



Qualitative Content Analysis : The Meaningful Association between the Extension of Sports Leisure Culture and the Spread of Wearable Devices

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Abstract

Purpose – The present research aims to assess the meaningful association between the extension of sports leisure culture and the spread of wearable devices. The research will discuss the current utilization of wearable devices in sports leisure and the present and future application of wearable devices in sports perspectives.

Research design, Data, and methodology – We have investigated and conducted the qualitative content analysis (QCA) to obtain the adequate textual dataset in the current literature and conducted an in-depth analysis of the incorporation of cloud computing in the leisure sports industry by focusing on the development of wearable technologies.

Result – From the QCA, it is evident that there is a meaningful connection between the extension of sports leisure culture and the spread of wearable devices, figuring out four kinds of associations as follows: (1) Monitoring the Impact of Sporting Activities, (2) Benefits of Sensor Technology, (3) Reducing Sedentary Behaviors, and (4) Measuring Workload done in Sport Leisure.

Conclusion – The present research concludes that wearable devices positively influence individuals to participate in sports and leisure activities. Various technologies are very effective in motivating individuals to adopt sports leisure culture mainly because there is a certain degree of satisfaction that individuals gain in seeing the level of physical activities.

Keywords: Sports Leisure Culture, Wearable Device, Economic Development

JEL Classification Code: E20, L83, Z21

1. Introduction

Sports leisure culture is crucial in contributing to the prevention of biological degradation of individuals by increasing the ability of the body to counteract illnesses and tensions that can result in the unhealthy nature of the body (Hallmann et al, 2017). Sports leisure culture has a significant impact on the body that can be felt not just t the organs but also in different bodily functions, requiring effort. Cumulatively through repetition, sports leisure is crucial in ensuring that the body can achieve morphogenetic and improvement in physiological abilities. The culture also impacts the vigor and health of individuals actively engaged in the activities. In contrast to sports culture, body immobilization has adverse effects such as atrophy, considering that the body is being maintained in a vicious circle of inactivity. The development of people's health and personalities is a crucial goal of the sports leisure culture. Different game-based sports produce a hyperactive system with additional components that work together to achieve a well-defined health goal. Regular engagement in sports culture, as well as any sort of physical activity like stretching, aerobics, and walking, along with a balanced diet and the abstinence from harmful habits like smoking and drinking, can be harmful to human health. One of the main motivations of sports leisure culture that has been analyzed and proven by specialists is that it creates a healthy lifestyle through physical exercise. Medical practitioners have found out there is growing interest in sports leisure in recent years, especially from young people and also highlighted the various effects of lack of sporting activities, such as deformation of the spine, obesity mass index, and cardiovascular problems.

Individuals who engage in various activities are thought to greatly benefit from the advent of wearable technologies in sports and leisure. The gadgets are also seen to be an effective motivator for people who engage in sports and leisure to improve their health. The incorporation of various wearable technologies into various athletic events in recent years has transformed the way individuals approach different sports by pushing the envelope. Wearable technology is increasingly being used in physical training programs for sports including basketball, tennis, marathons, and swimming (Ji & Park, 2019). The potential of wearable technology to evaluate human psychologic function and athletic performance during real-time activities has led to an increasing trend in personal healthcare environments (Vooris et al, 2019). The growing media attention and commercial exposure of wearable technology as useful instruments that can precisely analyze people's physical activities while participating in various sports has led to their adoption into sports and leisure. The availability of less expensive devices and the advancement of contemporary personal computing devices, such as smartphones and digital watches, can also be credited with the incorporation of wearable technology in sports and leisure.

The present research aims to assess the meaningful association between the extension of sports leisure culture and the spread of wearable devices. The research will discuss the current utilization of wearable devices in sports leisure and the present and future application of wearable devices in sports perspectives. Knowing the existence of a meaningful association between the sports leisure and the spread of wearable devices is essential in developing strategies in different sports activities and counseling individuals on the safe utilization of these devices and the potential limitations that wearable devices can bring to the sports leisure culture. The study will also highlight the implication of the association between sports leisure and wearable devices for practitioners in the company.

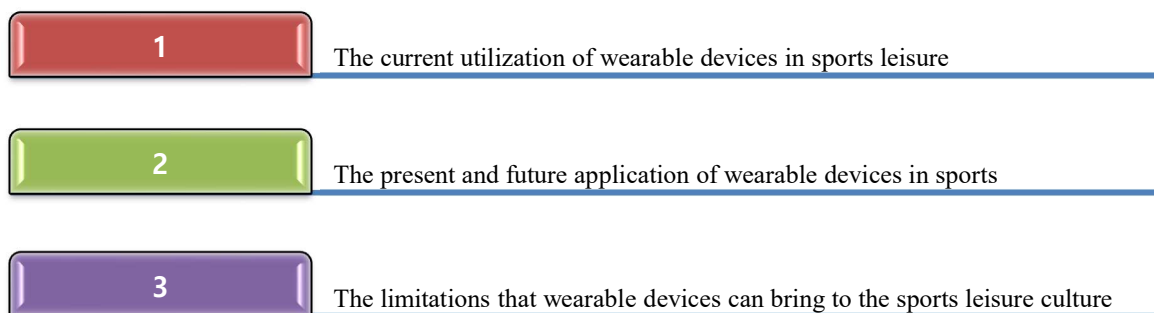


Figure 1: The Purpose of the Current Research

2. Literature Review

A study by the prior research group (Yao et al., 2020) highlights the incorporation of cloud computing in developing wearable devices for the leisure sports industry. The author emphasizes that utilizing cloud computing in leisure sports is essential for improving information as soon as possible. The current authors conducted an in-depth analysis of the incorporation of cloud computing in the leisure sports industry by focusing on the current application of cloud computing in the development of wearable technologies and the problems that need to be solved to ensure the full implementation of the technology in sports. The study indicates that the utilization of technology through wearable devices in leisure sports has been very effective in recent years in ensuring that individuals can monitor the impacts of sporting activities in terms of strengthening their health. The significant gap in this study is that it only focused on the Chinese sports leisure industry; this creates a need for future studies to include sports leisure industries from different places across the world to increase the validity of the results obtained.

The implementation of sensor technology in both professional and leisure sports facilitates the evaluation of human movement in terms of quality and quantity (Venek et al., 2022). The study conducted by Venek et al. (2022) provides an overview of sensor technologies and how it influences the evaluation of human movement quality in ecologically similar environments. The author's utilized online databases to identify articles that are eligible for the studies that focus on either recreation or professional athletes. Benson et al. (2020) also study the inclusion of wearable devices in sports leisure. This study described the different situations in which workload was monitored using wearable devices, including sports leisure. The authors also focused on assessing the quality of evidence that indicates utilization of wearable technology in tracking the amount of workload in sports leisure can inform injury prevention. The study mainly focused on team ball sporting activities such as soccer, rugby, and Australian football. The study participants were both professional athletes and active participants in leisure sports. The study's findings indicate that wearable technology can assess workload and effectively inform injuries. The significant research gap in this study is that there are different injury definitions; hence an investigation needs to indicate which injury definition the study is based on.

A study by the previous research (Scataglini et al., 2020) indicates that wearable devices have become an integral part of recreational and competitive runners. According to the authors, the main reason why many runners have adopted wearable devices is that the devices are non-intrusive and can ecologically monitor the health, well-being, and performance of the runner and provide personalized information that can be utilized to improve performance, comfort, and prevention of the different types of injuries. The authors conducted an exploratory study of user needs and used the data obtained to develop specifications that can be utilized to create other wearable technologies for recreational and professional long-distance runners. The study results indicate that 60 percent of runners prefer to be monitored and obtained feedback using wearable technologies. This suggests that many runners consider virtual medical professionals and virtual coaches wearable devices. The significant gap in this study is that the authors did not include individuals participating in different sports, such as swimming and ball games.

Chen and Yang (2021) conducted a study to evaluate the impact of wearable sports devices based on vision sensors in the sports industry. With the rapid development of vision sensor technology, vision sensors are at the forefront of flexible measurement systems in sports because they provide a direct information source. After all, wearable sports devices with visual sensors can effectively detect the vital signs of individuals engaging in leisure sports and professional athletes (Chen & Yang, 2021). The study also highlights that wearable devices can effectively detect various indicators of the individual's body, which can be crucial in enabling the individual to adjust their condition. The authors argue that the introduction of wearable technologies with visual sensors is critical to sports because it helps overcome the weakness of traditional medical testing, in which most are not visible in real-time. They conclude that the technologies can be utilized to adjust the physical conditions and health of individuals who actively engage in sporting activities which can also assist in avoiding fatigue and accidents. The central gap that exists in this study is that there is no data that were used to support the investigation. This creates a reason for future researchers to incorporate data from different athletes who use wearable devices with vision sensors to help the research being conducted.

Willy (2018) conducted a study to assess the innovations and risks associated with using wearable devices to prevent and rehabilitate injuries due to running sporting activities. The author highlights that running-related injuries are common and have a high reoccurrence rate. In recent years, healthcare practitioners and learners adopted wearable technologies to assess training loads and biomechanics to reduce running-related injuries. The study findings highlight that wearable devices are effective in assessing training loads and biomechanics even though there are no clear guidelines for using the devices by leisure runners and medical practitioners. The authors outline the best practices for utilizing wearable devices in the running, with the main practice of evaluating the device's quality by checking the mechanisms used to calculate both the training workload and biomechanics. The study findings also indicate that wearable devices effectively prevent and rehabilitate running-related injuries.

Ellingson et al. (2016) conducted a study to assess how wearable devices reduce prolonged sedentary behavior. This study is because wearable fitness devices are becoming increasingly common among individuals participating in leisure sports and professional athletes. The study's main focus was to highlight how wearable devices can reduce sedentary time in daily life. The authors argue that lowering sedimentary time is very challenging, mainly due to the various environmental factors that negatively influence the health of individuals. The main measures of the study included participant characteristics, sedentary behaviors, physical activities, mood, and sedentary awareness. The study's results indicate that feedback obtained from wearable devices was very effective in influencing sedentary behavior and improving the perspective of college students under natural conditions. The study results also suggest that two passive interventions have used different wearable devices that provide feedback to the individuals wearing them in response to their behaviors throughout their daily activities. The study findings indicate that wearable devices can effectively reduce bouts of prolonged sedentary time and behaviors that have significant health implications. One research gap that existed is that the study utilized a petite sample size of a healthy college-aged individual. Future studies should focus on using a sample from young and older people to generalize the results to younger and older populations.

3. Research Design

We have investigated and conducted the qualitative content analysis (QCA) to obtain the adequate textual dataset in the prior and current literature. To better grasp QCA, it might be helpful to compare it to the quantitative content analysis. In the first place, we originated from various academic disciplines. The QCA is frequently employed in mass communication to quantify manifest textual pieces, but it is often criticized for failing to capture important syntactical and semantic information that is contained in the text (Woo & Kang, 2020). In contrast, the fields of anthropology, qualitative sociology, and psychology pioneered the use of qualitative content analysis to delve into the hidden meanings of nonverbal communication. Second, we assumed that quantitative content analysis is deductive, with the goal of examining ideas and answering questions based on them. The evaluation of topics and themes, as well as the conclusions formed from them, were instead based on the data in qualitative content analysis, making it mostly inductive. Occasionally, qualitative content analysis will try to theorize.

The reduction of vast volumes of raw data to meaningful themes and categories via the use of inference and interpretation is the primary objective of QCA. Using inductive reasoning, we examined and compared the data repeatedly until patterns and conclusions emerge. But inductive reasoning is not always incompatible with qualitative content analysis. In qualitative research, it is helpful to generate ideas or variables from theory or past studies at the outset of data processing (Nantharath et al., 2016).

Depending on how much inductive reasoning is utilized, Hsieh and Shannon (2005) proposed three methods for conducting qualitative content analysis. The tried-and-true QCA approach is the first, in which code categories are deduced from the raw data inductively. Solid theories are developed via the use of this method. The other approach, known as directed content analysis”, starts with coding that is based on a theory or relevant research findings. Once the data have been thoroughly analyzed, we spent time looking for patterns or themes in the data. This approach is often used to confirm or increase the applicability of an existing theory or conceptual framework. Summative content analysis is the third approach; it begins with a simple count of words or other overt elements, but then expands its scope to include more subtle elements like themes and meanings. Although this technique may seem quantitative, its ultimate goal is an inductive analysis of the actual use of the terms or indicators (Sung, 2021; Hong, 2021).

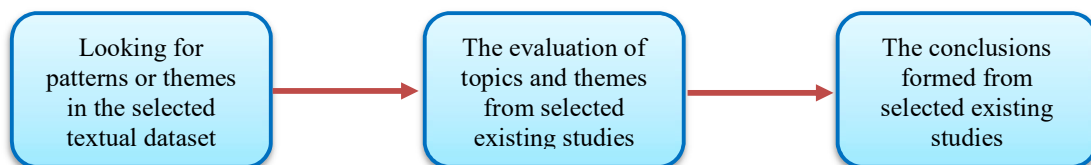


Figure 2: Textual Data Obtaining Procedure

4. Findings

4.1. Monitoring the Impact of Sporting Activities

From the literature content approach, it is evident that there is a meaningful connection between the extension of sports leisure culture and the spread of wearable devices. One of the leading significant associations highlighted from the reviewed studies is that wearable devices are crucial in ensuring that individuals can monitor the impact of sporting activities, especially in improving their health. In sports, a thorough study of lots of different information is essential. Wearable electronics, such as fitness bracelets, sensors built into athletic apparel or equipment, or sensors placed around a gym or playing field, enable the collection of copious amounts of data on various categories, storage in the cloud, and analysis of the data for use by team managers, coaches, advertisers, and other stakeholders.

Another important finding is that wearable devices can be used to conduct real-time monitoring of athletes, both unprofessional and professional. Real-time tracking of athletes' health and prompt notice of potential injuries to administer first aid and receive treatment are two significant factors contributing to the growing popularity of wearable electronics in sports (Arogam et al, 2019). Targeted health indicators are tracked in real-time throughout the workout or sporting event by wearables, including heart rate, blood pressure, blood oxygen enrichment, and other sensors linked to various portions of the athlete's body or included in their equipment (Seshadri et al., 2016).

Athletes can enhance their abilities and performance by incorporating wearable technology into their regular sports routines. For instance, athletes can directly measure their daily progress and record the workload and bodily characteristics, such as heart rate limitations, when training is most effective and beneficial, using fitness bracelets or sensors attached to the equipment. Smart wearables are evolving into a necessary and well-liked tool for assessing and enhancing sporting performance worldwide. The sports industry is already being transformed by wearable technology, which is building a tight-knit ecosystem of mobile apps, Bluetooth Low Energy (BLE) sensors, and other tools that communicate with one another to give athletes and other stakeholders the most accurate and timely information about their development and health (Xu et al., 2021).

From the literature review, it is also evident that wearable technologies can be used to track the improvement in sports leisure activities. The implementation of wearable technology during weight training perfectly illustrates how it may be used in sports to control and enhance performance (Kuo et al, 2022). This form of exercise is typically referred to as velocity-based training (VBT). VBT is a straightforward training technique that employs smart wear technology to monitor the athlete's body and the pace of the weight bar to enhance workout quality. Several devices have been tracking barbell speed in professional sports during the last 20 years, and this training technique is not new. However, both the popularity and effectiveness of this type of training have substantially improved with the expansion in the accessibility of accelerometers and wearables (Baca et al, 2009). The prompt prevention of injuries by continuous data accumulation on players' health and their immediate medical examination is another significant application of wearable technology in sports, where it can provide benefits and alter the approach to training (Teixeira et al, 2021). The English Premier League rugby team, which just established the first of its type in world rugby to gather data and subsequently research it to quantify the impact of concussion on rugby players, is an excellent example of employing wearable technology in sports medicine. During rugby matches, specialized impact sensors are worn over the earlobe to collect data on the force and direction of every hit to the player's head.

4.2. Benefits of Sensor Technology

Sensor technology is an important aspect of wearable technologies adopted in sports leisure culture. Sensor technology has been implemented in wearable devices in different ways, such as vision sensors. From the literature review, it is evident that sensor technology is important in sports leisure because it can be utilized to monitor both the internal and external workloads of individuals engaging in sports leisure (Arogam et al, 2019). This is an important aspect that promotes sports leisure culture because the various sensors, such as biomedical sensors, create an opportunity for continuously assessing the psychological parameters of individuals. However, sensors are not very common in sports leisure activities due to the expensive nature of the equipment. Sensors comprise different microelectromechanical hence individuals cannot easily afford wearable devices with expensive sensors (Segura Anaya et al., 2018; Ulrich et al., 2020).

The literature review shows a meaningful association between sports leisure culture and wearable devices, especially in young people who have embraced modern technology. Health and fitness wearable devices remain very popular among young people compared to the older population. This has resulted in many young people embracing the culture of sports leisure because they believe that wearable devices are crucial in providing health information and

have specific functions that enable them to access more personalized information. Sports wearable technology that is more advanced can track stride rate, ground contact time, stroke rate, and force analysis to help players improve their performances. These gadgets can be included in an exercise regimen to provide real-time monitoring for better outcomes and more precise statistics (Guerrero-Ibáñez et al., 2018; Ulrich et al., 2020).

4.3. Reducing Sedentary Behaviors

Wearable devices can also improve sedentary behaviors in individuals by encouraging people to improve their daily activity through engaging in leisure sports. Computer-based mobile and wearable devices are a promising modern approach to reducing the lack of physical activity. Wearable devices inspire an individual's motivation, engagement, and interest in physical activities through inspiring habit formation (Sasai, 2017). From the review conducted, it is evident that various wearable devices such as smartwatches can be very effective in reducing the lack of physical activities because it has various features that enable individuals to assess the number of physical activities, such as steps that they have been able to complete in a day (O’Keeffe et al, 2020). This can result in the development of a healthy habit in that individuals may become dependent on the devices in engaging in physical activities, which can result in positive health outcomes.

The review also highlights that wearable devices are important in sports leisure culture because they can be used to prevent and rehabilitate injuries. The development of gadgets and wearables makes it possible to monitor the human body accurately and succinctly in outdoor and sporting settings (Zadeh et al, 2021). Most importantly, development and implementation should align with injury prevention and recovery goals. Small-size wearable inertial measurement units have been created to track joint motion, load, and inertia, and GNSS/GPS has been extensively utilized to track athletic performance and injury prevention. In conjunction with the wearable sensor, it is possible to estimate joint loads, which offers crucial information for injury prevention (Rum et al, 2021). In addition, tele-rehabilitation is a developing discipline that provides athletes and patients with speedy remote evaluation and consultation using wearable sensors and digital communication technology. Athletic injuries to the lower extremities can lead to long absences from the sport, negative financial and psychological effects, and a high chance of re-injury (Luczak et al, 2020). Reducing the risk of primary and secondary injuries can be accomplished by enhancing current injury prevention and rehabilitation procedures. The introduction and ongoing advancement of wearable technology may give clinicians access to data that wasn't previously available. Wearable technology can provide more accurate motion, force, or pressure measurements than earlier clinical measurements. By utilizing these cutting-edge methods in both clinical and non-clinical contexts, therapists may be able to reach locations where people participate in sports (Di Paolo et al, 2021). Although there is much potential for employing this technology to guide clinical judgment, there is not enough data to support their integration and use.

4.4. Measuring Workload done in Sport Leisure

Another important finding is that wearable devices are crucial in measuring the amount of workload during a sports leisure activity, both physical and mental (Seshadri et al, 2021). Wearable devices can monitor athletes' physical performance and safety through position and motion. Monitoring the position and movement profiles of individuals participating in leisure sports is critical in developing training programs to improve individual performance (Huifeng et al, 2020). Movement-based sensors, highly utilized in sports leisure culture and professional sporting activities such as accelerometers, generate a highly accurate analysis of movement in individuals (Teixeira et al, 2021). The device has been recently developed to include wrist-based devices (Renner et al, 2020). The devices effectively measure workload through an individual's energy expenditure, position, movement, and balance control during sports leisure activities.

Table 1: Resources of the Findings (Total 22 Studies Founded)

Key Element	Evidence based on the Prior Resources
1. Monitoring the Impact of Sporting Activities	Arogamam et al, 2019; Seshadri et al., 2016; Kuo et al, 2022; Baca et al, 2009; Teixeira et al, 2021; Xu et al, 2021
2. Benefits of Sensor Technology	Arogamam et al, 2019; Segura Anaya et al., 2018; Guerrero-Ibáñez et al., 2018; Ulrich et al., 2020; Ulrich et al., 2020; Srisruthi et al., 2016)

3. Reducing Sedentary Behaviors	Sasai, 2017; O’Keeffe et al, 2020; Zadeh et al, 2021; Rum et al, 2021; Luczak et al, 2020; Di Paolo et al, 2021
4. Measuring Workload done in Sport Leisure	Seshadri et al, 2021; Huifeng et al, 2020; Teixeira et al, 2021; Renner et al, 2020; Matos et al, 2020

5. Implications for Practitioners

Wearable technology is being used in healthcare settings to offer more objective data and to be included into wellness programs. The Geisinger Orthopaedic Institute's study program uses wearable activity trackers to collect real-time patient data. Tracking patient behavior and compiling subjective data will be done with the help of this information. The data collected will be used to look into recovery-friendly practices and improve judgment and health outcomes. New wearables are being unveiled by a number of technology companies that could be used in healthcare (Erdmier et al., 2016). Philips revealed a wearable biosensor earlier this year that continuously monitors vitals like heart rate, respiration rate, skin temperature, posture, physical activity, and a single-lead ECG. The software that this biosensor is attached to would send signals to the doctor or caregiver, which could help with early detection and action to improve patient outcomes. The Biodesign Institute at Arizona State University is the organization in charge of Project HoneyBee. The best wearable biosensors are being researched by Project HoneyBee to enhance patient outcomes and cut healthcare costs. Among the conditions being studied right now are diabetes, atrial fibrillation, chronic obstructive pulmonary disease (COPD), and heart disease.

Due to the nature of the technology used to create the gadgets, wearable technologies also have the potential to improve medical communication services for healthcare professionals. Because the wearable devices can efficiently monitor and record biometric information in real time and send the information to medical professionals for analysis, they are great for streamlining communication between people engaging in sports and leisure and healthcare professionals. Healthcare professionals must have access to quick and responsive platforms for identifying healthcare issues. Wearable technology enables medical professionals to assess the level of physical activity of specific patients and create strategies for bettering care, allowing them to collaborate with patients. The meaningful association between sports leisure culture and the adoption of wearable devices impacts healthcare professionals by ensuring real-time physiologic and movement parameters during sports leisure activities. Various wearable technologies such as gyroscopes imply healthcare professionals because they provide access to individuals' advanced performance data. Medical professionals can also utilize heart rate monitoring devices to assess individuals' physiological adaptation and intensity of effort in sports leisure activities. This is an essential tool in healthcare because it assesses exercise intensity, physiologic response, and metabolic demand that an individual experiences during the completion of various sports and leisure activities (Kim & Kang, 2022; Hekman et al., 2014).

The extension of sports leisure culture and the spread of wearable technologies also implies medical practitioners because it enables healthcare practitioners to provide personalized approaches to health management. Medical practitioners can also utilize wearable technology to provide healthcare services to individuals who prefer regular feedback about their health and assess their level of engagement in sports leisure activities through performance monitoring. Sports leisure culture and the expansion of wearable devices also empower patients by raising awareness among individuals on their overall health condition based on feedback and reward mechanisms found in various wearable technologies. Since wearable technologies can motivate users to make informed health decisions, it creates an excellent doctor-patient relationship that can motivate medical professionals to provide high-quality healthcare services.

6. Limitations and Conclusions

The objective of this research was to assess the meaningful association between the extension of sports leisure culture and the spread of wearable devices. Identifying meaningful associations will assist healthcare practitioners, users, and wearable device manufacturers in understanding the different factors that are more significant in utilizing wearable devices—the study is based on the literature review of initial studies conducted on the topic. There appears to be a significant connection between sports leisure culture and the spread of wearable devices in improving physical activity in modern society. Wearable devices positively influence individuals to participate in sports and leisure

activities, considering the self-use-friendly nature of the devices based on various health situations. Various technologies such as smartwatches are very effective in motivating individuals to adopt sports leisure culture mainly because there is a certain degree of satisfaction that individuals gain in seeing the level of physical activities they have engaged in, such as the number of steps taken. By introducing wearable devices, more people are willing to engage in sports leisure, considering digital health actively is increasingly becoming more important and inevitable. Adopting wearable technology in sports leisure also has implications for medical professionals. The devices enable healthcare practitioners to obtain real-time data on the health of individuals. The adoption of wearable devices also has an implication for medical providers in terms of saving them time in conducting different tests on individuals, such as heart rate and blood pressure, mainly due to the existence of different devices that can automatically measure this information. The study investigated the utilization of wearable technologies in sports leisure activities without focusing on specific devices. Therefore further research should narrow to a more specific wearable device for sports leisure purposes to compare the existence of a meaningful association between sports leisure culture and specific wearable devices (Nantharath et al., 2019).

One of the main limitations is that majority of the articles included in the literature review were conducted using samples that were not very diverse. This is a significant limitation because it implies that the articles' findings cannot be generalized to a broader population. This is a limitation because the review findings may not significantly represent the meaningful association between sports leisure culture and the adoption of wearable devices and the impacts that the device has on individuals' physical activities. Another limitation is that it is tough to assess the meaningful association between sports leisure culture and wearable devices due to various factors that impact the adoption of wearable devices, such as personalized coaching, financial ability, wear time, and other forms of interventions in sports leisure activities. These may create barriers in determining the existence of a meaningful association between the extension of sports leisure culture and the adoption of wearable devices.

This research focused on establishing the existing findings from initial studies rather than critically determining answers to a particular answer on sports leisure culture and wearable devices. Therefore, policymakers must consider the adequacy of the existing knowledge rather than the quality in providing a framework for medical practices when interpreting the findings of the literature review conducted in this study (Woo & Kang, 2021). Another limitation of this study is that there are no adequate initial studies conducted to assess the meaningful association between the extension of sports leisure and the adoption of wearable technology. The inadequacy of initial studies restricted the approach taken in this paper because some of the studies included in the literature review were conducted more than five years ago, and the findings may not reflect the association between sports leisure and wearable devices.

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