High-Intensity Interval Training (HIIT) and Chronic Diseases: An Emerging Trend in the Scientific Literature? A Bibliometric Analysis

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Abstract

Aim: This study performs a bibliometric analysis to identify scientific trends regarding the effects of high-intensity interval training on individuals with chronic diseases.

Method: A total of 1 312 English language articles obtained from the Web of Science database and published between 1989 and 2025 were evaluated. Within the scope of the study, only "article"-type publications were included, and language and index (SCIE, SSCI, ESCI) filters were applied. Publications were analyzed using VOSviewer software in terms of distribution by year, country collaborations, keyword clusters, time trends, and citation analysis.

Results: According to the results of the analysis, a significant increase in publications on HIIT and chronic diseases was observed after 2016. Canada, the UK, Australia, and Iran are among the most productive countries, while the US, despite having a central position on the map of inter-country collaboration, did not make it to the top 10 in the number of publications.

Conclusion: Keyword clusters revealed that HIIT was intensively studied in relation to metabolic and cardiovascular disorders such as diabetes, obesity, and hypertension. Citation analysis findings show that articles on heart diseases, metabolic syndrome, and insulin resistance are prominent. The findings indicate that HIIT has been adopted not only for athletic performance enhancement but also as an effective intervention tool in the management of chronic diseases.

Keywords: High-intensity interval training, chronic diseases, physical activity, bibliometric analysis.

Yüksek Yoğunluklu Aralıklı Antrenmanlar ve Kronik Hastalıklar: Bilimsel Literatürde Ortaya Çıkan Bir Eğilim mi? Bibliyometrik Bir Analiz

Öz

Amaç: Bu çalışma, yüksek yoğunluklu aralıklı antrenmanların kronik hastalıklara sahip bireylerdeki etkilerine yönelik bilimsel eğilimleri belirlemek üzere bibliyometrik bir analiz gerçekleştirmektedir.

Yöntem: Web of Science veri tabanından elde edilen ve 1989–2025 yılları arasında yayımlanan 1,312 İngilizce makale değerlendirmeye alınmıştır. Araştırma kapsamında yalnızca "makale" türündeki yayınlar dahil edilmiş, dil ve indeks (SCIE, SSCI, ESCI) filtreleri uygulanmıştır. Yayınlar VOSviewer yazılımı

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kullanılarak yıllara göre dağılım, ülke iş birlikleri, anahtar kelime kümelenmeleri, zaman trendleri ve atıf analizleri bakımından incelenmiştir.

Bulgular: Analiz sonuçlarına göre, 2016 sonrası dönemde HIIT ve kronik hastalıklar konusundaki yayınlarda dikkate değer bir artış gözlenmiştir. Kanada, İngiltere, Avustralya ve İran en üretken ülkeler arasında yer alırken, ABD ülkeler arası işbirliği haritasında merkezi bir konuma sahip olmasına rağmen, yayın sayısında ilk 10'a girememiştir.

Sonuç: Anahtar kelime kümelenmeleri incelendiğinde HIIT'in diyabet, obezite, hipertansiyon gibi metabolik ve kardiyovasküler bozukluklarla ilişkili olarak yoğun biçimde çalışıldığı tespit edilmiştir. Atıf analizi bulguları ise, kalp hastalıkları, metabolik sendrom ve insülin direnci konularındaki makalelerin öne çıktığını göstermektedir. Araştırma sonuçları, HIIT'in yalnızca sportif performans geliştirme amacıyla değil, aynı zamanda kronik hastalıkların yönetiminde etkin bir müdahale aracı olarak benimsendiğini göstermektedir.

Anahtar Sözcükler: Yüksek yoğunluklu aralıklı antrenman, kronik hastalıklar, fiziksel aktivite, bibliyometrik analiz.

Introduction

HIIT is known as an exercise/training method performed at high intensity with short rest intervals (1-4 minutes)[1]. This method, which targets more than 75% of the maximal heart rate and maximal effort, which is between 80% and 95%, was created on the basis of intermittent exercises in which the training time is shortened and the intensity is increased, and it is stated to provide a strong acute physical response[2]. In addition, the aim of this type of exercise is recognized as a time-efficient training method among most training methods to provide similar or superior adaptations compared to traditional moderate-intensity continuous training according to a range of physiological performance and health status[3]. In terms of chronic diseases, the positive effects of HIIT on the organism (metabolic health, cardiovascular function, and respiratory capacity) are supported by some studies.

HIIT has recently come to the forefront with its positive effects on chronic diseases and physical performance[4,5]. Cardiovascular complications are one of the main causes of mortality, and it is stated that HIIT also accelerates recovery by adapting the cardiovascular system to high intensities with rest intervals[6]. These training methods increase maximal oxygen utilization capacity, improve aerobic and anaerobic metabolism, and improve maximal oxygen uptake by 8%, glycogen stores by 3%, and recovery heart rate by 7% in individuals with heart disease and cardio-metabolic risks. At the same time, HIIT is recommended as an effective method for the prevention of cardiovascular risk factors, especially high blood pressure[7].

When studies conducted in this direction are examined[8], it is observed that obese adults performed 10 sets of cycling exercise at 90% of maximum heart rate, three times per week for four weeks. When the results were evaluated, significant improvements in VO_2max and cardiorespiratory health and a decrease in resting systolic blood pressure

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were observed. In addition, 58% of the participants in the study found HIIT programs more enjoyable than other training programs.

In another study, 17 participants with coronary artery disease were randomly divided into moderate (50-60% VO_2max) and high (80-90% VO_2max) intensity aerobic training programs. At the end of the 10-week program, VO_2max increased more in the high-intensity exercise group, and left ventricular diastolic strain rate also increased in this group; these changes were not observed in the moderate-intensity group[9].

For example, in a different study, 32 women diagnosed with relapsing-remitting multiple sclerosis (RRMS) and 16 healthy individuals matched for age, gender, body weight, and height in a controlled manner performed a bicycle ergometer test. In the study, a statistically significant and strong relationship was found between the measured and predicted VO_2max values between the groups with and without MS in the tests performed to estimate the maximum work rate and VO_2max consumption. Based on linear regression analysis, it was determined that VO_2max was predicted with 10% accuracy in 95 out of every 100 individuals diagnosed with MS, within the limits of 95% confidence intervals for worst-case errors[10]. In addition, a study examined the effects of high-intensity interval aerobic exercise (HIIT) and moderate-intensity continuous aerobic exercise (MVCAE) programs in 28 patients with type 2 diabetes. In 6-week, 3-day-a-week programs, significant improvements were observed in aerobic capacity, cognitive function, muscular endurance and neuropathy scores in both groups. However, while FVC, FEV1, and PEF values increased in the (HIIT) group, a significant increase was observed only in PEF values in the MVCAE group[11]. The results suggest that both exercise programs improve physical and cognitive functions and reduce neuropathy symptoms in type 2 diabetics. A systematic review showed that high-intensity interval training in cancer patients provided more favorable effects on VO_2 peak and fat mass compared to conventional treatment. No differences were found in quality of life and fat-free mass. These results support that HIIT is an effective and time-efficient method for cancer patients[12].

In general, it is known that high-intensity interval training is only applied to improve performance in athletes. However, recent studies have shown that HIITs are also an effective and applicable method for individuals with chronic diseases. Although there are many studies on HIIT protocols in the literature, a comprehensive bibliometric analysis covering HIIT applications in people with chronic diseases has not yet been conducted. In recent years, there has been a remarkable increase in scientific publications examining the effects of high-intensity interval training (HIIT) on chronic diseases. As illustrated by the temporal distribution of publications (Figure 1), the number of studies has increased substantially, particularly after 2013, with a sharp rise observed between 2017 and 2024. This pattern indicates that research on HIIT and chronic diseases has evolved into a rapidly expanding and emerging area within the scientific literature. Despite the increasing number of studies on HIIT, there is a lack of comprehensive bibliometric analyses focusing on its application in chronic diseases. This study addresses this gap by systematically mapping research trends, key themes, and collaboration networks,

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thereby providing a structured overview of the field. Therefore, the aim of this study is to examine the applications of HIIT in different chronic diseases together with a comprehensive bibliometric analysis. Thus, the multifaceted application areas of HIITs in the field of health are systematically revealed through models such as thematic maps, keyword analysis, and collaboration between countries.

Material and Methods

Research Model

This study was designed using the bibliometric analysis method. Bibliometric analysis is defined as a method that allows researchers to examine academic publications, authors, institutions, and the impact level of research outputs in a particular scientific field with quantitative data[13]. Accordingly, bibliometric indicators are among the important tools for researchers and institutions to evaluate research performance[14]. It is also widely used to track the transformation of scientific paradigms, identify interdisciplinary differentiation, and determine the most influential publications and researchers[15]. Since this study is based solely on bibliometric data analysis and does not include any human participant data, it does not require ethics committee approval.

Data Collection Process

Data were collected from the Web of Science (WoS) database by filtering only "article"-type publications written in English and indexed in SCIE, SSCI, and ESCI indexes. The method of searching for studies was made to cover the literature between 1989 and 2025, and the following Boolean logic operators were used in the search query: TS=(("high intensity interval training" OR HIIT OR "interval training" OR "intermittent training") AND ("chronic disease" OR "chronic illness" OR "obesity" OR "diabetes" OR "type 2 diabetes" OR "hypertension" OR "high blood pressure" OR "cardiovascular disease" OR "heart disease" OR "cancer") NOT ("athlete" OR "athletes" OR "performance" OR "sport" OR "football" OR "basketball" OR "soccer" OR "runner" OR "swimmer" OR "recreational")) As a result of this query, 1.775 publications were initially identified. After filtering according to publication type, index, and language criteria, the total number of publications included in the analysis was determined to be 1 312.

Ethical Statement

This study is based solely on bibliometric analysis and does not involve any data collection from human or animal participants. The data used in this research were obtained from the Web of Science database and consist of publicly accessible secondary data. Therefore, in accordance with relevant regulations and ethical guidelines, ethical approval is not required.

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Data Analysis Method

The data collected from the Web of Science (WoS) database were exported in txt format and analyzed using VOSviewer (v1.6.20) software. The following techniques were used in the bibliometric analysis:

Publication Distribution by Year: Publications made between 1989 and 2025 are classified according to years. A significant increase was observed, especially after 2016.

Analysis of Cooperation between Countries: Countries with a minimum of 5 publications were included in the analysis, and 46 out of 73 countries were included in the analysis. The cooperation network created by the full counting method was visualized in network visualization mode, and the colors on the map reflected the cooperation clusters.

Number of Publications by Countries: The total number of publications of the countries was graphed by taking into account the Web of Science (WoS) database, and the scientific contribution levels of the countries were presented comparatively.

Collaboration Analysis between Authors: Authors with at least 5 publications were filtered, and 136 out of 6,248 authors were included in the analysis. Relationships based on joint publications were clustered in network visualization mode and presented as a network map.

Keyword Cluster Analysis: In the analysis performed with VOSviewer, the "all keywords" unit was selected, and 186 keywords mentioned in at least 5 studies were taken into consideration using the full counting method. However, the first 15 keywords were presented visually in order to eliminate the complex image on the map and to increase visual clarity.

Density Visualization: The density of keywords in the literature was visualized with color tones; frequently occurring terms were shown in yellow, and infrequently occurring terms were shown in blue-green tones.

Time-Based Keyword Trends: In the analysis performed in Overlay visualization mode, it is aimed to visualize the evolution of keywords over time with color transitions according to the average publication year. Although the years of this study cover the period between 1989 and 2025, the density in the network map is clustered between 2017 and 2022.

Citation Analysis: The top 1 000 most cited studies were analyzed. In the network visualization mode, node size represents the number of citations, lines represent citation relationships, and colors represent cluster structures. In the network map, it is seen that especially highly cited studies such as[16-18] and are located in the center.

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Results

Figure 1 shows the distribution of articles published in Web of Science (SCIE, SSCI, ESCI) indexes between 1989 and 2025 and written only in English. After 2020, a significant increase in the number of publications was observed. The highest number of publications was recorded in 2022 (n=156).

Figure 1. Distribution of the number of articles published in the web of science database between 1989 and 2025 by years

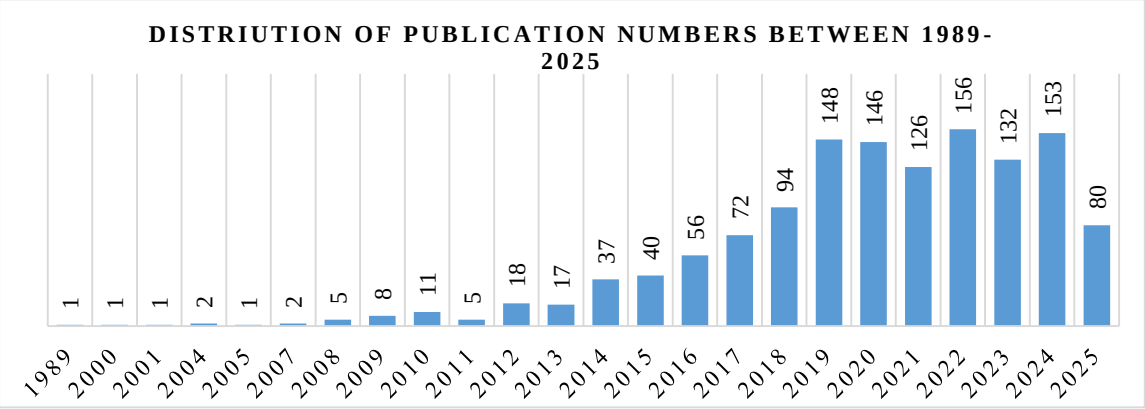

Figure 2 shows the cross-country collaborations in articles published between 1989 and 2025. The size of the nodes is scaled according to the total number of publications of each country. Colors represent countries grouped according to the clustering algorithm, while lines represent co-authorship relationships between countries. Countries such as the US, Canada, the UK, and Iran stand out with their extensive collaboration networks and centralized locations.

Figure 2. Inter-country cooperation network map

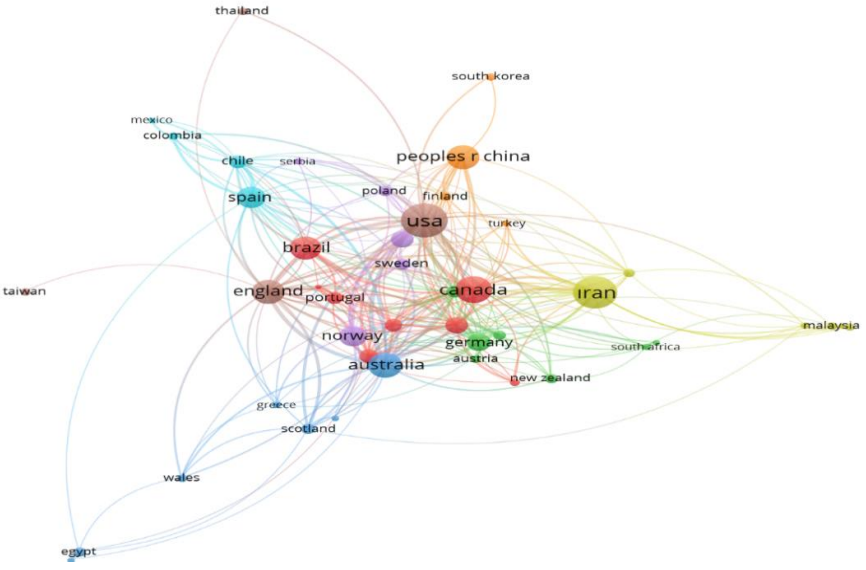

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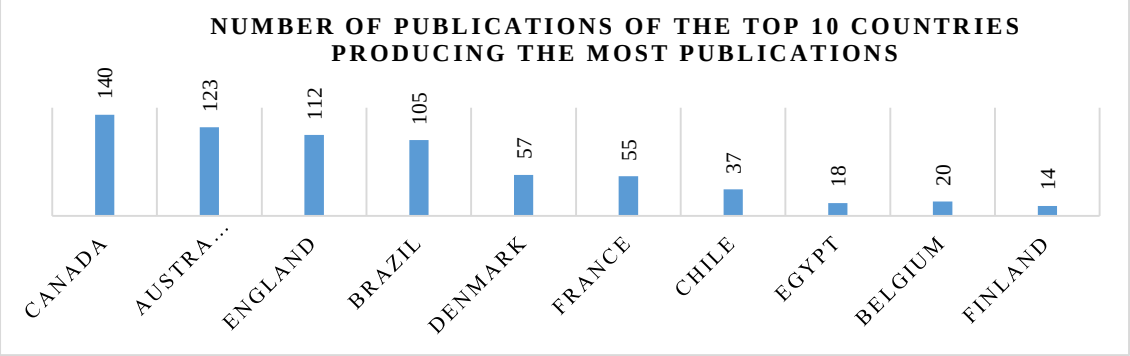
Figure 3 shows the distribution of publications on high-intensity interval training applications in chronic diseases according to countries. The 10 countries with the most publications are listed, and it is seen that countries such as Canada, Australia, and England are at the top.

Figure 3. Number of publications of the top 10 countries with the highest number of publications between 1989 and 2025



When Figure 4 is analyzed, the network map was created according to 186 keywords that were repeated at least 15 times in the studies. The colored clusters represent the keywords that are conceptually closest to each other. The terms “high-intensity interval training,” “exercise,” ‘obesity,’ and “diabetes” in the center represent the most basic research topics of the field. This clustering reveals the density of related thematic areas and their interrelationships.

Figure 4. Keyword clustering network map

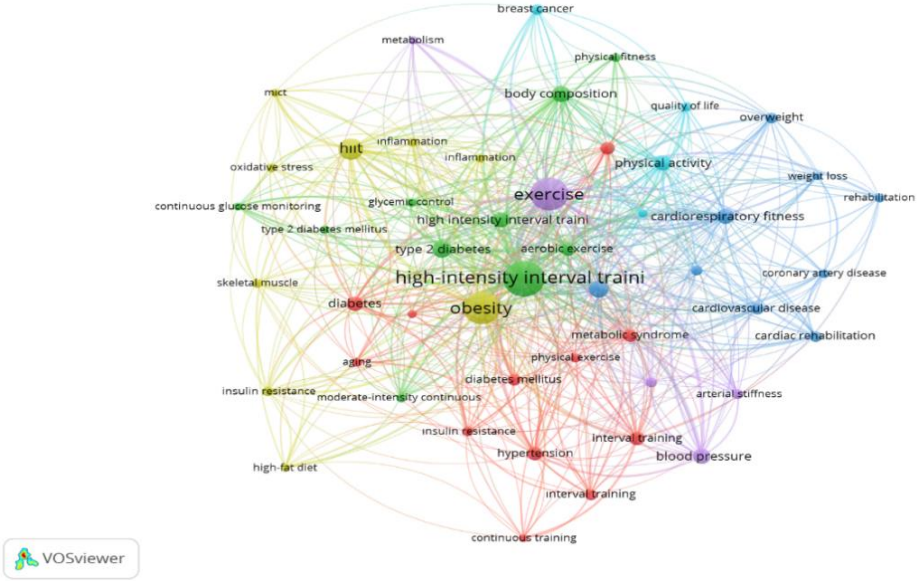


Figure 5 shows the coloring of the keywords used in the bibliometric analysis according to their average publication years over time. The resulting color scale was automatically

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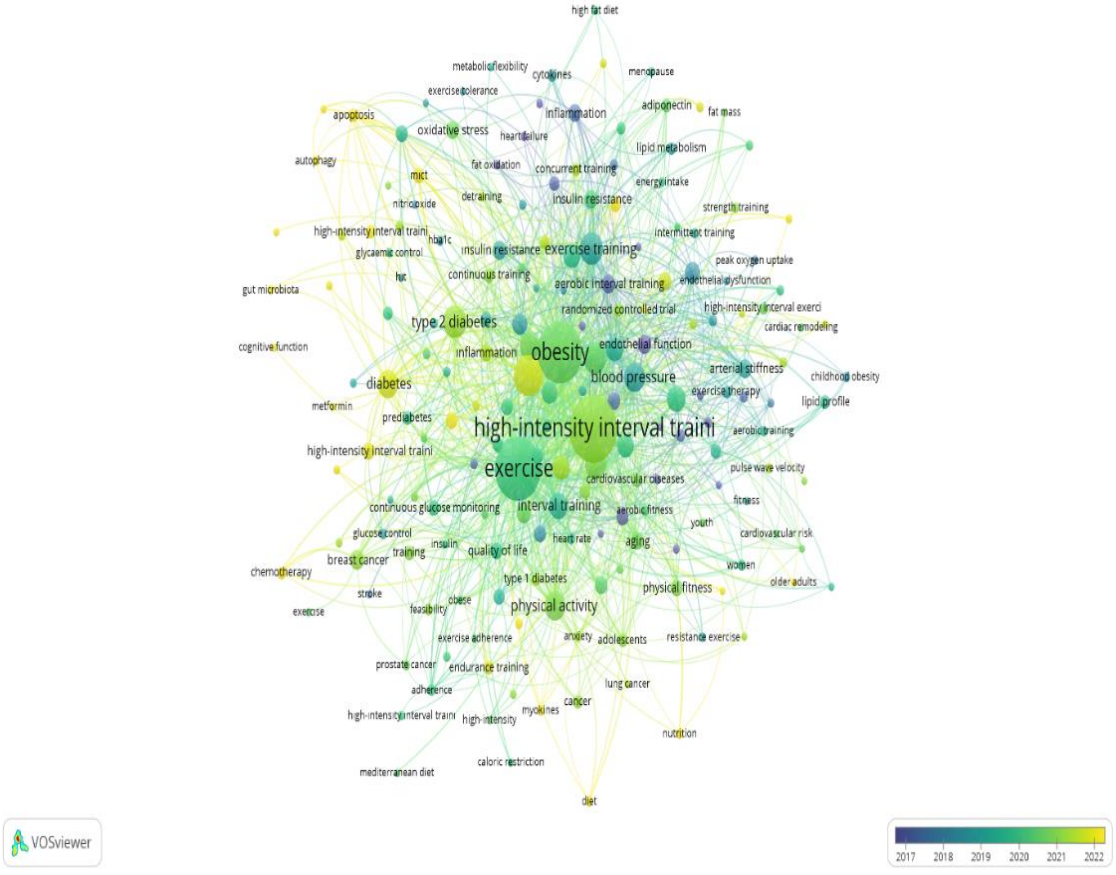
generated by the VOSviewer software according to the words concentrated between 2017 and 2022. This reveals that the selected keywords are mostly used in this period and that publications on the subject have increased in recent years.

Figure 5. Keyword time trend network map



*Our study covers the data between 1989 and 2025. However, since this map presents the distribution of keywords based on the average publication year, only the color scale for 2017-2022 is included in the visual. This technical limitation is due to the algorithm of the VOSviewer software and aims to more clearly emphasize the rise of time trends in recent years.

Figure 6. When analyzed, the map reveals the citation relationships between articles published between 1989 and 2025. In addition, each circle represents a publication, while the size of the circles is determined according to the total number of citations received by the relevant publication. Authors belonging to the same cluster are grouped with the same color. Highly cited pioneering studies such as “Wisløff (2007)”, “Tjønna (2008)”, “Little (2011)” and “Gibala (2006)” are prominently featured in the map. This suggests that studies that are considered foundational in the field of high-intensity interval training (HIIT) have had a strong impact on the literature.

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Figure 6. Citation analysis network map

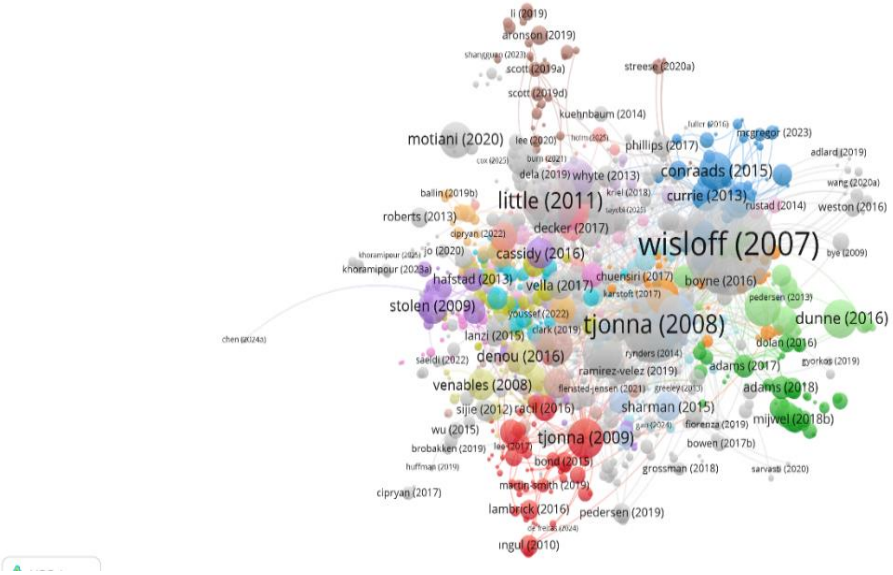

Figure 7 shows the co-authorship relationships of authors in articles published between 1989 and 2025. The circles represent authors, and the links represent co-authored articles. The map shows that researchers such as Ulrik Wisløff, Jeff S. Coombes, Shelley E. Keating, and Normand G. Boule are located in dense collaborative networks and occupy central positions. This structure indicates productive and interactive research groups in the field, while the cluster colors represent the collaborative communities to which the authors belong.

Figure 7. Collaboration Network Map by Authors

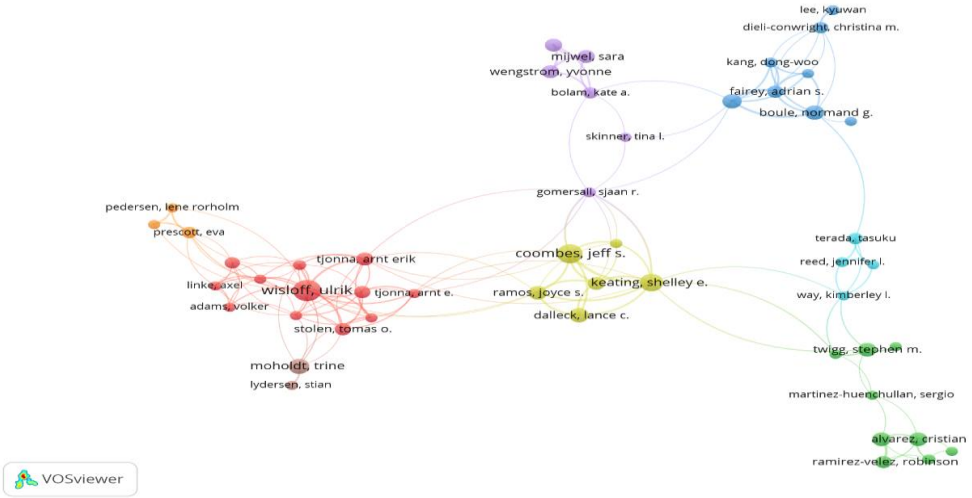

Figure 8 shows the density of the most frequently used keywords in the studies. The color transition from yellow to dark blue on the map indicates the frequency of the keyword.

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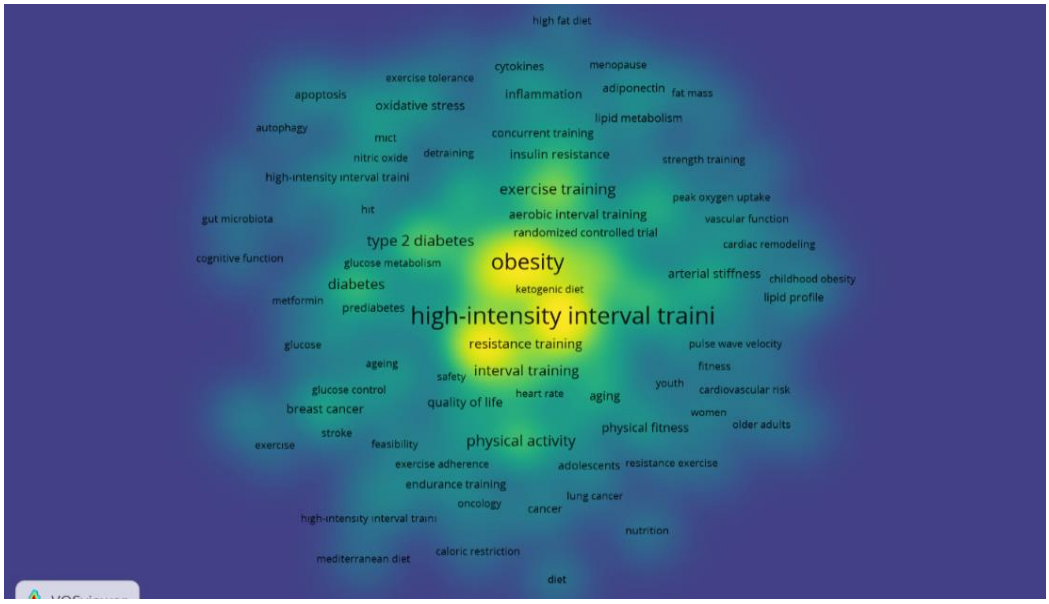
The fact that terms such as “high-intensity interval training”, “exercise”, “obesity”, “interval training” and “physical activity” are located in the bright yellow region on the map reveals that these concepts are very intensively studied in the literature. This shows that HIIT practices are an important research area in the context of health and chronic diseases.

Figure 8. Keyword density network map



Discussion

In this study, it was analyzed in detail whether HIIT programs were applied to individuals with chronic diseases between 1989 and 2025 and what the general trends were. When the findings of this study were evaluated, it was determined that the number of publications in the field was low between 1989 and 2007, the number of publications started to increase since 2008, and the peak number of publications was between 2019 and 2024. This situation is thought to reveal the applicability of HIIT programs in individuals with chronic diseases.

According to the map of cooperation between countries in the study, it was found that the US is at the center of the network map and that it conducts joint studies with many countries. However, it is noteworthy that the US is not among the top 10 countries according to the analysis of the number of publications. When this situation is evaluated, it suggests that although the number of publications of the USA is low, it cooperates with other countries at the international level and supports projects in other countries as a co-author. In addition, since many of the publications to which the USA contributes point to other countries as the primary institution, this may be the reason for its lower ranking in the number of publications. Indeed, in a study[19], it was stated that the USA has a high level of international cooperation with other countries in terms of contributing to the studies. In another study[20], stated that the USA is dominant in medical publishing with

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international countries. However, countries on the map such as Canada, the UK, Iran, China, and Australia also stand out as important nodes (Figure 2). Moreover, Canada and the UK are considered to have central roles in both the number of publications produced (Figure 3) and collaborative contributions (Figure 2).

Another study[21] reported that Canada and the UK are among the most productive countries in HIIT studies. Iran, on the other hand, has recently increased its visibility in regional and global research networks, and the number and distribution of collaborations with different continents (Figure 2) is remarkable. Other countries, such as China and Australia, have also taken an active role in HIIT studies through bidirectional cooperation with many countries (Figure 2). In conclusion, the dense clusters of connections in the map suggest that the topic of HIIT and chronic diseases is not limited to specific regions but has become a multi centered and global research area. Moreover, countries such as Brazil and Norway are located at prominent nodes on the map and contribute to HIIT research through regional collaborations. It is noteworthy that Norway is represented in the network, especially with its influential studies in sports science literature (Figure 2).

In the analysis of the number of publications by country (Figure 3), Canada has the highest number of publications, followed by Australia, England, Brazil, and France. This situation emphasizes that HIIT and chronic diseases are among the priority study areas in terms of both research funds and public health[22]. In particular, centers such as the University of British Columbia and McMaster University, which are leading with their studies in exercise science in Canada, may have contributed to this productivity. As mentioned earlier[21], stated that Canada, England, and Australia are among the most productive countries in the field of HIIT as a result of the bibliometric analysis. In addition, this distribution map of the number of publications suggests that HIIT is a health-oriented research area that is adopted not only in developed countries but also in different continents such as Latin America.

According to the keyword cluster analysis (Figure 4), the concepts of “high-intensity interval training”, “exercise”, “obesity” and “diabetes” were found to be central in the literature. The fact that these terms are used together intensively shows that HIIT is mostly addressed in studies related to metabolic diseases such as obesity and diabetes. Green clusters were found to focus specifically on metabolic disorders such as obesity, type 2 diabetes, insulin resistance, and glycemic control, while blue clusters were related to cardiorespiratory fitness, rehabilitation, arterial stiffness, and heart disease. A systematic research[23] has shown that HIIT increases VO_2max more effectively than moderate-intensity continuous exercise in individuals with cardiovascular diseases[24]. Purple clusters are linked to many health outcomes, such as quality of life, body composition, and physiological fitness. For example, the study reported that a randomized controlled HIIT program applied to patients with coronary artery disease in a study showed a significant improvement in VO_2max parameter values[25]. In the red clusters, hypertension and blood pressure parameters are related, and as a result of a meta-analysis, revealed that HIIT practices produced a significant decrease in systolic

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blood pressure and a limited but positive effect on diastolic blood pressure in individuals with hypertension[26].

In the yellow cluster, terms such as “oxidative stress”, “inflammation”, and “insulin resistance” indicate that HIIT interventions provide positive effects on metabolic responses, especially in obese individuals. In particular, HIIT has been reported to improve insulin sensitivity and reduce oxidative stress markers in obese individuals. In conclusion, this distribution clearly demonstrates that HIIT studies do not only focus on a single system but also have a multifaceted clinical and public health perspective, simultaneously covering metabolic, cardiovascular, and functional health dimensions[27].

In the keyword time trend analysis (Figure 5), it is clear that key concepts such as “high-intensity interval training”, “exercise”, “obesity” and “diabetes” have been the subject of study for a long time and that these concepts are central to research. These concepts, with their color transitions from yellow to green, show that they were intensively studied, especially in 2017-2019. In addition, more physiological terms such as “blood pressure”, “cardiovascular function”, “vascular function” and “oxidative stress” have become more prominent over time, meaning that the effects of HIIT are also being investigated in the context of physiological mechanisms. Especially in recent years (2021-2023), concepts such as “mitochondrial function”, “gut microbiota”, “autophagy”, “chemotherapy” and “cognitive function” have come to the forefront in yellow tones, and the much more systemic effects of the HIIT program are being investigated. This suggests that HIIT is being investigated not only in metabolic diseases such as obesity or diabetes, but also in different biological systems such as cancer treatment, aging, neurocognitive functions, and mitochondrial health. Recent studies suggest that research in this field is increasingly adopting multidisciplinary approaches. According to these results, it shows that HIIT programs have developed over time and are not limited to exercise physiology but have turned into a research field with a holistic approach that includes multiple systems[21].

According to the results of the citation analysis (Figure 6), studies by authors such as[16-18] are located in cluster centers with high centrality and high citation intake. This finding suggests that these studies are the main sources shaping the literature on HIIT and chronic diseases. This suggests that studies that emphasize the relationship between HIIT and metabolic disorders such as diabetes, hypertension, and cardiovascular diseases are of high academic and clinical value.

The collaboration network map by authors (Figure 7) shows that influential research groups in the field of HIIT and chronic diseases form distinct clusters. In particular, it is noteworthy that authors such as Wisloff, Ulrik; Tjonna, Arnt Erik; Stolen, Thomas; and Moholdt, Trine, who are in the red cluster, frequently work together and form a leading research group in this field. This group of authors has examined the effects of HIIT on cardiovascular health, especially in Norwegian clinical trials[16,17].

In the blue cluster, authors such as Boule, Normand G.; Faulkner, Guy E.; Lee, Soojin; Kang, Woo Hyun; and Lee, Soojin, and Kang, Woo Hyun collaborate more on the axis of

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type 2 diabetes, exercise physiology, and public health. In the green cluster, authors such as Martinez-Huerta, Sergio, and Ramirez-Velez, Robinson, have come to the forefront with their collaborations examining HIIT practices related to metabolic diseases, especially in Latin America-based research. When this cluster structure is evaluated, it is seen that an academic collaboration network with geographical, thematic, and methodological diversity has been formed in the field of HIIT and chronic diseases.

The density network map (Figure 8) shows that "high-intensity interval training," "obesity," "exercise," "physical activity," and "diabetes" have the highest frequency in the literature. This density map confirms that HIIT is the main research topic related to metabolic disorders. However, the high density of concepts reflecting metabolic responses such as "insulin resistance," "oxidative stress," and "inflammation" indicates that scientific interest in the effects of HIIT on metabolic health is strong. Meta-analysis revealed that HIIT significantly improved insulin resistance[28]. Furthermore, in an 8-week study in obese individuals, HIIT induced positive changes in oxidative stress markers and muscle mitochondrial function, which is reported to improve insulin sensitivity[27]. In addition, concepts such as "resistance training," "cardiorespiratory fitness," "aerobic interval training," and "quality of life" are also evident in the density map. A meta-analysis study showing that HIIT practices improve cardiorespiratory fitness and quality of life in older adults seems to confirm the clinical importance of these concepts[29]. In conclusion, this distribution of intensity suggests that HIIT is a broad area of research that addresses not only performance but also many health outcomes, from metabolic health to psychosocial well-being.

Conclusion and Suggestions

This bibliometric analysis comprehensively reveals the general trend in the literature by revealing research trends, conceptual clusters, international collaboration networks, and the most influential publications of HIIT practices in individuals with chronic diseases. Moreover, this study, which covers the period between 1989 and 2025, has shown a significant increase in the number of publications, especially in the post-2016 period. The analyses reveal that HIIT interventions are increasingly being investigated in cardiovascular diseases, type 2 diabetes, obesity, hypertension, and some types of cancer, with both clinical effects and physiological mechanisms. Keyword analyses and citation maps show that HIIT is not only limited to its effects on metabolic responses but is also associated with multidimensional health outcomes such as cardiorespiratory fitness, inflammation, oxidative stress, mitochondrial function, and quality of life. In this context, HIIT is positioned not only as a means to improve athletic performance but also as an effective and time-efficient intervention in the management of chronic diseases.

This study provides a comprehensive bibliometric overview of the scientific production on HIIT applications in individuals with chronic diseases, including their level, geographical distribution, and thematic trends. By analyzing international publication trends in detail, priority topics for researchers, high-impact studies, and productive author-network structures were identified. For this reason, the study will be an important reference for identifying gaps in the literature, developing new research

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topics, and increasing the opportunities for interdisciplinary cooperation. Particularly for researchers publishing in health sciences, physiology, exercise science, and public health, it is suggested that more focus should be placed on the effects of HIIT on cardiometabolic health, quality of life, cognitive function, and inflammatory responses. Furthermore, the low number of HIIT studies conducted in developing countries indicates an unequal distribution of scientific production at the global level. Therefore, it is suggested that more regional research on HIIT practices in different socioeconomic and cultural contexts would be important to contribute to the field.

For future studies, the effects of HIIT on different types of chronic diseases (e.g., chronic kidney disease, COPD, and rheumatic diseases) have not yet been adequately studied. Future studies should evaluate the safety and efficacy of HIIT in these patient groups. Furthermore, the majority of HIIT research in groups such as women, the elderly, and pediatrics involves adult male subjects. Given gender- and age-based physiological differences, it is important to further study HIIT protocols in women and the elderly. However, the effects of HIIT on not only physiological but also psychosocial outcomes such as anxiety, depression, stress, and cognitive functioning should also be investigated.

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