researchers as a result of the literature review (Blanca-Torres et al., 2020; Büyükergün, 2020; Doğar et al., 2021; Palazon et al., 2015; Patra et al., 2006; Prieto et al., 2015; Villarejo et al., 2010). These created categories were presented to the opinion of three experts working in the faculty of sports sciences who had done content analysis before. As a result of these evaluations, necessary arrangements were made and the data entry form was created (Appendix A). In the created form, the studies were examined in terms of publication types, years, writing languages, number of authors, methods, patterns, sampling methods, sample numbers, data collection tools, sample characteristics, topics, main themes, and text types of the proceeding's papers.

Validity and Reliability

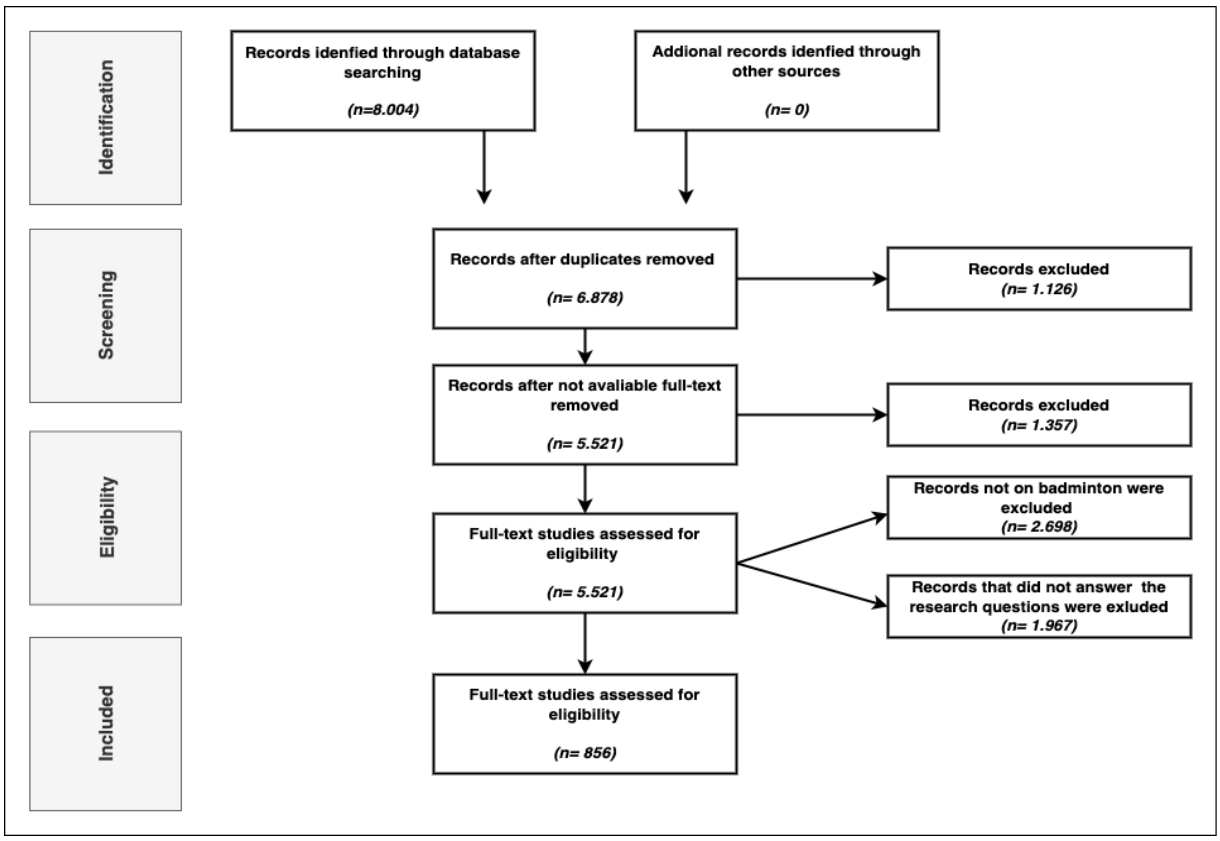
Before the screening process started; the researchers prepared the keywords, inclusion and exclusion criteria, and data entry form. Two researchers independently searched the databases and processed them into the data entry form. The forms created independently by the researchers were compared, and the final form was processed by achieving consensus on the differently coded data. For the validity of the study, the data collection and analysis processes are described in detail.

Data Collection

The search was conducted following the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2009). After the

limitations specified in the screening strategy were made, 8.004 publications with 'badminton' in their title, abstract, and keywords were reached. First of all, 1.126 duplicate studies in different databases were extracted. Subsequently, 1.357 studies were removed, whose full text is not available. Afterward, 2.698 studies that were not specifically about badminton were also excluded. Finally, 1.967 studies that did not answer the research questions were excluded. As a result of these processes, 856 studies were included in the study (Figure 1).

Figure 1
Search Results and the Selection Procedure



Data Analysis

Content analysis was used to analyze the data. Content analysis identifies the presence of words, sentences, concepts, phrases, or characters in one or more texts and represents them numerically (Elo & Kyngäs, 2008). Content analysis was used in this research as it is analyzes written, verbal, or visual communication messages that include both qualitative and quantitative approaches. For a clearer understanding of the data, the SPSS 23 Package Program was used and the results were presented in tables with frequencies (f) and percentages (%).

RESULTS

The findings obtained by examining, evaluating, and classifying scientific articles, proceedings papers, and postgraduate theses on badminton are presented in the tables 1 to 13 below.

Table 1
Distribution of Studies By Publication Types

Publication Types	f	%
Articles	624	72.9
Proceedings Papers	134	15.7
M.Sc. Theses	71	8.3
Ph.D. Dissertations	27	3.2
Total	**856**	**100**

Note: M.Sc.: Master of Science, Ph.D.: Philosophie Doctor

According to Table 1, most of the studies are composed of articles, followed by proceedings papers, M.Sc. theses, and Ph.D. dissertations, respectively.

Table 2
Distribution of Studies by Years

Years	f	%
1939-1950	3	0.4
1951-1960	5	0.6
1961-1970	1	0.1
1971-1980	14	1.6
1981-1990	28	3.3
1991-2000	46	5.4
2001-2005	42	4.9
2006-2010	121	14.1
2011-2015	180	21
2016-2020	416	48.6
Total	**856**	**100**

According to Table 2, three publications were made in 1939–1950, five publications in 1951–1960, one publication in 1961–1970, 14 publications in 1971–1980, 28 publications in 1981–1990, 46 publications in 1991–2000, 42 in 2001–2005, 121 publications were made in the years 2006–2010, 180 publications in the years 2011–2015, and 416 publications were made in the years 2016–2020.

It is seen that the most publications are between the years 2016-2020, and the least number of publications was made between 1961-1970. According to this, it is seen that there were irregular and few publications between 1939-1970 and then there was a continuous increase between 1971-2020.

Table 3
Distribution of Studies by Written Language

Language	f	%
Turkish	105	12.3
English	751	87.7
Total	**856**	**100**

According to Table 3, it is seen that 751 studies are in English, and 105 publications are in Turkish.

Table 4
Distribution of Articles and Proceedings Papers by a Number of Authors

Number of Authors	f	%
1	104	13.7
2	172	22.7
3	184	24.3
4	125	16.5
Five and above	173	22.8
Total	**758**	**100**

According to Table 4, articles and proceedings papers were published with a maximum of three authors. This is followed by studies with five or more authors, four authors, three authors, two authors and one respectively.

Table 5
Distribution of Proceedings Papers by Text Types

Type	f	%
Full Text	90	67.2
Abstract Text	44	32.8
Total	**134**	**100**

According to Table 5, there are 134 proceedings papers, 90 of which are full texts and 44 are abstracts.

Table 6
Distribution of Studies by Methods

Context	Data Collection Methods	Method	f	%
Research Study	**Quantitative**	Experimental	388	45.3
		Non-experimental	282	32.9
	Qualitative	Qualitative	105	12.3
	Mixed	Mixed	54	6.3
Literature Search		Review	27	3.2
		Total	**856**	**100**

According to Table 6, the studies were mainly carried out using quantitative experimental methods. This is followed by quantitative non-experimental, qualitative, respectively mixed-method and review studies.

Table 7
Distribution of Studies by Pattern

Design	f	%
Fully Experimental	204	23.8
Semi-Experimental	71	8.3
Pre-Experimental	113	13.2
Descriptive	55	6.4
Causal Comparison	101	11.8
Correlation	39	4.6
Scanning	87	10.2
Ethnography	3	0.4
Phenomenology	52	6.1
Case study	28	3.3
Historical Analysis	1	0.1
Action Research	21	2.5
Discovery Pattern	37	4.3
Descriptive Pattern	12	1.4
Parallel Pattern	5	0.6
Review	27	3.2
Total	**856**	**100**

According to Table 7, studies are primarily in complete experimental design. This is followed by pre-experimental, causal comparison, screening, and quasi-experimental designs. The least used patterns are historical analysis, ethnography, and parallel design.

Table 8
Distribution of Studies by Sampling Method

Sampling Type	Sampling Method	f	%
Probabilistic Sampling	Simple Random Sampling	266	31.1
	Systematic Sampling	29	3.4
	Stratified Random Sampling	382	44.6
	Cluster Sampling	26	3
Nonprobability Sampling	Monographic Sampling	2	0.2
	Convenience Sampling	2	0.2
	Purposive Sampling	57	6.7
	Others	92	10.7
	Total	**856**	**100**

According to Table 8, the stratified sampling method was used the most. This is accompanied by simple random, purposive sampling, systematic random, and cluster sampling methods, respectively.

Table 9
Distribution of Studies by the Number of Samples

Number of Samples	f	%
1 – 30	386	45.1
31 – 50	126	14.7
51 – 100	98	11.4
101 – 150	32	3.7
151 – 200	12	1.4
201 and above	69	8.1
Unspecified	133	15.5
Total	**856**	**100**

According to Table 9, a maximum of 1-30 people (386-45.1%) were used as samples in the studies. This is not specified in the order, followed by 31-50, 51-100, 101-150, 151-200, 201, and above people, respectively.

Table 10
Distribution of Studies by Data Collection Tools

Data collection tool	f	%
Observations	141	16.5
Interviews	29	3.4
Survey – Scales	92	10.7
Documents	83	9.7
Physical/Physiological Measurement Tools	441	51.5
Others	70	8.2
Total	**856**	**100**

According to Table 10, the physical/physiological measurement data collection tools were used the most in the studies. Observation, questionnaire-scale, document, interview, and other data collection tools are used respectively.

Table 11
Distribution of Studies by Sample Characteristics

Sample Characteristics	f	%
International Level Athletes	181	21.1
Club Level Athletes	272	31.8
Amateur Level Athletes	40	4.7
Primary School Students	18	2.1
Secondary School Students	23	2.7
High School Students	25	2.9
University Students	111	13
Disabled Individuals	19	2.2
Instructors (Trainers/Teachers)	14	1.6
Others	153	17.9
Total	**856**	**100**

According to Table 11, most of the club-level athletes were taken as samples in the studies. This is accompanied by international-level athletes, university students, amateur-level athletes, high school students, secondary school students, disabled individuals, and primary school students, respectively. It is seen that the instructors are the least taken as a sample.

Table 12
Distribution of Studies by Subject

Topic	f	%
Physical Education and Games	5	0.6
Physical Education and Sports Pedagogy	83	9.7
Exercise and Sports Physiology	145	16.9
Exercise and Sports Psychology	91	10.6
Physical Education and Sports for the Disabled	11	1.3
Physical Fitness	102	11.9
Biomechanics	105	12.3
Motor Behavior	79	9.2
Nutrition in Exercise and Sports	19	2.2
Recreation	5	0.6
Sports Medicine	99	11.6
Sports History	7	0.8
Sports Management	11	1.3
Others	94	11
Total	**856**	**100**

According to Table 12, most studies were conducted on exercise and sports physiology. This is followed by biomechanics, physical fitness, sports medicine, exercise and sports psychology, physical education and sports pedagogy, motor behavior, exercise and nutrition in sports, physical education and sports for disabled people, sports management, history of sports, recreation and physical education and game.

Table 13
Distribution of Studies by Main Themes

Main Theme	f	%
Teaching Methods and Techniques	77	9
Psycho-social Studies	92	10.7
Evaluating the Effects of Training on Performance	112	13.1
Physiological, Anthropometric, and Motoric Measurement	160	18.7
The Relationship between Exercise and Nutrition	18	2.1
Sports Injuries and Rehabilitation	91	10.6
Game Equipments	55	6.4
Motion Analysis	86	10
Match Analysis	77	9
Others	88	10.3
Total	**856**	**100**

According to Table 13, studies are mostly on physiological, anthropometric, and motoric measurements. This is succeeded by the main themes of evaluating the effects of training on performance, psycho-social studies, sports injuries and rehabilitation, movement analysis, teaching methods and techniques, match analysis, game equipment, and the relationship between exercise and nutrition.

DISCUSSION

This research is aimed to shed light on new scientific studies by systematically reviewing them on badminton and determining which subjects and which areas they focus on. For this purpose, 624 articles, 134 proceedings papers, 71 M.Sc. theses, and 27 Ph.D. dissertations were included in the research. It was determined that most of the studies consisted of articles accompanied by proceedings papers, M.Sc. theses, and Ph.D. dissertations, respectively. When the literature is considered, it is understood that it parallels with the research results. For example, Villarejo et al. (2010) concluded that 122 (84%) of the 136 studies they analyzed on rugby were published as articles. Yılmaz (2019) examined the sports science studies (articles and postgraduate theses) for the hearing impaired in Turkey and found that 31 of 60 were articles. Çiftçi (2014) reviewed postgraduate theses and articles on swimming and concluded that 45 of 83 studies were articles. Accordingly, it is understood that articles are mostly preferred in studies related to badminton, and less space is given in postgraduate theses.

According to the years, it was determined that the most work was done between 2016 and 2020, and the least work was done between 1961 and 1970. Blanca-Torres et al. (2020) reviewed the studies on badminton published in the WOS database between 2007 and 2017. It was observed that these studies, which were examined, gradually increased after 2011. It is seen that there is a notable increase in the last years of the time interval analyzed similarly in other studies (Büyükergün, 2020; Çetinkaya, 2011; Prieto et al., 2015). In this case, it shows that the analysis studies on badminton and other analysis studies are numerically similar in terms of years. In other words, it can be said that scientific studies in the field of sports have increased remarkably since 2000. This situation is parallel with the results of the study. Therefore, it is possible to accept this point reached numerically as an indicator of the importance given to badminton and sports sciences. In addition, this rapid increase in publications can be evaluated in light of the cyclical relationship between science and technology. In other words, while the developments in science and technology increase the number of publications, the increase in the number of publications provides the development in science and technology.

Badminton is also in this cycle and interacts with many fields (such as health, engineering, management, education, history, and psychology). It can be said that this has increased the number of studies on badminton.

It has been determined that the writing languages of the studies are mostly English. In parallel with the research results, Villarejo et al. (2010) determined that 135 of the 136 studies on rugby indexed on the ISI Web of Knowledge platform between 1998 and 2007 were in English. The fact that scientific journals indexed in international academic databases are primarily published in English confirms this situation (Patra et al., 2006). The publication of studies on badminton and similar subjects, mainly in English, shows that English is predominantly preferred in scientific studies. It can also be said that the world accepts English as the language of science.

It has been determined that articles and proceedings papers are made with a maximum of three authors and at least one author. Atalay (2017) considered the trend of research in sports management in Turkey and concluded that the articles mainly had two and three authors. Prieto et al. (2015) examined the studies on handball in the WOS database between 1900 and 2012 and published in MEDLINE databases between 1950 and 2012. As a result of the research, they found that while the number of authors was 2.63 percent in the 1961 period, it increased to 3.81 percent in the 1961–2012 period. According to this result, it can be said that the studies on badminton were carried out by the researchers in cooperation. In addition, it can be said that new studies have been carried out by bringing together researchers from different fields, and therefore studies with more than one author have been made. Moreover, it is thought that research is complex, so researchers need to work together.

It has been discovered that the proceedings papers are mostly in full text. When the literature on the subject was searched, no studies examined the text types of the proceedings papers. According to the research results, it is seen that in the databases examined, the proceedings papers are mostly published as full text and summary text, and there are no poster proceedings papers.

Quantitative methods were mostly used. When the literature is inspected, it is understood that it shows parallelism with the results of the research. Dumangöz (2022) examined research articles on tennis and emotions and found that 60% of them used quantitative methods. Biricik (2020) examined the theses in the field of sports management in Turkey and found that quantitative researches are in the majority. Elmas et al. (2018) examined the theses made in social areas in sports and found that 83.4% of them used quantitative methods. Yavuz et al. (2018) examined academic studies in the field of sports management

and found that the quantitative approach was used in 70% of them. However, it is known that the quantitative method is dominant in sports sciences. Parallel to this, it is an expected result that studies on badminton are mainly carried out with quantitative methods. The emergence of such a result can be evaluated as more effective and useful research using quantitative methods. In addition, the fact that badminton is practice-oriented by its nature may have brought about this result.

When the literature is examined, it is seen that mixed-methods research is used less in both badminton and other sports sciences (Dumangöz, 2022; Biricik, 2020; Yavuz et al., 2018). Regarding this, Roest et al. (2013) stated that the mixed method is used in a small number of studies in the field of sports sciences and that its construction is weak. This situation can be evaluated as the researchers did not dominate the mixed design and therefore did not use it.

It has been ascertained that mostly full experimental research is used in the studies. Moreover, it was determined that other experimental designs were more numerous. Accordingly, it can be said that researchers aim to achieve success in matches by improving athlete performance, and therefore they give more space to experimental studies. In addition, more use of experimental methods in sports sciences can also be said to aim to reach sample groups more quickly, take fewer samples, and save labor and time in data collection and analysis processes (Biricik, 2020). Furthermore, the fact that experimental studies provide a proven cause-and-effect relationship and yield prospective results may have led researchers to conduct experimental studies (Thompson & Panacek, 2006).

The least historical analysis pattern was used. It can be said that this is due to the fact that historical information does not change over time, and therefore, the thought of not writing the same information over and over again. In other words, it can be said that the lack of historical analysis studies stems from the thought that these studies will not contribute to the field.

It has been confirmed that the probability sampling method is the predominant one in the studies. When the literature is reviewed, it is seen that mostly random and purposive sampling methods are used in parallel with the research results (Babur et al., 2016; Biçer, 2017; Kurt & Erdoğan, 2015; Selçuk et al., 2014; Yüksel et al., 2016). In addition, in this study, it was determined that the number of studies using the stratified sampling method was high. The reason for this may be to reduce the sample standard error by making more economical research in a short time (Miles & Huberman, 1996). In this regard, Yıldırım and Şimşek (2011) stated that a limited number of appropriately selected samples can carry the characteristics of the universe, and the findings can be reflected in general.

While participants ranging from 1 to 50 people were mostly used in the studies, participants ranging from 101 to 200 people were used less. In parallel, Palazon et al. (2015) found that a sample size of 1–100 is mostly used in the analysis of football-related studies. According to these results, as the number of samples increases, the number of studies decreases. It can be said that this situation stems from the thought that as the number of participants decreases, the data can be collected in a shorter time and analyzed more effectively and accurately.

It was concluded that data collection tools used in physical/physiological measurements were used in approximately half of the studies. Atalay (2017) found that 39 of 56 articles were published as questionnaires in his research on sports management in the ULAKBİM national database. Biricik (2020) examined the published postgraduate theses on sports management and found that 261 of 341 theses were made using a questionnaire/scale data collection tool. It can be said that the reason why the results of the research differ from some studies in the literature is due to the fact that the studies are not based on practice and are generally aimed at measuring the emotions and thoughts of individuals. Contrary to these results in the literature, Williams and Wragg (2004) stated that the studies in the field of sports are mostly carried out experimentally. Based on this statement, it can be considered that the large number of data collection tools used in physical/physiological measurements in badminton is due to the fact that experimental studies are predominantly carried out.

Interview data collection tools were the least used in the study. Collecting data by interview allows the researcher to obtain deeper information from data collection tools such as questionnaires/scales (Kızıltepe, 2017). However, the fact that the interview takes time, increases the cost, is difficult to analyze, and has problems in ensuring validity and reliability may have caused this tool to be less preferred.

In the studies, it was seen that mostly club, international-level athletes, and university students were used as samples. In parallel with the results of the research, it was determined that the studies on sports management in Biricik (2020), published postgraduate theses on sports management, and Atalay (2017) on sports management in the national database of ULAKBİM were mostly conducted on athletes. Dumangöz (2022), examining research articles on tennis and emotions, found that researches were mostly concentrated on athletes. Palazon et al. (2015) analyzed the studies on football and found that the studies were mostly done on professional and amateur athletes. Blanca-Torres et al. (2020) analyzed the studies on badminton published in the WOS database and found that they were mostly done on international and national competitive athletes. Considering that the main purpose of sports

is the development of athletes, this is an expected result. The overuse of university students as a sample may be due to the fact that researchers are generally academics at universities and that they can reach students there most easily.

As a sample, instructors, individuals with disabilities, and primary school students were used the least. It is known that education given at a young age is important in order to reach the upper levels. However, the small sample size of primary, secondary, and high school students can be interpreted as insufficient emphasis on infrastructure in research. In addition, the small number of studies on disabled individuals and coaches indicates that researchers focus on high-level athletes.

It has been ascertained that studies are mostly carried out on exercise and sports physiology, biomechanics, and physical fitness. Prieto et al. (2015) concluded that research on handball was mostly conducted on physiology, psychology, anthropometrics, biomechanics and sports medicine. According to these findings, it is understood that researches for performance improvement in badminton are intense and the health of the athlete is kept in the foreground. Since badminton is played in a narrow field, it is important to apply the basic techniques correctly and effectively. For this reason, it can be said that researches on biomechanics are in the majority. It has been ascertained that there are few studies on physical education and game, recreation, and sports history. According to this result, it can be said that the researchers ignore the fact that badminton is a game tool and a recreational activity.

It was discovered that the most studies were carried out on the theme of physiological, anthropometric, and motoric measurements. However, it was determined that the themes were close to each other numerically. Therefore, it can be said that the studies focus on physiological, anthropometric and motoric measurements, which are among the criteria for talent selection and physical fitness. In addition, it may have been thought that physical and physiological changes would contribute more to athlete performance.

The lack of studies dealing with the relationship between exercise and nutrition is considered as an important deficiency. Because evaluating exercise and nutrition together directly affects the performance of the athletes before, during and after the training and in the competition (Ekin & Düz, 2021).

CONCLUSION

In the light of the findings, there is a lack of studies in which disabled people, instructors, primary and secondary school students are taken as a sample. In addition, new scientific studies on recreation, physical education and games will contribute to the field. As a

result, it has been determined that scientific productions on badminton are mostly studies on exercise and sports physiology in which physiological, anthropometric and motoric measurements are taken by conducting experimental studies on athletes selected by simple random sampling. The recommendations of this research are as follows:

- The scope of the research can be expanded and different databases can be added.
- Studies with more Turkish spelling can be conducted.
- More proceedings papers can be presented at congresses.
- More Ph.D. theses on badminton can be done.
- More reviews and mixed design studies can be conducted.
- Research can be designed using parallel and explanatory designs.
- Research can be conducted using non-probability sampling methods.
- Studies with a sample size of 100 or more can be designed.
- Studies can be designed by collecting data through interviews.
- In newly designed studies, disabled people, instructors, primary and secondary school students can be sampled.
- Studies can be conducted on recreation, physical education and games.
- Studies on the relationship between exercise and nutrition can be conducted.

Limitations

The limitations of this research are as follows:

- publications defined in British Medical Journal, Eric, Ulakbim National Databases, WOS, Google Scholar, YÖK National Theses Center and ProQuest databases
- the examined publications are articles, proceedings papers and postgraduate theses
- studies between 1939-2020
- studies written in Turkish and English
- studies whose full text has been reached
- results reached with the keyword 'Badminton'
- limited to studies that answer research questions

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Author contributions

All authors carried out the research design together. The first author was involved in the data collection, data analysis and writing process. The second author took responsibility for interpretation of the data, the supervision and critical reviewing of the original draft, as well as the approval of the final draft. All authors contributed to the discussion of the results and the manuscript's preparation

Declaration of conflict interest

The authors declare that they have no conflict of interest.

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Appendix A

Data Entry Form

A- Background of the Research	
Publication Type:	Article ( ) Proceedings Papers ( ) Ph.D. Dissertations ( ) M.Sc. Theses ( )
Year:	
Number of Authors	1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 and above ( )
B- Classification of the Study	
Language:	Turkish ( ) English ( ) Other( )
Proceedings Papers Type:	Full Text ( ) Abstract Text ( ) Poster ( )
C- Research Method	
Quantitative:	Experimental ( ) Non-Experimental ( )
Qualitative ( ) Mixed ( ) Review ( ) Meta-Analysis ( )	
D- Research Design	
Experimental:	Full Experimental ( ) Semi-Experimental ( ) Pre-Experimental ( )
Non-Experimental:	Descriptive ( ) Scale Development ( ) Correlation ( ) Scanning ( ) Causal Comparison ( )
Qualitative:	Action Research ( ) Theory Building (Embedded Theory) ( ) Concept Analysis ( ) Case Study ( ) Historical Analysis ( ) Phenomenology ( ) Narrative ( ) Ethnography ( )
Mixed:	Parallel ( ) Explanatory ( ) Exploratory ( ) Nested ( )
Literature Search:	Review ( ) Meta-Analysis ( )
E- Sampling Method	
Probabilistic Sampling:	Simple Coincidence ( ) Systematic Coincidence ( ) Stratified Random ( ) Cluster ( )
Nonprobability Sampling:	Monographic ( ) Convenience ( ) Purposive ( ) Snowball ( )
Other	
F- Data Collection Tool	
Observation ( ) Interview ( ) Survey/Scale ( ) Document ( ) Physical/Physiological Measurement Tools ( ) Other( )	
G- Number of Samples	
1-30 ( ) 31-50 ( ) 51-100 ( ) 101-150 ( ) 151-200 ( ) 201 and above ( ) Unspecified ( )	
H- Sample Characteristics	
International Level Athlete ( ) Club Level Athlete ( ) Amateur Level Athlete ( ) Primary School Student ( ) Secondary School Student ( ) High School Student ( ) University Student ( ) Disabled Individuals ( ) Instructors (Coachs/Teachers) ( ) Other ( )	
I- Subject	
Exercise and Sports Physiology ( ) Physical Education and Sports Pedagogy ( ) Physical Education and Game ( ) Exercise and Sports Psychology ( ) Physical Fitness ( ) Nutrition in Exercise and Sports ( ) Motor Behavior ( ) Sports and Health ( ) Recreation ( ) Sports Management ( ) Sports History ( ) Biomechanics ( ) Other ( ) Physical Education and Sports for the Disabled ( )	
J- Main Theme	
Physiological, Anthropometric and Motoric Measurement ( ) Psycho-social Studies ( ) Effects of Training on Performance ( ) Game Equipment ( ) Teaching Methods and Techniques ( ) Motion Analysis ( ) The Relationship between Exercise and Nutrition ( ) Match Analysis ( ) Comparison with Other Sports ( ) Other ( )	